

PFAS UPDATE AND REVIEW OF EPA'S PROPOSED PFAS REGULATIONS

JOE MARTIN
OFFICE OF WATER QUALITY



ARKANSAS
ENERGY & ENVIRONMENT

WHAT ARE PER & POLYFLUOROALKYL SUBSTANCES (PFAS)?

- ✔ **LARGE CLASS OF CHEMICALS WITH UNIQUE CHEMICAL AND PHYSICAL PROPERTIES**
- ✔ **MANY EXTREMELY PERSISTENT AND MOBILE IN THE ENVIRONMENT**
- ✔ **USED IN A RANGE OF CONSUMER AND INDUSTRIAL APPLICATIONS SINCE THE 1940s**

PFAS PROPERTIES

✓ OIL, WATER, STAIN, AND SOIL REPELLENCY

- One part repels water and one part repels oil

✓ CHEMICAL AND THERMAL STABILITY

- Carbon – fluorine bond considered one of the strongest bonds in nature

✓ REDUCE FRICTION

- Surface coatings

WHAT ARE PFAS USES?

- ✓ WATER REPELLENT CLOTHING
- ✓ STAIN RELEASE FINISHING
- ✓ TEXTILE COATINGS
- ✓ FAST FOOD PACKAGING
- ✓ OUTDOOR PRODUCTS



WHAT ARE PFAS USES?

- ✓ **FIREFIGHTING APPLICATIONS**
- ✓ **SEALANTS, CAULK, STAINS**
- ✓ **ADHESIVES, LAMINATES**
- ✓ **PAINT ADDITIVES**



PFAS HISTORY

✓ DISCOVERED IN THE 1930s

- DuPont discovered by accident when conducting research into new chemicals to be used as refrigerants

✓ MARKETED AFTER WORLD WAR II

- DuPont marketed this substance as Teflon

✓ 3M DEVELOPED SCOTCHGARD

- Also discovered by accident
- Marketed due to its imperviousness to alcohol and water

CLASSIFYING PFAS

✓ NONPOLYMERS

- Perfluoroalkyl Substances
- Polyfluoroalkyl Substances

✓ POLYMERS

- Fluoropolymers
- Side-chain fluorinated polymers

NONPOLYMERS

✓ PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

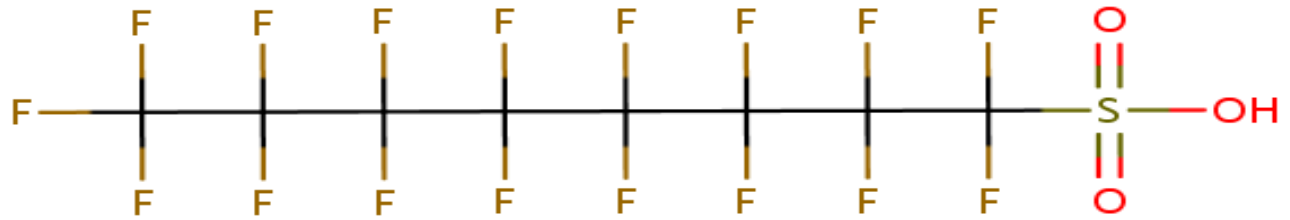
✓ PERFLUOROALKYL SUBSTANCES

- Fully fluorinated alkane molecule
- Two or more carbon chain (tail) with a charged functional group (head) attached to one end

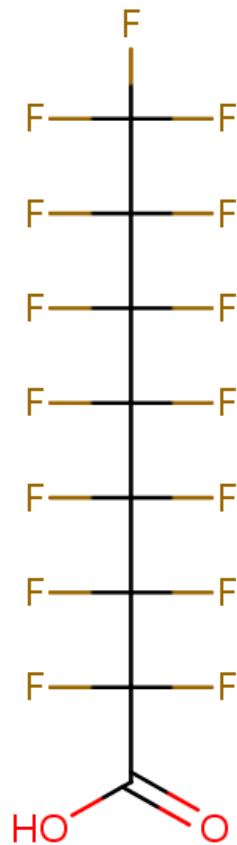
✓ COMMON FUNCTIONAL GROUPS

- SO_3^- – Sulfonate
- CO_2^- – Carboxylate

PFOS



PFOA



PERFLUOROALKYL ACIDS (PFAA)

✓ PERFLUOROALKYL CARBOXYLIC ACIDS (PFCA)

- Terminal degradation product of fluorotelomer alcohols
- An example of a PFCA is perfluorooctanoic acid (PFOA)

✓ PERFLUOROALKANE SULFONIC ACIDS (PFSA)

- Terminal degradation product of polyfluoroalkyl sulfonamido ethanols (FASEs)
- An example of a PFSA is perfluorooctane sulfonic acid (PFOS)

PERFLUOROALKYL ACIDS (PFAA)

✓ SHORT-CHAIN vs LONG-CHAIN

- Depends on the particular PFAS

✓ PERFLUOROALKYL CARBOXYLIC ACIDS (PFCA)

- Four to seven carbons are short-chain
- Eight or more carbons are long-chain

✓ PERFLUOROALKANE SULFONIC ACIDS (PFSA)

- Four to five carbons are short-chain
- Six or more carbons are long-chain

POLYFLUOROALKYL SUBSTANCES

✓ NOT FULLY FLUORINATED

- Some carbon atoms in the chain will have hydrogen bound instead of fluorine

✓ FLUOROTELOMER SUBSTANCES

- Polyfluoroalkyl substances produced by fluorotelomerization
- Degradation of fluorotelomer based substances is a potential source of PFCAs

✓ N:X NAMING CONVENTION

- N is the number of fully fluorinated carbons and x is the number of carbons that are not fully fluorinated
- 8:2 Fluorotelomer sulfonic acid (8:2 FTS)

POLYMERS

✓ FLUOROPOLYMERS

- Carbon only polymer backbone with fluorines attached directly to the carbon

✓ POLYMERIC PERFLUOROPOLYETHERS (PFPE)

- Relatively little is known about these chemicals in the environment

✓ SIDE-CHAIN FLUORINATED POLYMERS

- Non-fluorinated polymer backbone
- Fluorinated side chains branch off polymer backbone

GEN X AND PFBS

- ✓ **HEXAFLUOROPROPYLENE OXIDE – DIMER ACID**
 - Processing aid technology to make fluoropolymers without the use of PFAS
 - Replacement for PFOA

- ✓ **PERFLUOROBUTANE SULFONIC ACID**
 - Replacement for PFOS

PFAS REGULATIONS

- ✓ UCMR 3 – 2013-2015
PUBLIC WATER SYSTEMS > 10,000
- ✓ TEST FOR PFOS, PFOA, AND 4 OTHERS
 - PFNA, PFHxS, PFHpA, PFBS
 - Reference concentration of 70 ug/L for PFOA & PFOS
- ✓ PUBLIC WATER SYSTEMS WITH RESULTS > REF
 - 0.9% for PFOS
 - 0.3% for PFOA

PFAS REGULATIONS

✓ 2016 – DRINKING WATER HEALTH ADVISORY

✓ BASED ON LIFETIME EXPOSURE

- Developmental endpoints most sensitive
- Based on studies from mice and rats

✓ 70 ug/L FOR PFOA & PFOS

PFAS REGULATIONS

✓ 2022 – DRAFT AQUATIC LIFE CRITERIA

- PFOA concentrations in studies ranged seven orders of magnitude

✓ PFOA DRAFT CRITERIA

- Water Column Acute and Chronic
- Tissue based for Inverts, Fish Muscle Tissue and Whole Body

✓ PFOS DRAFT CRITERIA

- Water Column Acute and Chronic
- Tissue based for Inverts, Fish Muscle Tissue and Whole Body

EPA PFOA DRAFT CRITERIA

✓ WATER COLUMN ACUTE CRITERION

- EC 50 – Concentration of a chemical that produces a specific effect
- LC 50 – Concentration of chemical estimated to kill 50% of subjects

✓ FOUR MOST SENSITIVE GENERA

- Chydorus (Cladoceran), Daphnia (Cladoceran), Brachionus (Rotifer), Ligumia (Black sandshell mussel)

✓ FINAL ACUTE CRITERION – 49 mg/L

- FAV – 5th centile of genus sensitivity distribution – 97.14 mg/L
- FAV/2 – 49 mg/L minimal effects acute criterion
- Not to be exceeded more than once in three years on average

EPA PFOA DRAFT CRITERIA

✓ WATER COLUMN CHRONIC CRITERION

- EC 10 – Concentration of a chemical estimated to produce a chronic effect on survival, growth, or reproduction in 10% of organisms

✓ FOUR MOST SENSITIVE GENERA

- Hyalella (Amphipod), Lithobates (American Bullfrog), Daphnia (Cladoceran), Brachionus (Rotifer)

✓ FINAL CHRONIC CRITERION – 0.094 mg/L

- FCV – 5th centile of genus sensitivity distribution – 0.094 mg/L
- Four day average not to be exceeded more than once in three years

EPA PFOA DRAFT CRITERIA

✓ TISSUE BASED CRITERION

- Used bioaccumulation factor (BAF) approach
- 20th centile BAF x chronic water column criterion
- Not to be exceeded more than once in 10 years

✓ INVERTEBRATES

- 1.11 mg/kg wet weight

✓ FISH MUSCLE TISSUE & WHOLE BODY

- Muscle tissue – 0.125 mg/kg wet weight
- Whole body – 6.10 mg/kg wet weight

EPA PFOS DRAFT CRITERIA

✓ WATER COLUMN ACUTE CRITERION

- EC 50 – Concentration of a chemical that produces a specific effect
- LC 50 – Concentration of chemical estimated to kill 50% of subjects

✓ FIVE MOST SENSITIVE GENERA

- Pimephales (Fathead minnow), Oncorhynchus (Rainbow trout), Ligumia (Black sandshell), Neocaridina (Japanese swamp shrimp), Xenopus (African clawed frog)

✓ FINAL ACUTE CRITERION – 3.0 mg/L

- FAV – 5th centile of genus sensitivity distribution – 6.011 mg/L
- FAV/2 – 3.0 mg/L minimal effects acute criterion
- Not to be exceeded more than once in three years on average

EPA PFOS DRAFT CRITERIA

✓ WATER COLUMN CHRONIC CRITERION

- EC 10 – Concentration of a chemical estimated to produce a chronic effect on survival, growth, or reproduction in 10% of organisms

✓ FOUR MOST SENSITIVE GENERA

- Chironomus (Midge), Lampsilis (Fatmucket), Enallagma (Blue damselfly), Danio (Zebrafish)

✓ FINAL CHRONIC CRITERION – 0.0084 mg/L

- FCV – 5th centile of genus sensitivity distribution – 0.0084 mg/L
- Four day average not to be exceeded more than once in three years

EPA PFOS DRAFT CRITERIA

✓ TISSUE BASED CRITERION

- Used bioaccumulation factor approach
- 20th centile BAF x chronic water column criterion
- Not to be exceeded more than once in 10 years

✓ INVERTEBRATES

- 0.937 mg/kg wet weight

✓ FISH MUSCLE TISSUE & WHOLE BODY

- Muscle tissue – 2.91 mg/kg wet weight
- Whole body – 6.75 mg/kg wet weight

PFAS HEALTH EFFECTS

✓ PFOA & PFAS INTERIM HEALTH ADVISORY

- PFOA – Non-cancer – Liver damage
- PFOA – Likely carcinogen – Testicular, Kidney
- PFOS – Non-cancer – Deficient antibody response to vaccine
- PFOS – Suggestive evidence of cancer – Bladder, Prostate

✓ GENX CHEMICALS

- Liver lesions – Most sensitive non-cancer effect

✓ PFBS

- Thyroid – Decreased thyroxine serum

EPA PFAS DRINKING WATER HEALTH ADVISORIES - 2022

✓ PFOA & PFAS INTERIM HEALTH ADVISORY

- 0.004 ppt PFOA
- 0.02 ppt PFOS

✓ FINAL HEALTH ADVISORY FOR GENX CHEMICALS

- 10 ppt

✓ FINAL HEALTH ADVISORY FOR PFBS

- 2,000 ppt

EPA PFAS PROPOSED DRINKING WATER LIMITS

- ✔ **PFOA & PFAS MAXIMUM CONTAMINATE LEVEL**
 - 4.0 ng/L for PFOA & PFOS on finished drinking water
- ✔ **ENFORCEABLE LIMIT ON COMBINATION OF PFNA, PFH_xS, PFBS, AND GENX**
- ✔ **HAZARD INDEX USED TO DETERMINE IF COMBINED PFAS POSE A RISK**

EPA PFAS PROPOSED DRINKING WATER LIMITS

✓ HAZARD INDEX

- If running annual average is > 1, it is a violation of the Hazard Index MCL

✓ Equation Hazard Index = ([GenX water]/[10 ppt]) + ([PFBS water]/[2000 ppt]) + ([PFNA water]/[10 ppt]) + ([PFHxS water]/[9.0 ppt])

✓ HAZARD INDEX USED TO DETERMINE IF COMBINED PFAS POSE A RISK

UCMR 5

✓ **SAMPLE 29 PFAS FROM 2023-2025**

- Large systems > 10,000 people served – all systems
- Small systems 3300 – 10,000 people served – all systems
- Small systems < 3300 people served – nationally representative sample

✓ **SAMPLING FREQUENCY**

- Quarterly for surface water or mixed source systems
- Twice a year for ground water systems

✓ **COLLECTION WILL BE AT THE ENTRY POINT TO DISTRIBUTION SYSTEM**

MOVING FORWARD

- ✓ PFAS TASK FORCE
- ✓ MEETING MONTHLY
- ✓ CAREFULLY REVIEWING SCIENCE AS IT BECOMES AVAILABLE



KEEP IN TOUCH



JOE MARTIN

5301 Northshore Drve
North Little Rock, AR 72118



PHONE

t: 501.682.0660



EMAIL

Joe.M.Martin@adeq.state.ar.us



WEBSITE

www.adeq.state.ar.us



@AREnergyEnvironment



@ArkansasEE



ARKANSAS
ENERGY & ENVIRONMENT