United States
Environmental Protection
Agency

# Development of the Proposed Unregulated Contaminant Monitoring Rule for the Fifth Monitoring Cycle (UCMR 5): Public Meeting and Webinar

Held July 16, 2019
USEPA, Office of Ground Water and Drinking Water

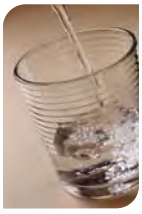
Office of Water (MLK 140) EPA 815-A-19-001 July 2019

# Development of the Proposed Unregulated Contaminant Monitoring Rule for the Fifth Monitoring Cycle (UCMR 5)



Public Meeting and Webinar

July 16th, 2019
Meeting starts at 9:00 a.m. EDT



U.S. EPA

Office of Ground Water and Drinking Water

## If you are participating by webinar…

- Listen-only mode
- Click on "+" next to "Questions" in the control panel (Figure 1) to submit questions/comments
  - Type a question in the box; click send (Figure 2)
- Submit questions as soon as possible
  - Questions will be answered at the end of each presentations

Figure 1

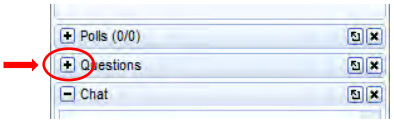
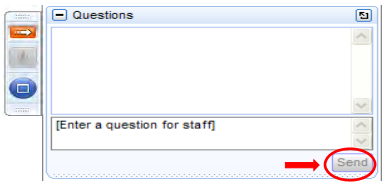



Figure 2



# Welcome

Eric Burneson, U.S. EPA
Office of Ground Water and Drinking Water
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# General Meeting Information

- Purpose
  - Provide an opportunity for stakeholders to learn and discuss potential approaches to developing the proposal for the fifth Unregulated Contaminant Monitoring Rule (UCMR 5):
    - The impacts of the America's Water Infrastructure Act (AWIA) of 2018
    - Analytical methods and analytes being considered including Per - and Polyfluoroalkyl Substances (PFAS)
    - Sampling design
    - Laboratory approval
    - Other possible requirements
- Webinar lines are muted to minimize background noise
- On-site attendees:
  - Please mute electronic devices/cell phones
  - Bathrooms in hall, follow signs

| Agenda | |
|---|---|
| 8:30 | Registration/sign-in |
| 9:00 | Logistics/General Meeting Information |
| | Welcome |
| | Overview of the Unregulated Contaminant Monitoring Program |
| | UCMR 5 Potential Approaches |
| ~10:30 | Break |
| | UCMR 5 Candidate Prioritization, Rationale and Method Consideration |
| ~12:00-1:00 | Lunch |
| ~1:00 | Anticipated Process for Approval of Laboratories Supporting UCMR 5 |
| | Closing Remarks |
| | Break |
| ~3:00 | Discussion |
| ~5:00 | Adjourn |

# Overview of the Unregulated Contaminant Monitoring Program

Dan Hautman, U.S. EPA
Office of Ground Water and Drinking Water
Standards and Risk Management Division
Technical Support Center

# Overview

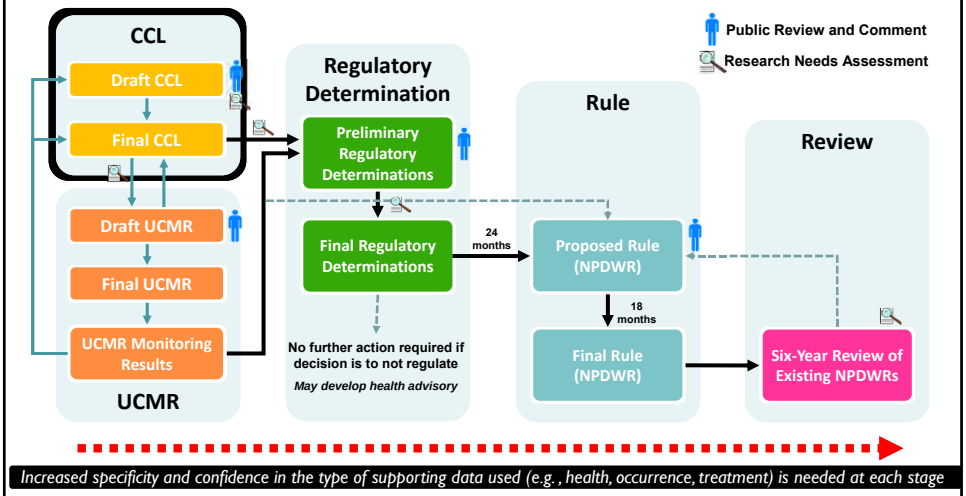
- Regulatory background for UCMR
  - Unregulated Contaminant Monitoring (UCM) program
  - Safe Drinking Water Act (SDWA) authority
  - Relationship to Contaminant Candidate List (CCL), Regulatory Determinations, and Six-Year Review



# SDWA

- Passed in 1974, SDWA authorized the Environmental Protection Agency (EPA) to set enforceable health standards for contaminants in drinking water
  - National Primary Drinking Water Regulations (NPDWRs)
- 1986 SDWA amendments were the basis for the original UCM program
  - State drinking water programs managed the original UCM program
  - Public Water Systems (PWSs) serving > 500 people were required to monitor
- 1996 SDWA amendments changed the process of developing and reviewing NPDWRs
  - CCL
  - UCMR
  - Regulatory Determination
  - Six-Year Review

## General Flow of SDWA Regulatory Processes



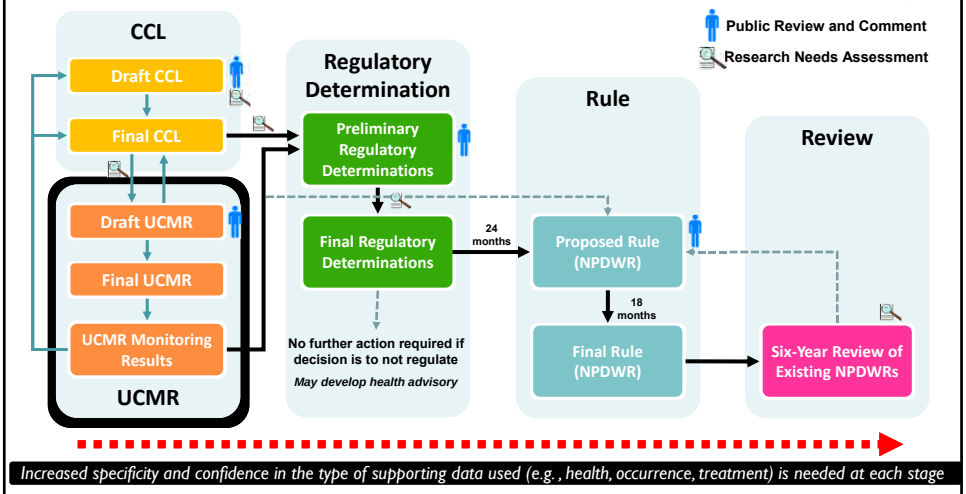



## CCL

- SDWA 1412(b)(1)(B) established listing of contaminants for consideration
  - Contaminants are:
    - Not subject to any proposed or promulgated NPDWR
    - Known or anticipated to occur in PWSs
    - May require regulation under SDWA
  - List must be published every 5 years

**The Final CCL 4 was published November 17, 2016 and includes 97 chemicals or chemical groups and 12 microbes**

## General Flow of SDWA Regulatory Processes






## UCMR

- SDWA section 1445(a)(2), as amended in 1996, established requirements for the UCMR Program:
  - Issue list of no more than 30 unregulated contaminants, once every 5 years
  - Require PWSs serving population >10,000 people as well as a nationally representative sample of small PWSs serving ≤10,000 people to monitor
  - Store analytical results in the National Contaminant Occurrence Database for Drinking Water (NCOD)
  - EPA funds shipping/analytical costs for small PWSs
- EPA manages program in partnership with States, tribes, and territories (herein after referred to as "States")

## America's Water Infrastructure Act of 2018

- SDWA was amended in 2018 by Public Law 115-270
  - AWIA
  - Enacted October 23, 2018
- Key changes to UCMR (see SDWA section 1445(j)) include:
  - Require PWSs serving between 3,300 and 10,000 to monitor
  - Ensure that only a representative sample of PWSs serving fewer than 3,300 people monitor
- Limitations:
  - Subject to the availability of appropriations and sufficient laboratory capacity to accommodate the analysis
- Authorization of Appropriations:
  - Additional $15,000,000 in each fiscal year for which monitoring is required to be carried out



## Objective of UCMR Program

- Collect nationally representative occurrence data for unregulated contaminants that may require regulation under the SDWA
  - Consider data collected as part of future EPA decisions on actions to protect public health
  - Provide data to States, local governments and to the public for their use in decisions regarding public health protection

**National occurrence data publicly available:**
http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule

## UCMR History

- UCMR 1 (2001-2005, 26 contaminants)
  - Published in Federal Register (FR) on September 17, 1999
- UCMR 2 (2007-2011, 25 contaminants)
  - Published in FR on January 4, 2007
- UCMR 3 (2012-2016, 30 contaminants)
  - Published in FR on April 16, 2012
- UCMR 4 (2017-2021, 30 contaminants)
  - Published in FR on December 20, 2016
  - PWSs monitor 2018-2020
- UCMR 5 (2022-2026)
  - Anticipating proposal summer 2020 and final rule late 2021
  - PWSs monitor 2023-2025

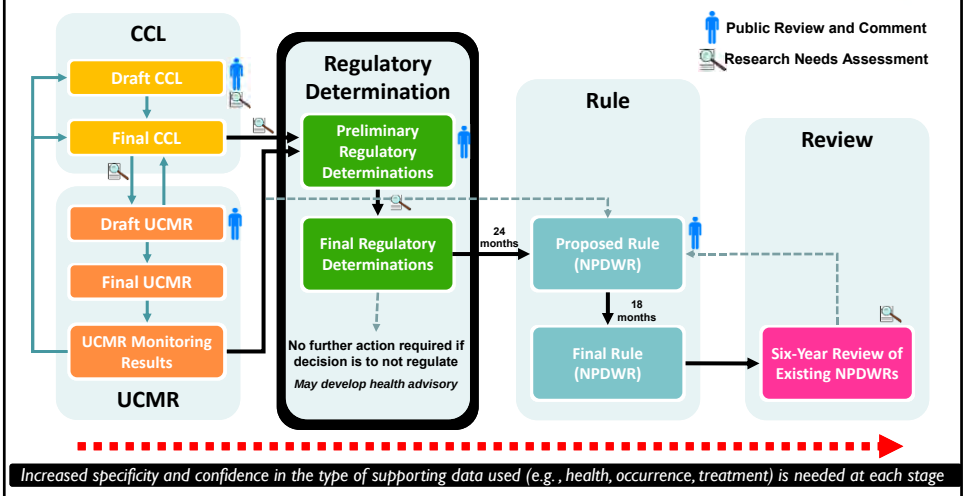
**Each new UCMR cycle is established via a revision to the rule for the ongoing/preceding cycle**



## General Process for Developing UCMR

- Early public stakeholder meetings
  - Provide background on statutory requirements
  - Discuss method development for emerging contaminants
  - Discuss anticipated elements of the proposal
- Agency development of the proposal
  - Includes a workgroup of multi-state and multi-office representatives, and tribal consultation
- Publish proposed rule in the FR
  - Provides a public comment period (generally 60 days)
- Public stakeholder meeting during public comment period
- Publish final rule in the FR
- Public stakeholder meeting after final rule publication
  - Review final rule and prepare for implementation

## General Flow of SDWA Regulatory Processes






## Regulatory Determinations

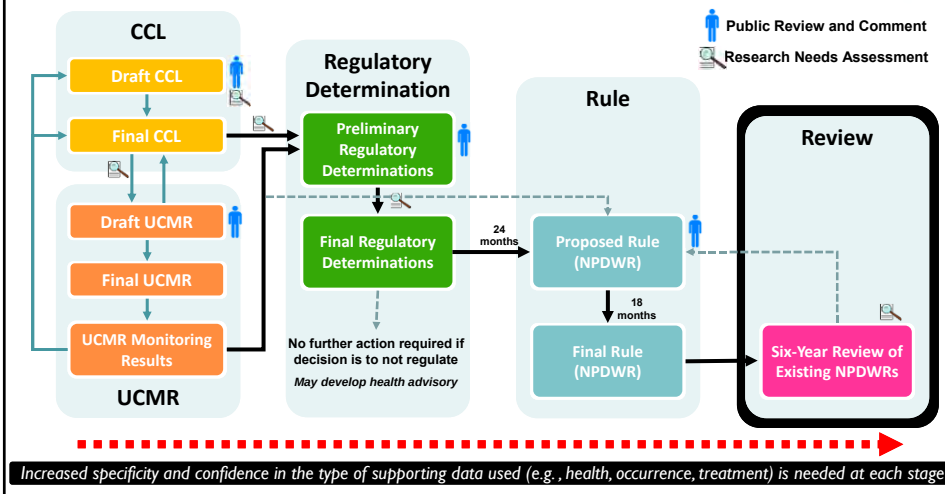
- Every five years, the Administrator shall, after notice of the preliminary determination and opportunity for public comment, for not fewer than five contaminants included on the CCL, make determinations on whether or not to regulate such contaminants.
- SDWA requires EPA to publish a maximum contaminant level goal (MCLG) and promulgate an NPDWR for a contaminant if the Administrator determines that:



1. The contaminant may have an **adverse effect** on the health of persons;
2. The contaminant is **known to occur or there is substantial likelihood** that the contaminant will occur in public water systems with a frequency and at levels of public health concern; **and**
3. In the sole judgment of the Administrator, regulation of such contaminant presents a meaningful opportunity for health risk reduction for persons served by public water systems.

**SDWA Section 1412(b)(1)*

## General Flow of SDWA Regulatory Processes






## Six-Year Review

- SDWA Section 1412(b)(9) requires review and revision, as appropriate, of each NPDWRs not less often than every six years. The review includes:
  - Re-evaluation of exposure to regulated contaminants based on their health effects and occurrence in drinking water
  - Evaluation of exposure to unregulated contaminants connected to regulated contaminants
- Any revisions to existing NPDWRs must maintain protection or provide for greater health protection

# UCMR 5 Potential Approaches

Brenda Bowden, U.S. EPA
Office of Ground Water and Drinking Water
Standards and Risk Management Division
Technical Support Center

## Overview

- Timeline
- Sampling design considerations
- PWS types
- Approach to tiered monitoring
  - Assessment Monitoring (AM)
  - Screening Survey (SS)
  - Pre-Screen Testing (PST)
- Applicability
- Sampling frequency and locations
- Implementation roles
  - EPA
  - States
  - Small PWSs
  - Large PWSs
- Potential changes between UCMR 4 and UCMR 5

## Draft Timeline of UCMR 5 Activities

| 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|
| ← **UCMR 5 Development** → | | | **Publish Final Rule** |
| Method Development Stakeholder Meeting **(June 6, 2018)** | Pre-Proposal Stakeholder Meeting **(July 16, 2019)** | Publish Proposal, 60 day Public Comment Period, Stakeholder Meeting **(Summer 2020)** | Publish UCMR 5 Final Rule **(Winter 2021)** |
| | | **Post Proposal: Initiate Implementation** → • Lab Approval • PWS SDWARS registration/notification/Inventory • Partnership Agreements (PAs), State Monitoring Plans (SMPs), Small System Inventory (SSI), Large System Inventory (LSI) • Ground Water Representative Monitoring Plan (GWRMP) submittal • Outreach/trainings | |

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## Draft Timeline of UCMR 5 Activities

| 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|
| **Pre-monitoring Implementation** | **Monitoring** | | | **Post-monitoring Phase** |
| • Continuation of Lab Approval • PWS SDWARS registration/notification/Inventory • PAs, SMPs, SSIs, LSIs • GWRMP submittal • Outreach/trainings | ← **Implementation Activities** → • Assist PWSs with compliance • Implement small system monitoring • Post data quarterly to NCOD **Reporting and analysis of data** • All PWSs serving 3,300 or more people • Representative sample of small PWSs serving fewer than 3,300 people | | | • Complete resampling, as needed • Conclude data reporting • Finalize NCOD • Compliance assistance/ enforcement, as needed |

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## Sampling Design Considerations

- Sampling and statistical design used in UCMR 1, 2, 3 and 4 was:
  - Vetted with stakeholders
  - Peer reviewed
  - Three rounds of public comment
  - Update to incorporate AWIA



## Sampling Design Considerations

- Data Quality Objectives
  - Unbiased national exposure estimates; small margin of error
  - Account for differential occurrence
    - Stratify across system size and source water type to account for differences
    - Multiple sample events over multiple years to address temporal variability
    - Allocation across States proportional to population served; at least two per State

# PWS Types

- **PWS**: provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year
  - Community water system (CWS)
    - PWS that supplies water to the same population year-round
  - Non-Transient Non-Community Water System (NTNCWS)
    - PWS that supplies water to at least 25 of the same people at least six months per year, but not year-round
    - For example, schools
  - Transient Non-Community Water System (TNCWS) (not generally included in UCMR monitoring)
    - PWS that provides water where people do not remain for long periods of time
    - For example, gas stations and campgrounds



# UCMR Approach

- UCMR approach relies on using one or more of 3 monitoring tiers
  - Assessment Monitoring (primary approach to-date)
  - Screening Survey (used in UCMR 1, UCMR 2, UCMR 3)
  - Pre-Screen Testing (used in UCMR 3)
- Based on:
  - Availability and complexity of analytical methods
  - Laboratory capacity
  - Sampling frequency
  - Relevant universe of PWSs
  - Other considerations (e.g., cost/burden)

## Assessment Monitoring: Statistical Approach

- Presuming availability of appropriations and lab capacity, AWIA will expand participating systems to include:
  - Nationally representative sample of 800 small systems serving fewer than 3,300
  - Census of small systems serving between 3,300 and 10,000 persons
  - Census of large systems serving > 10,000 persons
- Small-system statistical sample and census, combined with large-system census data provides a powerful tool for assessing contaminant occurrence
- Total number of systems: ~10,300



## Screening Survey: Statistical Approach

- Designed to ensure the data can be used to support regulatory decisions
- Account for possible laboratory capacity issues
- Approach used in UCMR 2 and 3 involved:
  - National sample of 800 systems, allocated across systems serving 100,000 or fewer people
  - Census of all systems serving 100,001 and over (~400 systems)
    - Adds further confidence in the sampling results by including a census of the largest systems
- **Total number of systems ~1,200**

## Pre-Screen Testing

- Envisioned for use with methods that are in the early stages of development, and/or very specialized (such as those for viruses or DNA/microchips)
- May be conducted by limited number of PWSs identified as vulnerable (by EPA and/or State agencies), as was done with UCMR 3 virus monitoring



## Draft UCMR System Applicability per AWIA

| | System Type | Systems Serving > 10,000 people | Systems Serving 3,300 – 10,000 people | Systems Serving <3,300 people |
|---|---|---|---|---|
| Assessment Monitoring | CWS[1] & NTNCWS[2] | All systems (4,365) | All systems (5,147) (~400 pre-AWIA) | 800 randomly selected systems (~400 pre-AWIA) |
| Screening Survey | CWS & NTNCWS | All systems (436) serving more than 100,000, and ~320 randomly selected systems serving 10,001 to 100,000 | 480 randomly selected systems | |
| Pre-Screen Testing | May be conducted by a limited number of PWSs | | | |

[1]Community Water System
[2]Non-Transient Non-Community Water System

## UCMR Sampling Frequency

- UCMR 1 – UCMR 4 have used similar sampling frequency
  - **Surface Water (SW)** – surface water systems (including groundwater under the direct influence of surface water) sampled four times during their year of monitoring
  - **Ground Water (GW)** – ground water systems sampled two times during their year of monitoring
  - Specialized sampling frequency was used for focused sample designs (e.g., eight sample events for cyanotoxins in UCMR 4)



## UCMR Sampling Locations

- Sampling locations for potential AM and SS contaminants
  - Contaminants generally sampled at the entry points to the distribution systems (EPTDSs)
  - Disinfection byproducts and microbial contaminants generally sampled at Disinfectants and Disinfection Byproducts Rules (D/DBPR) Total Trihalomethanes (TTHM)/Haloacetic Acids (HAA5) distribution system (DS) locations or at the at the distribution system maximum residence time (DSMRT) location
  - Adjustment in sampling locations may be warranted depending on the final selection of UCMR 5 contaminants

## EPA Implementation Roles

- Small PWS support:
  - Maintain lab and implementation contracts to support UCMR
  - Compile contact and inventory information
  - Manage sample kit distribution and tracking
  - Responsible for data review and reporting
- Large and Small PWS support:
  - Extract data from the Safe Drinking Water Accession and Review System (SDWARS) for evaluation and reporting to NCOD
  - Support SDWARS reporting system and users
  - Perform inventory and schedule updates
  - Provide technical assistance
  - Use SDWARS for real-time communication and outreach



## EPA Implementation Roles (Cont.)

- Review and track PWS applicability and monitoring progress
- Coordinate Laboratory Approval Program
- Provide technical support for Regions, States, PWSs and laboratories
- Coordinate outreach
- Support Regional compliance assistance and enforcement efforts

## Extended UCMR Implementation Team

- Office of Ground Water and Drinking Water (OGWDW), Drinking Water Protection Division (DWPD), Infrastructure Branch
  - Assist with SDWARS development and operation
- EPA Regional Offices
  - Coordinate State PAs
  - Assist States and PWSs with UCMR requirements, compliance assistance, and enforcement
- Partnering States
  - Support various levels of monitoring coordination



## States' Role in the UCMR Program

- Participation by States is voluntary
- State roles are documented via PAs
- States help EPA implement the UCMR program; help to ensure high data quality
- PA activities can include any/all of the following:
  - Review and revise SMPs
  - Provide inventory for small and large PWSs
  - Review and approve proposed GWRMPs
  - Provide compliance assistance
  - Notify and instruct systems
  - Collect samples
  - Other

## UCMR Responsibilities – Small PWSs

- EPA funds costs associated with analyses and shipping for small PWSs (i.e., those serving 10,000 or fewer people)
- This would include the small PWSs serving between 3,300 and 10,000 per AWIA
- EPA engages States and PWSs to collect samples
- EPA coordinates sample analyses with contracted laboratories and funds the analyses
- EPA examines the results along with quality control (QC) data and makes results available via SDWARS



## UCMR Responsibilities – Large PWSs

- PWSs serving more than 10,000 people are responsible for the costs associated with analyses
- PWS coordinates sample analyses with an approved laboratory
- Laboratories post the data to SDWARS
- PWS reviews and can act upon (e.g., approve) data in SDWARS
- States and EPA can review results following large PWS review

## Potential Change Between UCMR 4 and UCMR 5 Proposal: GWRMPs

- Expand the number of PWSs that can participate in the GWRMPs
  - **UCMR 4:** Current EPA rule
    - Large ground water systems with multiple EPTDSs can sample at representative sampling locations rather than at each EPTDS if prior approval is received (See 40 CFR 141.35(c)(3)), known as GWRMPs
  - **UCMR 5 potential change:**
    - Expand GWRMPs to water systems that serve 10,000 or fewer people
  - **Reason for considering change:** Reduce the number of sample points per water system and ultimately reduce cost



## Potential Change Between UCMR 4 and UCMR 5 Proposal: Deadlines

- Reduce the number of days between sample collection and laboratory posting of data **(40 CFR 141.40(c)(6)(ii) *Reporting Schedule and* 40 CFR 141.40(a)(5)(vi) *Reporting*)**
  - **UCMR 4: Current EPA rule**
    - "laboratory posts the data to EPA's electronic data reporting system within **120 days** from sample collection date…"
    - "You must require your laboratory to submit these data electronically to the State and EPA using EPA's electronic data reporting system, accessible at https://www.epa.gov/dwucmr, within **120 days** from the sample collection date."
  - **UCMR 5 potential change:**
    - "laboratory posts data **that pass quality control (QC)** to EPA's electronic data reporting system within **90 days** from sample collection date…"
    - "You must require your laboratory to submit these data electronically to the State and EPA using EPA's electronic data reporting system, accessible at https://www.epa.gov/dwucmr, within **90 days** from the sample collection date."
  - **Reason for considering change:** Many laboratories are currently posting results in less than 90 days. This change will expedite the availability of monitoring results.

## Potential Change Between UCMR 4 and UCMR 5 Proposal: Deadlines

- Reduce the number of days for PWS review of data posted by their laboratory **(40 CFR 141.40(c)(6)(ii) *Reporting Schedule and* 40 CFR 141.40(a)(5)(vi) *Reporting*)**
  - **UCMR 4: Current EPA rule**
    - "You have **60 days** from when the laboratory posts the data in EPA's electronic reporting system to review, approve, and submit the data to the State and EPA…"
    - "You then have **60 days** from when the laboratory posts the data to review, approve and submit the data to the State and EPA..."
  - **UCMR 5 potential change:**
    - "You have **30 days** from when the laboratory posts the data in EPA's electronic reporting system to review, approve, and submit the data to the State and EPA…"
    - "You then have **30 days** from when the laboratory posts the data to review, approve and submit the data to the State and EPA..."
  - **Reason for considering change:** Most PWSs that review their results do so in less than 30 days. This change will expedite the availability of monitoring results.



## Potential Change Between UCMR 4 and UCMR 5 Proposal: Deadlines

- Establish more flexible deadlines for laboratory approval
  - **UCMR 4: Current EPA rule**
    - To participate in the UCMR Laboratory Approval Program, the laboratory must complete and submit the necessary registration forms within **60 days of final rule publication**, and necessary application materials within **120 days of final rule publication**.
  - **UCMR 5 potential change:**
    - To participate in the UCMR Laboratory Approval Program, the laboratory must complete and submit the necessary registration and application materials **180 days prior to the start of initial monitoring period**.
  - **Reason for considering change:** Provide greater flexibility per laboratory interest.

# UCMR 5 Candidate Prioritization, Rationale and Method Considerations

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Steve Wendelken, Ph.D., U.S. EPA

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Standards and Risk Management Division

Technical Support Center

## Overview

- CCL 4 contaminants
- Candidate Selection Process and Rationale
- Method Considerations
- Health and Occurrence Data with Sources
- Contaminant Specific Information by Method

# CCL 4

| | | |
|---|---|---|
| 1,1,1,2-Tetrachloroethane (502.2, 524.2, 524.3, 524.4) | Erythromycin (542) | Oxirane, methyl- |
| 1,1-Dichloroethane (UCMR 3) | Estradiol (17-beta estradiol) (UCMR 3) | Oxydemeton-methyl (538) |
| 1,2,3-Trichloropropane (UCMR 3) | Estriol (UCMR 3) | Oxyfluorfen (UCMR 4) |
| 1,3-Butadiene (UCMR 3) | Estrone (UCMR 3) | Perfluorooctanesulfonic acid (PFOS) (UCMR 3) |
| 1,4-Dioxane (UCMR 3) | Ethinyl Estradiol (17-alpha ethynyl estradiol) (UCMR 3) | Perfluorooctanoic acid (PFOA) (UCMR 3) |
| 17 alpha-Estradiol | Ethoprop (UCMR 4) | Permethrin (UCMR 4) |
| 1-Butanol (UCMR 4) | Ethylene glycol | Profenofos (UCMR 4) |
| 2-Methoxyethanol (UCMR 4) | Ethylene Oxide | Quinoline (UCMR 4) |
| 2-Propen-1-ol (UCMR 4) | Ethylene thiourea | RDX (UCMR 2) |
| 3-Hydroxycarbofuran (531.1, 531.2, 540, 543) | Formaldehyde (556, 556.1) | sec-Butylbenzene (502.2, 524.2, 524.3, 524.4) |
| 4,4'-Methylenedianiline | Germanium (UCMR 4) | Tebuconazole (UCMR 4) |
| Acephate (538) | Halon 1011 (bromochloromethane) (UCMR 3) | Tebufenozide (540, 543) |
| Acetaldehyde (556, 556.1) | HCFC–22 (UCMR 3) | Tellurium |
| Acetamide | Hexane | Thiodicarb |
| Acetochlor (UCMR 1, UCMR 2) | Hydrazine | Thiophanate-methyl |
| Acetochlor ethanesulfonic acid (ESA) (UCMR 2) | Manganese (UCMR 4) | Toluene diisocyanate |
| Acetochlor oxanilic acid (OA) (UCMR 2) | Mestranol | Tribufos (UCMR 4) |
| Acrolein | Methamidophos (538) | Triethylamine |
| Alachlor ethanesulfonic acid (ESA) (UCMR 2) | Methanol | Triphenyltin hydroxide (TPTH) |
| Alachlor oxanilic acid (OA) (UCMR 2) | Methyl bromide (Bromomethane) (UCMR 3) | Urethane (In Development) |
| alpha-Hexachlorocyclohexane (UCMR 4) | Methyl tert-butyl ether (UCMR 1) | Vanadium (UCMR 3) |
| Aniline | Metolachlor (UCMR 2) | Vinclozolin (525.3, 527) |
| Bensulide (540, 543) | Metolachlor ethanesulfonic acid (ESA) (UCMR 2) | Ziram |
| Benzyl chloride | Metolachlor oxanilic acid (OA) (UCMR 2) | Adenovirus |
| Butylated hydroxyanisole (UCMR 4) | Molybdenum (UCMR 3) | Caliciviruses (UCMR 3) |
| Captan | Nitrobenzene (UCMR 1) | Campylobacter jejuni |
| Chlorate (UCMR 3) | Nitroglycerin | Enterovirus (UCMR 3) |
| Chloromethane (Methyl chloride) (UCMR 3) | N-Methyl-2-pyrrolidone (In Development) | Escherichia coli (O157) |
| Clethodim | N-Nitrosodiethylamine (NDEA) (UCMR 2) | Helicobacter pylori |
| Cobalt (UCMR 3) | N-Nitrosodimethylamine (NDMA) (UCMR 2) | Hepatitis A virus |
| Cumene hydroperoxide | N-Nitroso-di-n-propylamine (NDPA) (UCMR 2) | Legionella pneumophila (In Development) |
| Cyanotoxins (UCMR 4) | N-Nitrosodiphenylamine | Mycobacterium avium (In Development) |
| Dicrotophos (538) | N-Nitrosopyrrolidine (NPYR) (UCMR 2) | Naegleria fowleri |
| Dimethipin (UCMR 4) | Nonylphenol (In Development) | Salmonella enterica |
| Diuron (UCMR 1) | Norethindrone (19-Norethisterone) | Shigella sonnei |
| Equilenin | n-Propylbenzene (502.2, 524.2, 524.3, 524.4) | |
| Equilin (UCMR 3) | o-Toluidine (UCMR 4) | |

# CCL 4 Contaminants Monitored in UCMRs

| | | |
|---|---|---|
| 1,1-Dichloroethane (UCMR 3) | Dimethipin (UCMR 4) | Nitrobenzene (UCMR 1) |
| 1,2,3-Trichloropropane (UCMR 3) | Diuron (UCMR 1) | N-Nitrosodiethylamine (NDEA) (UCMR 2) |
| 1,3-Butadiene (UCMR 3) | Equilin (UCMR 3) | N-Nitrosodimethylamine (NDMA) (UCMR 2) |
| 1,4-Dioxane (UCMR 3) | Estradiol (17-beta estradiol) (UCMR 3) | N-Nitroso-di-n-propylamine (NDPA) (UCMR 2) |
| 1-Butanol (UCMR 4) | Estriol (UCMR 3) | N-Nitrosopyrrolidine (NPYR) (UCMR 2) |
| 2-Methoxyethanol (UCMR 4) | Estrone (UCMR 3) | o-Toluidine (UCMR 4) |
| 2-Propen-1-ol (UCMR 4) | Ethinyl Estradiol (17-alpha ethynyl estradiol) (UCMR 3) | Oxyfluorfen (UCMR 4) |
| Acetochlor (UCMR 1, UCMR 2) | Ethoprop (UCMR 4) | Perfluorooctanesulfonic acid (PFOS) (UCMR 3) |
| Acetochlor ethanesulfonic acid (ESA) (UCMR 2) | Germanium (UCMR 4) | Perfluorooctanoic acid (PFOA) (UCMR 3) |
| Acetochlor oxanilic acid (OA) (UCMR 2) | Halon 1011 (bromochloromethane) (UCMR 3) | Permethrin (UCMR 4) |
| Alachlor ethanesulfonic acid (ESA) (UCMR 2) | HCFC–22 (UCMR 3) | Profenofos (UCMR 4) |
| Alachlor oxanilic acid (OA) (UCMR 2) | Manganese (UCMR 4) | Quinoline (UCMR 4) |
| alpha-Hexachlorocyclohexane (UCMR 4) | Methyl bromide (Bromomethane) (UCMR 3) | RDX (UCMR 2) |
| Butylated hydroxyanisole (UCMR 4) | Methyl tert-butyl ether (UCMR 1) | Tebuconazole (UCMR 4) |
| Chlorate (UCMR 3) | Metolachlor (UCMR 2) | Tribufos (UCMR 4) |
| Chloromethane (Methyl chloride) (UCMR 3) | Metolachlor ethanesulfonic acid (ESA) (UCMR 2) | Vanadium (UCMR 3) |
| Cobalt (UCMR 3) | Metolachlor oxanilic acid (OA) (UCMR 2) | Caliciviruses (UCMR 3) |
| Cyanotoxins (UCMR 4) | Molybdenum (UCMR 3) | Enterovirus (UCMR 3) |

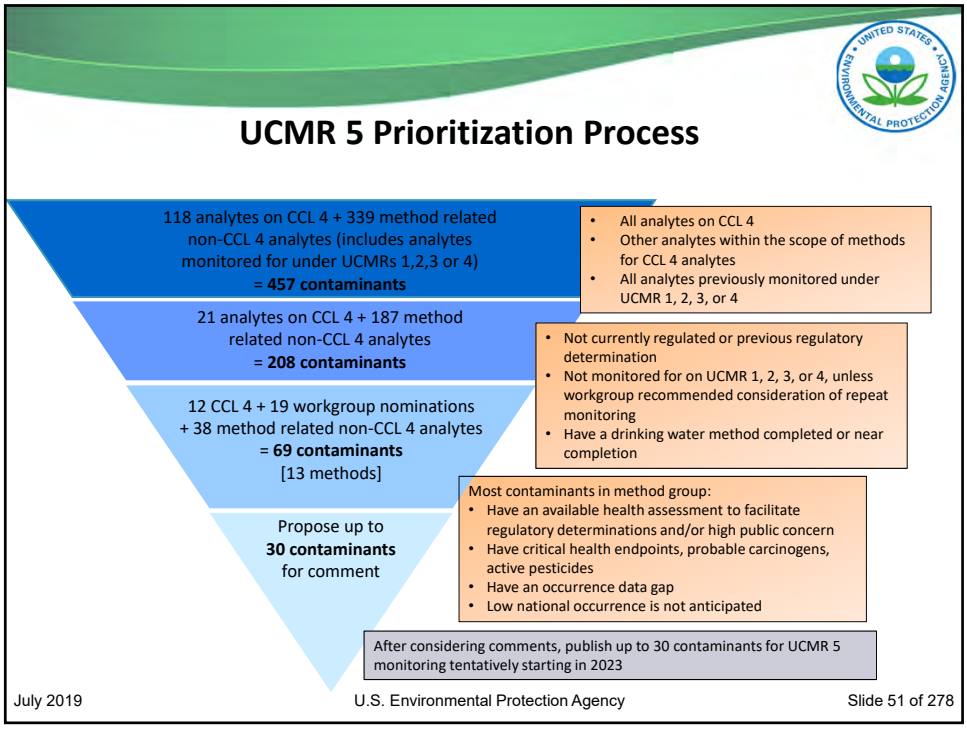
# CCL 4 Contaminants Not Yet Monitored in UCMR

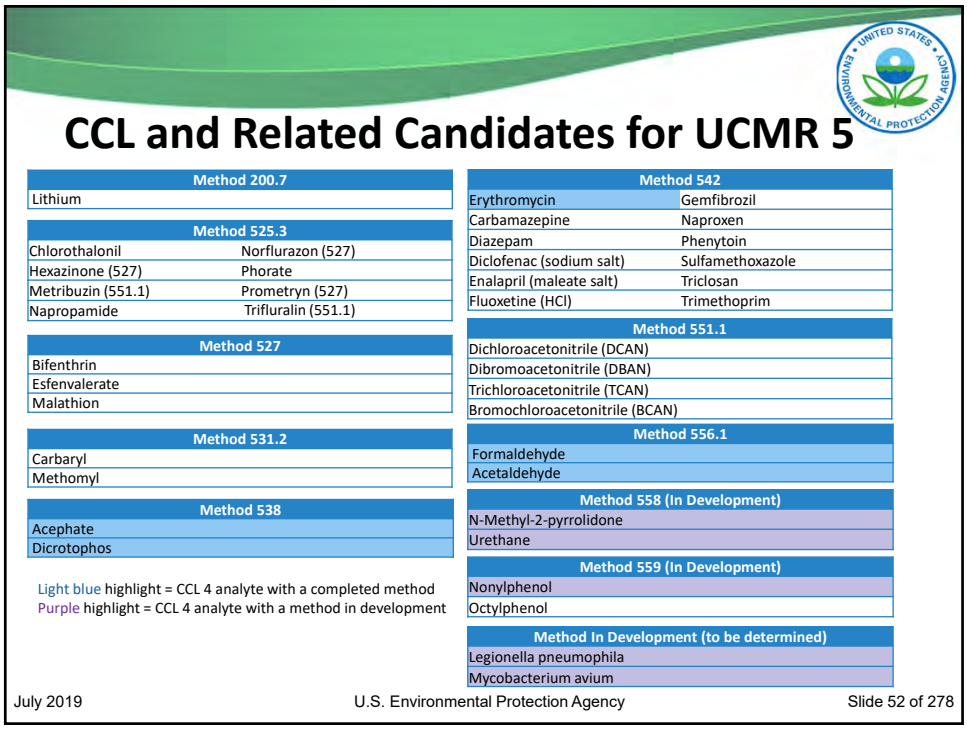
| Method Available | Method in Development | No Method or Current Development Activity by EPA | |
|---|---|---|---|
| 1,1,1,2-Tetrachloroethane (502.2, 524.2, 524.3, 524.4) | N-Methyl-2-pyrrolidone | 17 alpha-Estradiol | Adenovirus |
| 3-Hydroxycarbofuran (531.1, 531.2, 540, 543) | Nonylphenol | 4,4'-Methylenedianiline | Campylobacter jejuni |
| Acephate (538) | Urethane | Acetamide | Escherichia coli (O157) |
| Acetaldehyde (556, 556.1) | Legionella pneumophila | Acrolein | Helicobacter pylori |
| Bensulide (540, 543) | Mycobacterium avium | Aniline | Hepatitis A virus |
| Dicrotophos (538) | | Clethodim | Naegleria fowleri |
| Erythromycin (542) | | Equilenin | Salmonella enterica |
| Formaldehyde (556, 556.1) | | Ethylene glycol | Shigella sonnei |
| Methamidophos (538) | | Ethylene thiourea | |
| n-Propylbenzene (502.2, 524.2, 524.3, 524.4) | | Hydrazine | |
| Oxydemeton-methyl (538) | | Nitroglycerin | |
| sec-Butylbenzene (502.2, 524.2, 524.3, 524.4) | | N-Nitrosodiphenylamine | |
| Tebufenozide (540, 543) | | Norethindrone (19-Norethisterone) | |
| Vinclozolin (525.3, 527) | | Oxirane, methyl- | |
| | | Tellurium | |
| | | Thiodicarb | |
| | | Thiophanate-methyl | |
| | | Triethylamine | |
| | | Triphenyltin hydroxide (TPTH) | |
| | | Ziram | |
| | | Benzyl chloride* | |
| | | Captan* | |
| | | Cumene hydroperoxide* | |
| | | Ethylene Oxide* | |
| | | Hexane* | |
| | | Mestranol* | |
| | | Methanol* | |
| | | Toluene diisocyanate* | * Method Challenges |

# CCL 5 Nominations

| | | |
|---|---|---|
| 1,1-dichloroethane | Heroin and its metabolites | *Aeromonas hydrophila* |
| 1,4-dioxane | Hexavalent chromium | Adenovirus |
| 3-Hydroxycarbofuran | Manganese | Caliciviruses |
| Azinphos-methyl | Methamphetamine and its metabolites | *Campylobacter jejuni* |
| Brominated haloacetic acids (HAA6Br) | Molybdenum | CCL 4 contaminants (12 microbes) |
| Bromochloroacetic acid (BCAA) | N-Nitrosodiethylamine (NDEA) | Cyanotoxins |
| Bromochloroiodo-methane (BCIM) | N-Nitrosodimethylamine (NDMA) | Cyanotoxins (anatoxin; microcystin -LA, -LR, -LW, -RR, -YR; cylindrospermopsin) |
| Bromodichloroacetic acid (BDCAA) | N-Nitroso-di-n-propylamine (NDPA) | Enterovirus |
| Bromo-dichloro-nitromethane (BDCNM) | N-Nitrosodiphenylamine (NDPhA) | *Escherichia coli (0157)* |
| Bromodiiodomethane (BDIM) | N-Nitrosopyrrolidine (NPYR) | *Helicobacter pylori* |
| CCL 4 contaminants (97 chemicals or chemical groups) | Parents and metabolites of top 200 most prescribed drugs in 2016 | Hepatitis A virus |
| Chlorate | Perfluoroalkyl and polyfluoroalkyl substances (PFAS) | *Legionella pneumophila* |
| Chlorodibromoacetic acid (CDBAA) | Perfluorobutanesulfonic acid (PFBS) | *Mycobacterium avium* |
| Chloro-diiodo-methane (CDIM) | Perfluorobutanoic acid (PFBA) | Mycobacterium species predominantly found in finished drinking water |
| Chloropicrin (trichloro-nitromethane; TCNM) | Perfluoroheptanoic acid (PFHpA) | *Naegleria fowleri* |
| Chlorpyrifos | Perfluorohexanesulfonic acid (PFHxS) | Nontuberculous mycobacteria (NTM) |
| Dibromo-chloro-nitromethane (DBCNM) | Perfluorononanoic acid (PFNA) | *Pseudomonas aeruginosa* |
| Dibromo-iodo-methane (DBIM) | Perfluorooctanesulfonic acid (PFOS) | *Salmonella enterica* |
| Dichloro-iodo-methane (DCIM) | Perfluorooctanoic acid (PFOA) | *Shigella sonnei* |
| Fluoxetine | Strontium | |
| Gemfibrozil | Tribromoacetic acid (TBAA) | |
| GenX chemicals | Triiodo-methane (TIM) | |

* Public comment nominations were received October 4 – December 4, 2018


UCMR 5 Prioritization Process
118 analytes on CCL 4 + 339 method related non-CCL 4 analytes (includes analytes monitored for under UCMRs 1,2,3 or 4) = 457 contaminants
21 analytes on CCL 4 + 187 method related non-CCL 4 analytes = 208 contaminants
12 CCL 4 + 19 workgroup nominations + 38 method related non-CCL 4 analytes = 69 contaminants [13 methods]
Propose up to 30 contaminants for comment
All analytes on CCL 4
Other analytes within the scope of methods for CCL 4 analytes
All analytes previously monitored under UCMR 1, 2, 3, or 4
Not currently regulated or previous regulatory determination
Not monitored for on UCMR 1, 2, 3, or 4, unless workgroup recommended consideration of repeat monitoring
Have a drinking water method completed or near completion
Most contaminants in method group:
Have an available health assessment to facilitate regulatory determinations and/or high public concern
Have critical health endpoints, probable carcinogens, active pesticides
Have an occurrence data gap
Low national occurrence is not anticipated
After considering comments, publish up to 30 contaminants for UCMR 5 monitoring tentatively starting in 2023
July 2019
U.S. Environmental Protection Agency
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CCL and Related Candidates for UCMR 5
Method 200.7
Lithium
Method 525.3
Chlorothalonil
Hexazinone (527)
Metribuzin (551.1)
Napropamide
Norflurazon (527)
Phorate
Prometryn (527)
Trifluralin (551.1)
Method 527
Bifenthrin
Esfenvalerate
Malathion
Method 531.2
Carbaryl
Methomyl
Method 538
Acephate
Dicrotophos
Light blue highlight = CCL 4 analyte with a completed method
Purple highlight = CCL 4 analyte with a method in development
Method 542
Erythromycin
Carbamazepine
Diazepam
Diclofenac (sodium salt)
Enalapril (maleate salt)
Fluoxetine (HCl)
Gemfibrozil
Naproxen
Phenytoin
Sulfamethoxazole
Triclosan
Trimethoprim
Method 551.1
Dichloroacetonitrile (DCAN)
Dibromoacetonitrile (DBAN)
Trichloroacetonitrile (TCAN)
Bromochloroacetonitrile (BCAN)
Method 556.1
Formaldehyde
Acetaldehyde
Method 558 (In Development)
N-Methyl-2-pyrrolidone
Urethane
Method 559 (In Development)
Nonylphenol
Octylphenol
Method In Development (to be determined)
Legionella pneumophila
Mycobacterium avium
July 2019
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# CCL and Related Candidates for UCMR 5 (cont'd)

| Draft Method 533 | |
|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 4,8-dioxa-3H-perfluorononanoic acid (ADONA) (537.1) |
| 1H, 1H, 2H, 2H-perfluorohexane sulfonic acid (4:2 FTS) | Hexafluoropropylene oxide dimer acid (HFPO-DA) (537.1) |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | Perfluorobutanesulfonic acid (PFBS) (537.1) |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | Perfluorodecanoic acid (PFDA) (537.1) |
| Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA) | Perfluorododecanoic acid (PFDoA) (537.1) |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | Perfluoroheptanoic acid (PFHpA) (537.1) |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | Perfluorohexanoic acid (PFHxA) (537.1) |
| Perfluorobutanoic acid (PFBA) | Perfluorohexanesulfonic acid (PFHxS) (537.1) |
| Perfluoroheptanesulfonic acid (PFHpS) | Perfluorononanoic acid (PFNA) (537.1) |
| Perfluoropentanesulfonic acid (PFPeS) | Perfluorooctanesulfonic acid (PFOS) (537.1) |
| Perfluoropentanoic acid (PFPeA) | Perfluorooctanoic acid (PFOA) (537.1) |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS) (537.1) | Perfluoroundecanoic acid (PFUnA) (537.1) |
| 9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS) (537.1) | |

| PFAS Analytes Unique to Method 537.1 | |
|---|---|
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | Perfluorotetradecanoic acid (PFTA) |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | Perfluorotridecanoic acid (PFTrDA) |

Light blue highlight = CCL 4 analyte with a completed method



# EPA Health Assessment Data Sources

- Office of Pesticide Programs (OPP)
  - https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1
- Office of Research and Development
  - Integrated Risk Information System (IRIS) https://cfpub.epa.gov/ncea/iris_drafts/AtoZ.cfm
  - Provisional Peer-Reviewed Toxicity Values (PPRTVs) https://www.epa.gov/pprtv/provisional-peer-reviewed-toxicity-values-pprtvs-assessments
- Office of Water Health Advisory (HA) or Health Effect Support Document (HESD)
  - https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information

## Non-EPA Health Assessment Data Sources

- Available non-EPA health assessments were also included in the "Additional Health Values" section, for example:
  - Agency for Toxic Substances and Disease Registry (ATSDR) https://www.atsdr.cdc.gov/az/a.html
  - World Health Organization (WHO) https://www.who.int/gho/en/
  - Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada) https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality.html#tech_doc



## Health Values

- The health values are calculated drinking water concentrations based on publicly-available information:
  - 2018 Edition of Drinking Water Standards and Health Advisories (DWSHA) Tables
    - https://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf
  - CCL 4 Contaminant Information Sheets (CISs)
    - https://www.epa.gov/sites/production/files/2016-11/documents/815r16003.pdf
  - Human Health Benchmarks for Pesticides (HHBP)
    - https://iaspub.epa.gov/apex/pesticides/f?p=HHBP:home:10911636297819
  - Other non-EPA sources (e.g., Health Canada)
- The health values are:
  - Not *federally* enforceable
  - Subject to change as health effects information becomes available
  - Calculated using different assumptions (e.g., body weight, intake, population group)

# Occurrence Data and Information Sources

**Finished Water Data**

- Unregulated Contaminant Monitoring Rule (UCMR) (2001 - current)
- Unregulated Contaminant Monitoring (UCM) Round 1 and 2 (1988 - 1997)
- National Inorganics and Radionuclides Survey (NIRS) (1984 – 1986)
- Disinfection Byproduct Information Collection Rule (DBP-ICR) Data (1997 – 1998)
- U.S. Department of Agriculture (USDA) Pesticide Data Program (PDP)
- Pesticide Monitoring Program (PMP)
- California Department of Health Services (CAL DHS)
- Small-Scale Local Occurrence Studies



# Occurrence Data and Information Sources (cont.)

**Supplemental Drinking Water and Ambient Water Data**

- U.S. Geological Survey (USGS), Ambient Water
  - National Water Quality Assessment Program (NAWQA)
  - National Reconnaissance of Emerging Contaminants (NREC)
  - Special reports
  - Groundwater Ambient Monitoring and Assessment Program (GAMA)
- Other specialized studies and literature

**Production, Release, Usage and Other Data**

- Toxic Release Inventory (TRI)
- National Center for Food and Agricultural Policy (NCFAP)
- Cancellation Status for Pesticides
- Persistent, Bioaccumulative and Toxic (PBT) Profiler
- Chemical Data Reporting (CDR) under the Toxic Substance Control Act (TSCA)

# Candidate Analyte Information

**For each candidate analyte group the sets of slides that follow will address the following:**

- Method number/technology type/name
- Potential sampling location
- Analytes under consideration
- Background (including the availability of health effects and occurrence information)



# Metals

## EPA Method 200.7 (ICP-AES), 1994

***Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry***

Location: EPTDS

| Analytes |
| --- |
| Lithium |

# Lithium: Background

| | |
|---|---|
| **CASRN** | 7439-93-2 |
| **Contaminant Group** | Metal, pharmaceutical |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Nationally representative finished water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Lithium: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | Provisional Peer-Reviewed Toxicity Values (PPRTV), 2008 |
| **Critical Effect** | Adverse effects in several organs and systems (e.g., kidney effects); lower bound of the therapeutic serum concentration range selected as basis |
| **Provisional Reference Dose** | 0.002 mg/kg-day (chronic and subchronic) |
| **Health Value** | NA |
| **Additional Health Values**<br>• Cancer Classification: Inadequate information to assess carcinogenic potential (I) | |

# Lithium: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | National Inorganics and Radionuclides Survey (NIRS), 1984-1986 |

**Additional Occurrence Data**

Finished Water:

- NIRS: Detected in 551 of 988 (55.8%) PWSs; detection range 5-7,929 ug/L
- Glassmeyer, 2017: Detected in 56% of partially treated samples from 25 PWSs; median detected 10.8 ug/L

Ambient Water:

- NAWQA: Detected in 5,683 of 5,983 (95%) sites; detection range 0.15-2,420 ug/L
- Glassmeyer, 2017: Detected in 56% of samples from 25 PWSs; median detected 10.7 ug/L



# Semivolatile Organic Chemicals

## EPA Method 525.3 (GC/MS), 2012

***Determination of Semivolatile Organic Chemicals in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS)***

Location: EPTDS

| Analytes | |
|---|---|
| Chlorothalonil | Norflurazon (527) |
| Hexazinone (527) | Phorate |
| Metribuzin (551.1) | Prometryn (527) |
| Napropamide | Trifluralin (551.1) |

# Chlorothalonil: Background

| | |
|---|---|
| **CASRN** | 1897-45-6 |
| **Contaminant Group** | Pesticide; Used as a fungicide and bactericide |
| **PCCL/CCL Status** | Preliminary Contaminant Candidate List (PCCL) |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 7% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BF = Biodegrades fast (BIODEG) |



# Chlorothalonil: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OW Health Advisory (HA), 1988 |
| **Critical Effect** | Histological changes to the kidney tubules |
| **Cancer Slope Factor** | 0.024 $(mg/kg/day)^{-1}$ |
| **Health Value** | 1.5-150 ug/L (cancer risk range $10^{-6}$ to $10^{-4}$); Wilson et al., 1985 (unpublished/MRID 00146945) |

**Additional Health Values**

- 1988 HA: One day HA = 200 ug/L; Ten day HA = 200 ug/L; Drinking Water Equivalent Level (DWEL) = 500 ug/L
- 1988 IRIS Reference Dose (RfD) = 0.015 mg/kg-day (renal tubular epithelial vacuolation)
- ADI = 0.03 mg/kg-day
- California Office of Environmental Health Hazard Assessment (OEHHA) Cancer Slope Factor (CSF) = 0.017 $(mg/kg-day)^{-1}$
- Cancer Classification: Probable human carcinogen; indicates sufficient evidence in animals and inadequate or no evidence in humans (Group B2)
- International Agency for Research on Cancer (IARC) Cancer Classification: Possibly carcinogenic to humans (Group 2B)

# Chlorothalonil: Occurrence

| Best Available Occurrence Data | State |
|---|---|

**Additional Occurrence Data**

Finished Water:

- CAL DHS: Detected in 0 of 4,099 (0.0%) PWSs
- PMP: Detected in 0 of 225 (0.0%) samples
- USDA PDP: Detected in 0 of 6 (0.0%) sites

Ambient Water:

- NAWQA: Detected in 21 of 5,787 (0.36%) sites; detection range 0.01-3.33 ug/L
- USDA PDP: Detected in 0 of 6 (0.0%) sites (Raw)
- PMP: Detected in 0 of 312 (0.0%) samples
- Toccalino, 2010: Detected in 0 of 507 (0.0%) samples
- USDA PDP: Detected in 0 of 29 (0.0%) samples (2002)

Production/Release:

- TRI: Total on and off-site releases: 1,036,501 lbs in 11 states; TRI releases to water: 14 lbs in 2 states



# Hexazinone: Background

| | |
|---|---|
| **CASRN** | 51235-04-2 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Hexazinone: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | Office of Pesticides Program (OPP) Reregistration Eligibility Decision (RED), 1994; on 2018 Drinking Water Standards and Health Advisories (DWSHA) Tables |
| **Critical Effect** | Changes in clinical chemistry and histopathological parameters from a one-year feeding study in dogs |
| **Reference Dose** | 0.05 mg/kg-day |
| **Health Value** | 400 ug/L (chronic) |

**Additional Health Values**

- 1996 HA: One day HA = 3,000 ug/L; Ten day HA = 2,000 ug/L; DWEL = 2,000 ug/L
- 1987 IRIS RfD = 0.033 mg/kg-day; decreased body weight
- Cancer Classification: Not classifiable as to human carcinogenicity (Group D)



# Metribuzin: Background

| | |
|---|---|
| **CASRN** | 21087-64-9 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Nationally representative finished water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | BST = Biodegrades sometimes/recalcitrant (PBT) |

# Metribuzin: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP RED, 1997; on 2018 DWSHA Tables |
| **Critical Effect** | Changes in thyroid, lung weight and other histopathological parameters in a two-year feeding study in rats |
| **Reference Dose** | 0.01 mg/kg-day |
| **Health Value** | 70 ug/L (chronic) |

**Additional Health Values**

- 1988 HA: One day HA = 5,000 ug/L; Ten day HA = 5,000 ug/L; DWEL = 350 ug/L
- 1987 IRIS RfD = 0.025 mg/kg-day (liver and kidney effects, decreased body weight, mortality)
- 2019, Health Canada: Maximum Acceptable Concentration (MAC)(2005) = 80 ug/L
- Cancer Classification: Not classifiable as to human carcinogenicity (Group D)



# Metribuzin: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Unregulated Contaminant Monitoring (UCM) |

**Additional Occurrence Data**

Finished Water:

- UCM Round 2: Detected in 9 of 13,568 (0.07%) PWSs; detection range 0.1-2 ug/L
- PMP: Detected in 0 of 228 (0.0%) samples
- USDA PDP: Detected in 2 of 13 (15.40%) sites; detection range 0.0107-0.075 ug/L

# Metribuzin: Occurrence

**Additional Occurrence Data (cont'd)**

Ambient Water:

- NAWQA: Detected in 606 of 11,379 (5.33%) sites; detection range 0.001-15.6 ug/L
- GAMA: Detected in 2 of 1,828 (0.10%) PWSs; detection range 0.01-0.113 ug/L
- PMP: Detected in 47 of 323 (14.60%) samples; maximum detected 0.291 ug/L
- Toccalino, 2010: Detected in 11 of 898 (1.20%) samples; detection range 0.00458-0.105 ug/L
- USDA PDP: Detected in 1 of 288 (0.30%) samples at 0.042 ug/L (2001)
- USDA PDP: Detected in 0 of 582 (0.0%) samples (2002)
- USDA PDP: Detected in 2 of 7 (28.60%) sites; detection range 0.0107-0.12 ug/L (Raw)

Production/Release:

- NCFAP: Releases to water: 3,320,231 lbs in 48 states
- TRI: Total on and off-site releases: 15,725 lbs in 9 states; TRI releases to water: 21 lbs in 2 states



# Napropamide: Background

| | |
|---|---|
| **CASRN** | 15299-99-7 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Napropamide: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP Human Health Benchmark for Pesticides (HHBP), 2005 |
| **Critical Effect** | Decreased weight gain in females and increased liver lesions in male rats |
| **Reference Dose** | 0.12 mg/kg-day |
| **Health Value** | 770 ug/L (chronic) |
| **Additional Health Values** | |



# Norflurazon: Background

| | |
|---|---|
| **CASRN** | 27314-13-2 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 17% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BST = Biodegrades sometimes/recalcitrant (PBT) |

# Norflurazon: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 2001 |
| **Critical Effect** | Increased absolute and relative liver weight and increased cholesterol values in dogs |
| **Reference Dose** | 0.015 mg/kg-day |
| **Health Value** | 96 ug/L (chronic) |

**Additional Health Values**

- HHBP: 800 ug/L (RfD = 0.03 mg/kg-day); non-cancer (acute - females 13-49 years)
- 1987 IRIS RfD = 0.04 mg/kg-day (archived)



# Norflurazon: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |

**Additional Occurrence Data**

Finished Water:

- PMP: Detected in 0 of 225 (0.0%) samples

Ambient Water:

- NAWQA: Detected in 217 of 7,803 (2.78%) sites; detection range 0.00025-26.5 ug/L
- PMP: Detected in 6 of 312 (1.90%) samples; maximum detected 0.414 ug/L
- USDA PDP: Detected in 0 of 154 (0.0%) samples (2001)
- USDA PDP: Detected in 0 of 288 (0.0%) samples (2002)

# Phorate: Background

| | |
|---|---|
| **CASRN** | 298-02-2 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Phorate: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 1999 |
| **Critical Effect** | Inhibition of red blood cell and brain cholinesterase activity in dogs |
| **Reference Dose** | 0.00017 mg/kg-day |
| **Health Value** | 1.1 ug/L (chronic) |

**Additional Health Values**

- HHBP: 5 ug/L (RfD = 0.0008 mg/kg-day); non-cancer (acute - children)
- 2019, Health Canada: MAC (2005) = 2 ug/L
- Cancer Classification: Evidence of non-carcinogenicity for humans (Group E)

# Prometryn: Background

| | |
|---|---|
| **CASRN** | 7287-19-6 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Prometryn: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 2009 |
| **Critical Effect** | Kidney effects and bone marrow atrophy in dogs |
| **Reference Dose** | 0.04 mg/kg-day |
| **Health Value** | 300 ug/L (chronic) |

**Additional Health Values**

- HHBP: 3,300 ug/L (RfD = 0.12 mg/kg-day); non-cancer (acute - females 13-49 years)
- 1987 IRIS RfD: 0.004 mg/kg-day (archived)
- Cancer Classification: Evidence of non-carcinogenicity for humans (Group E)

# Trifluralin: Background

| | |
|---|---|
| **CASRN** | 1582-09-8 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 3% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BST = Biodegrades sometimes/recalcitrant (PBT) |



# Trifluralin: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP RED, 1996; on 2018 DWSHA Table |
| **Critical Effect** | Reduced body weight, decreased red cells and hemoglobin levels, increased cholesterol and liver weight in a one-year feeding study in dogs |
| **Reference Dose** | 0.02 mg/kg-day |
| **Health Value** | 10 ug/L (chronic) |

**Additional Health Values**

- 1990 HA: One day HA = 80 ug/L; Ten day HA = 80 ug/L; DWEL = 700 ug/L; Cancer Risk $10^{-4}$ = 400 ug/L
- 2019, Health Canada: MAC (2005) = 45 ug/L
- 1989 IRIS RfD = 0.0075 mg/kg-day (increased liver weights; increase in methemoglobin)
- 1988 IRIS CSF = 0.0077 $(mg/kg\text{-}day)^{-1}$ (renal pelvis carcinomas, urinary bladder papillomas)
- Cancer Classification: Possible human carcinogen (Group C)
- IARC Cancer Classification: Not classifiable as to its carcinogenicity to humans (Group 3)

# Trifluralin: Occurrence

| Best Available Occurrence Data | State |
|---|---|

**Additional Occurrence Data**

Ambient Water:

- NAWQA: Detected in 485 of 10,201 (4.75%) sites; detection range 0.001-1.74 ug/L

Production/Release:

- NCFAP: Releases to water: 22,263,693 lbs in 46 states
- TRI: Total on and off-site releases: 11,482 lbs in 22 states



# Pesticides and Flame Retardants

## EPA Method 527 (GC/MS), 2005

***Determination of Selected Pesticides and Flame Retardants in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS)***

Location: EPTDS

| Analytes | |
|---|---|
| Bifenthrin | Hexazinone (525.3) |
| Esfenvalerate | Norflurazon (525.3) |
| Malathion | Prometryn (525.3) |

# Bifenthrin: Background

| | |
|---|---|
| **CASRN** | 82657-04-3 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Bifenthrin: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 2012 |
| **Critical Effect** | Reductions in locomotor activity; supported by multiple guideline studies |
| **Reference Dose** | 0.01 mg/kg-day |
| **Health Value** | 70 ug/L (acute - children) |
| **Additional Health Values**<br>• 1988 IRIS RfD = 0.015 mg/kg-day (tremors)<br>• Cancer Classification: Possible human carcinogen (Group C) | |

# Esfenvalerate: Background

| | |
|---|---|
| **CASRN** | 66230-04-4 |
| **Contaminant Group** | Pesticide; medication |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 2% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); DFA = Degrades slowly with acclimation (Hazardous Substances Data Bank [HSDB]) |



# Esfenvalerate: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 2004 |
| **Critical Effect** | Acute neurotoxicity screen based on tremors |
| **Reference Dose** | 0.0018 mg/kg-day |
| **Health Value** | 12 ug/L (chronic and acute) |
| **Additional Health Values**<br>• Cancer Classification: Evidence of non-carcinogenicity for humans (Group E) | |

# Esfenvalerate: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |
| **Additional Occurrence Data**<br>Ambient Water:<br>• NAWQA: Detected in 0 of 2,965 (0.00%) sites<br>Production/Release:<br>• NCFAP: Releases to water: 228,885 lbs in 47 states | |



# Malathion: Background

| | |
|---|---|
| **CASRN** | 121-75-5 |
| **Contaminant Group** | Pesticide; veterinary medicine |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 25% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); DF = Degrades fast (HSDB) |

# Malathion: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP RED, 2009; on 2018 DWSHA Tables |
| **Critical Effect** | Red blood cell cholinesterase inhibition in rats |
| **Reference Dose** | 0.07 mg/kg-day |
| **Health Value** | 500 ug/L (chronic) |

**Additional Health Values**

- 1992 HA: One day HA = 200 ug/L; Ten day HA = 200 ug/L; DWEL = 2,000 ug/L
- 1987 IRIS RfD = 0.02 mg/kg-day (red blood cell cholinesterase [RBC ChE] depression)
- ATSDR Minimal Risk Level = 0.02 mg/kg-day
- 2019, Health Canada: MAC (2005) = 190 ug/L
- ADI = 0.3 mg/kg-day
- Cancer Classification: Suggestive evidence of carcinogenic potential (S)
- IARC Cancer Classification: Probably carcinogenic to humans (Group 2A)



# Malathion: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |

**Additional Occurrence Data**

Finished Water:

- CAL DHS: Detected in 0 of 271 (0.0%) PWSs
- PMP: Detected in 0 of 228 (0.0%) samples
- USDA PDP: Detected in 0 of 283 (0.0%) samples (2001)
- USDA PDP: Detected in 0 of 669 (0.0%) samples (2002)
- USDA PDP: Detected in 2 of 13 (15.40%) sites; detection range 0.01-0.331 ug/L

# Malathion: Occurrence

**Additional Occurrence Data (cont'd.)**

Ambient Water:

- NAWQA: Detected in 416 of 11,237 (3.70%) sites; detection range 0.00041-9.58 ug/L
- USDA PDP: Detected in 0 of 7 (0.0%) sites (Raw)
- GAMA: Detected in 0 of 1828 (0.0%) PWSs
- PMP: Detected in 6 of 323 (1.90%) samples; maximum detected 0.106 ug/L
- Toccalino, 2010: Detected in 0 of 898 (0.0%) samples

Production/Release:

- NCFAP: releases to water: 5,809,943 lbs in 42 states
- TRI: Total on and off-site releases: 108,619 lbs in 12 states; TRI releases to water: 5 lbs in 1 state



# N-Methylcarbamoyloximes and N-Methylcarbamates

## EPA Method 531.2 (DAI/HPLC), 2001

***Measurement of N-Methylcarbamoyloximes and N-Methylcarbamates in Water by Direct Aqueous Injection HPLC with Postcolumn Derivatization***

Location: EPTDS

| Analytes | |
|---|---|
| Carbaryl | Methomyl |

# Carbaryl: Background

| | |
|---|---|
| **CASRN** | 63-25-2 |
| **Contaminant Group** | Pesticide; veterinary medicine |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Nationally representative finished water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 13% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BSA = Biodegrades slowly with acclimation |



# Carbaryl: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP RED, 2008; on 2018 DWSHA Table |
| **Critical Effect** | Hemangiosarcomas in mice |
| **Cancer Slope Factor** | $8.75 \times 10^{-4}$ (mg/kg-day) $^{-1}$ |
| **Health Value** | 40-4,000 ug/L (cancer risk range $10^{-6}$ to $10^{-4}$) |

**Additional Health Values**

- 1988 HA: One day HA = 1,000 ug/L; Ten day HA = 1,000 ug/L; DWEL = 400 ug/L
- 1987 OW HA and IRIS RfD = 0.01 mg/kg-day (kidney and liver toxicity)
- ADI = 0.008 mg/kg-day
- 2019, Health Canada: MAC (2005) = 90 ug/L
- Cancer Classification: Likely to be carcinogenic to humans (L)
- IARC Cancer Classification: Not classifiable as to its carcinogenicity to humans (Group 3)

# Carbaryl: Occurrence

| Best Available Occurrence Data | UCM |
|---|---|

**Additional Occurrence Data**

Finished Water

- UCM Round 2: Detected in 13 of 12,679 (0.10%) PWSs; detection range 0.18-3 ug/L
- PMP: Detected in 2 of 228 (0.90%) samples; maximum detected 0.041 ug/L (Method 2001)
- PMP: Detected in 0 of 225 (0.0%) samples (Method 9060)
- USDA PDP: Detected in 5 of 13 (38.50%) sites; detection range 0.005-0.3 ug/L

Production/Release:

- TRI: Total on and off site releases: 872 lbs in 9 states; TRI releases to water: 6 lbs in 2 states
- NCFAP: releases to water: 4,857,542 lbs in 48 states



# Carbaryl: Occurrence

**Additional Occurrence Data (cont'd)**

Ambient Water:

- NAWQA: Detected in 820 of 11,274 (7.27%) sites; detection range 0.00038-23.5 ug/L
- GAMA: Detected in 1 of 1,831 (0.05%) PWSs at 0.007 ug/L
- NREC: (SW National Reconnaissance) Detected in 14 of 85 (16.50%) sites; median detected 0.04 ug/L
- NREC: (GW National Aggregate) Detected in 0.12% of samples; median detected 0.9 ug/L
- NREC: (SW National Aggregate) Detected in 5.05% of samples; median detected 0.17 ug/L
- PMP: Detected in 7 of 323 (2.20%) samples; maximum detected 0.047 ug/L (Method 2001)
- PMP: Detected in 2 of 312 (0.60%) samples; maximum detected 0.063 ug/L (Method 9060)
- Toccalino, 2010: Detected in 6 of 898 (0.70%) samples; detection range 0.00277-0.0196 ug/L
- USDA PDP: Detected in 0 of 296 (0.0%) samples (2001)
- USDA PDP: Detected in 0 of 550 (0.0%) samples (2002)
- USDA PDP: Detected in 5 of 7 (71.40%) sites; detection range 0.0078-0.33 ug/L

# Methomyl: Background

| | |
|---|---|
| **CASRN** | 16752-77-5 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Nationally representative finished water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | Biodegrades fast (BF) |



# Methomyl: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OW HA, 1988 |
| **Critical Effect** | Histological changes in the kidney and spleen |
| **Reference Dose** | 0.025 mg/kg-day |
| **Health Value** | 200 ug/L (chronic) |

**Additional Health Values**

- 1988 HA: One day HA = 300 ug/L; Ten day HA = 300 ug/L; DWEL = 900 ug/L
- 1987 IRIS RfD = 0.025 mg/kg-day (kidney and spleen pathology)
- ADI = 0.02 mg/kg-day
- Cancer Classification: Evidence of non-carcinogenicity (Group E) (1988 HA)

# Methomyl: Occurrence

| Best Available Occurrence Data | UCM |
|---|---|

**Additional Occurrence Data**

Finished Water:

- UCM Round 2: Detected in 18 of 12,659 (0.14%) PWSs; maximum detected 3 ug/L
- CAL DHS: Detected in 1 of 4,611 (0.02%) PWSs at 15 ug/L
- PMP: Detected in 0 of 225 (0.0%) samples

Ambient Water:

- NAWQA: Detected in 83 of 7,697 (1.08%) sites; detection range 0.00018-3 ug/L
- PMP: Detected in 0 of 312 (0.0%) samples
- USDA PDP: Detected in 0 of 134 (0.0%) samples (2001)
- USDA PDP: Detected in 0 of 495 (0.0%) samples (2002)



# Organic Contaminants

## EPA Method 538 (DAI-LC/MS/MS), 2009

***Determination of Selected Organic Contaminants in Drinking Water by Direct Aqueous Injection-Liquid Chromatography/Tandem Mass Spectrometry (DAI-LC/MS/MS)***

Location: EPTDS

| Analytes | |
|---|---|
| Acephate | Dicrotophos |

# Acephate: Background

| | |
|---|---|
| **CASRN** | 30560-19-1 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | Biodegrades fast (BF) |



# Acephate: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 2000 |
| **Critical Effect** | Brain Cholinesterase inhibition |
| **Reference Dose** | 0.0012 mg/kg-day |
| **Health Value** | 7.7 ug/L (chronic) |

**Additional Health Values**

- HHBP: 30 ug/L (RfD = 0.005 mg/kg-day); non-cancer (acute – children)
- CCL 4 Non-Carcinogenic (NCAR) Health Value = 4 ug/L, Risk Assessment Information System- Health Effects Data Cancer Slope Factor (RAIS HE CSF) = 0.0087 $(mg/kg\text{-}d)^{-1}$
- 1989 IRIS RfD = 0.004 mg/kg-day (archived)
- ADI = 0.03 mg/kg-day
- Cancer Classification: Possible human carcinogen (Group C)

# Acephate: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |
| **Additional Occurrence Data**<br>Ambient Water:<br>• NAWQA: Detected in 135 of 1,760 (7.67%) sites; detection range 0.00051-10.4 ug/L<br>Production/Release:<br>• NCFAP: Releases to water: 2,462,354 lbs in 35 states<br>• TRI total on and off-site releases: 27,210 lbs in 4 states | |



# Dicrotophos: Background

| | |
|---|---|
| **CASRN** | 141-66-2 |
| **Contaminant Group** | Pesticide |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 39% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BS = Biodegrades slowly (PBT) |

# Dicrotophos: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 2015 |
| **Critical Effect** | Inhibition of brain cholinesterase in adult rat |
| **Reference Dose** | 0.00003 mg/kg-day |
| **Health Value** | 0.2 ug/L (chronic) |

**Additional Health Values**

- HHBP: 0.5 ug/L (RfD = 0.00007 mg/kg-day); non-cancer (acute – children)
- 1987 IRIS RfD = 0.0001 mg/kg-day (archived)
- Cancer Classification: Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential (S)



# Dicrotophos: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |

**Additional Occurrence Data**

Finished Water:

- Hopple, 2009: Detected in 0 of 48 (0.0%) samples (GW; Phase 2)
- PMP: Detected in 0 of 221 (0.0%) samples
- USDA PDP: Detected in 0 of 13 (0.0%) sites

Ambient Water:

- NAWQA: Detected in 33 of 4,916 (0.67%) sites; detection range 0.0005-6.83 ug/L
- USDA PDP: Detected in 0 of 6 (0.0%) sites
- Hopple, 2009: Detected in 0 of 221 (0.0%) samples (GW; Phase 1)
- Hopple, 2009: Detected in 0 of 48 (0.0%) samples (GW; Phase 2)
- PMP: Detected in 0 of 317 (0.0%) samples

Production/Release:

- NCFAP: Releases to water: 359,726 lbs in 13 states

# Pharmaceuticals and Personal Care Products

## EPA Method 542 (LC/ESI-MS/MS), 2016

***Determination of Pharmaceuticals and Personal Care Products in Drinking Water by Solid Phase Extraction and Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (LC/ESI-MS/MS)***

Location: EPTDS

| Analytes | |
|---|---|
| Carbamazepine | Gemfibrozil |
| Diazepam | Naproxen |
| Diclofenac (sodium salt) | Phenytoin |
| Enalapril (maleate salt) | Sulfamethoxazole |
| Erythromycin | Triclosan |
| Fluoxetine (HCl) | Trimethoprim |



# Carbamazepine: Background

| | |
|---|---|
| **CASRN** | 298-46-4 |
| **Contaminant Group** | Pharmaceutical and personal care product (PPCP) |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Carbamazepine: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- U.S. Food and Drug Administration (FDA): Maximum Recommended Daily Dose (MRDD) = 26.7 mg/kg-day



# Carbamazepine: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |

**Additional Occurrence Data**

Finished Water:

- Glassmeyer, 2017: Detected in 11% of partially treated samples from 9 PWSs; maximum detected 0.586 ug/L (Phase I)
- Glassmeyer, 2017: Detected in 8% of partially treated samples from 25 PWSs; maximum detected 0.02650 ug/L (Phase II)

Ambient Water:

- Glassmeyer, 2017: Detected in 11% of samples from 9 PWSs; maximum detected 0.269 ug/L (Phase I)
- Glassmeyer, 2017: Detected in 28% of samples from 25 PWSs; maximum detected 0.0357 ug/L (Phase II)
- NAWQA: Detected in 62 of 626 (9.90%) sites; detection range 0.00021-0.468 ug/L
- NREC: (GW National Reconnaissance) Detected in 5 of 27 (18.52%) sites; median detected 0.023 ug/L
- Focazio, 2008: Detected in 16 of 74 (21.62%) sites; maximum detected 0.19 ug/L

# Diazepam: Background

| | |
|---|---|
| **CASRN** | 439-14-5 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Diazepam: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- FDA: MRDD = 0.667 mg/kg-day
- IARC Cancer Classification: Not classifiable as to its carcinogenicity to humans (Group 3)

# Diazepam: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |
| **Additional Occurrence Data**<br>Ambient Water:<br>• NAWQA: Detected in 2 of 556 (0.36%) sites; detection range 0.00047-0.00115 ug/L | |



# Diclofenac: Background

| | |
|---|---|
| **CASRN** | 15307-86-5 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Diclofenac: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |
| **Additional Health Values**<br>• FDA: MRDD = 3.75 mg/kg-day | |



# Enalapril: Background

| | |
|---|---|
| **CASRN** | 75847-73-3 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Enalapril: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |
| **Additional Health Values**<br>• FDA: MRDD = 0.667 mg/kg-day | |



# Erythromycin: Background

| | |
|---|---|
| **CASRN** | 114-07-8 |
| **Contaminant Group** | PPCP; antibiotic |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 6% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BST = Biodegrades sometimes/recalcitrant |

# Erythromycin: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | WHO, 2006; on CCL 4 contaminant information sheets (CISs) |
| **Critical Effect** | Inhibition of beneficial gastrointestinal bacteria (based on a therapeutic application; may not be applicable to general population) |
| **Acceptable Daily Intake (ADI)** | 0.0007 mg/kg-day |
| **Health Value** | 4.9 ug/L (chronic) |
| **Additional Health Values**<br>• FDA: MRDD = 66.7 mg/kg-day | |

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# Erythromycin: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |
| **Additional Occurrence Data**<br>Ambient Water:<br>• Focazio, 2008: Detected in 8.10% of 73 sites; maximum detected 0.3 ug/L<br>• NAWQA: Detected in 1 of 557 (0.18%) sites at 0.00633 ug/L<br>• NREC: (GW National Reconnaissance) Detected in 0 of 90 (0.0%) sites<br>• NREC: (SW National Reconnaissance) Detected in 22 of 104 (21.50%) sites; median detected 0.1 ug/L; maximum detected 1.7 ug/L | |

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# Fluoxetine: Background

| | |
|---|---|
| **CASRN** | 54910-89-3 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Fluoxetine: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |
| **Additional Health Values**<br>• FDA: MRDD = 1.33 mg/kg-day | |

# Fluoxetine: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |
| **Additional Occurrence Data**<br>Ambient Water:<br>• NAWQA: Detected in 3 of 557 (0.54%) sites; detection range 0.00585-0.0171 ug/L<br>• NREC: (GW National Reconnaissance) Detected in 2 of 74 (2.7%) sites; median detected 0.0305 ug/L<br>• NREC: (SW National Reconnaissance) Detected in 1 of 84 (1.2%) sites; median detected 0.012 ug/L<br>• Focazio, 2008: Detected in 1 of 74 (1.35%) sites; maximum detected <RL ug/L<br>• Barnes, 2008: Detected in 2 of 47 (4.26%) sites; maximum detected 0.056 ug/L | |



# Gemfibrozil: Background

| | |
|---|---|
| **CASRN** | 25812-30-0 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Gemfibrozil: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- FDA: MRDD = 20 mg/kg-day
- IARC Cancer Classification: Not classifiable as to its carcinogenicity to humans (Group 3)



# Gemfibrozil: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |

**Additional Occurrence Data**

Ambient Water:

- NREC: (GW National Reconnaissance) Detected in 0 of 74 (0%) sites
- NREC: (SW National Reconnaissance) Detected in 3 of 84 (3.6%) sites; median detected 0.048 ug/L
- Barnes, 2008: Detected in 0 of 47 (0.00%) sites

# Naproxen: Background

| | |
|---|---|
| **CASRN** | 22204-53-1 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Phenytoin: Background

| | |
|---|---|
| **CASRN** | 57-41-0 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 16% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BSA = Biodegrades slowly with acclimation |

# Phenytoin: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**
- FDA: MRDD = 5 mg/kg-day
- IARC Cancer Classification: Possibly carcinogenic to humans (Group 2B)



# Phenytoin: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | State |

**Additional Occurrence Data**
Finished Water:
- Snyder, 2008: Detected in 74% of samples from 20 PWSs; maximum detected 0.032 ug/L

Ambient Water:
- NAWQA: Detected in 5 of 557 (0.90%) sites; detection range 0.0415-0.44 ug/L
- Snyder, 2008: Detected in 91% of samples from 20 PWS; maximum detected 0.04 ug/L
- Vanderford et al., 2006: Maximum detected 0.17 ug/L

Production/Release:
- TRI total on and off-site releases: 1,700 lbs in 2 states

# Sulfamethoxazole: Background

| | |
|---|---|
| **CASRN** | 723-46-6 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Sulfamethoxazole: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- IARC Cancer Classification: Not classifiable as to its carcinogenicity to humans (Group 3)

# Sulfamethoxazole: Occurrence

| **Best Available Occurrence Data** | State |
|---|---|

**Additional Occurrence Data**

Finished Water:

- Glassmeyer, 2017: Detected in 0% of partially treated samples from 9 PWSs (Phase I)
- Glassmeyer, 2017: Detected in 4% of partially treated samples from 25 PWSs; maximum detected 0.0082 ug/L (Phase II)

Ambient Water:

- NAWQA: Detected in 30 of 619 (4.85%) sites; detection range 0.0016-1.46 ug/L
- Glassmeyer, 2017: Detected in 0% of samples from 9 PWSs (Phase I)
- Glassmeyer, 2017: Detected in 40% of samples from 25 PWSs; maximum detected 0.1611 ug/L (Phase II)



# Sulfamethoxazole: Occurrence

**Additional Occurrence Data (cont'd)**

Ambient Water:

- NREC: (GW National Reconnaissance) Detected in 6 of 62 (9.68%) sites; median detected 0.055 ug/L
- NREC: (GW National Reconnaissance) Detected in 12 of 74 (16.22%) sites; median detected 0.021 ug/L
- NREC: (SW National Reconnaissance) Detected in 13 of 104 (12.5%) sites; median detected 0.15 ug/L
- NREC: (SW National Reconnaissance) Detected in 16 of 84 (19%) sites; median detected 0.066 ug/L
- Barnes, 2008: Detected in 11 of 47 (23.40%) sites; maximum detected 1.11 ug/L
- Focazio, 2008: Detected in 2 of 74 (2.7%) sites at an unquantifiable concentration of 0.023 ug/L

# Triclosan: Background

| | |
|---|---|
| **CASRN** | 3380-34-5 |
| **Contaminant Group** | Antiseptic/disinfectant/antimicrobial; pesticide |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Triclosan: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OPP HHBP, 1998 |
| **Critical Effect** | Diarrhea and hematological changes in baboons |
| **Reference Dose** | 0.3 mg/kg-day |
| **Health Value** | 2,000 ug/L (chronic and acute) |
| **Additional Health Values**<br>• Cancer Classification: Not likely to be carcinogenic to humans (N) | |

# Triclosan: Occurrence

| Best Available Occurrence Data | State |
|---|---|

**Additional Occurrence Data**

Finished Water:

- Glassmeyer, 2017: Detected in 0% of partially treated samples from 25 PWSs (Phase II)
- Hopple, 2009: Detected in 0 of 57 (0.0%) samples (GW; Phase 2)
- Kingsbury, 2008: Detected in 3.1% of 96 samples; maximum detected 0.05 ug/L (SW; Phase 2)



# Triclosan: Occurrence

**Additional Occurrence Data (cont'd)**

Ambient Water:

- NAWQA: Detected in 31 of 567 (5.47%) sites; detection range 0.01-0.56 ug/L
- Glassmeyer, 2017: Detected in 12% of samples from 25 PWSs; 0.00350 ug/L maximum detected (Phase II)
- Hopple, 2009: Detected in 0.5% of 217 samples; maximum detected 0.065 ug/L (GW; Phase 1)
- Hopple, 2009: Detected in 0 of 55 (0.0%) samples (GW; Phase 2)
- Kingsbury, 2008: Detected in 5.6% of 144 samples; maximum detected 0.1 ug/L (SW; Phase 1)
- Kingsbury, 2008: Detected in 5.2% of 96 samples; maximum detected 0.098 ug/L (SW; Phase 2)

# Trimethoprim: Background

| | |
|---|---|
| **CASRN** | 738-70-5 |
| **Contaminant Group** | PPCP |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Trimethoprim: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |
| **Additional Health Values**<br>• FDA: MRDD = 5.33 mg/kg-day | |

# Trimethoprim: Occurrence

| Best Available Occurrence Data | State |
|---|---|

**Additional Occurrence Data**

Ambient Water:

- NAWQA: Detected in 14 of 619 (2.26%) sites; detection range 0.00498-0.0927 ug/L
- NREC: (GW National Reconnaissance) Detected in 1 of 63 (1.59%) sites; median detected 0.09 ug/L
- NREC: (GW National Reconnaissance) Detected in 1 of 74 (1.35%) sites; median detected 0.0003 ug/L
- NREC: (SW National Reconnaissance) Detected in 13 of 104 (12.5%) sites; median detected 0.15 ug/L
- NREC: (SW National Reconnaissance) Detected in 23 of 84 (27.4%) sites; median detected 0.013 ug/L
- Barnes, 2008: Detected in 0 of 47 (0.00%) sites
- Focazio, 2008: Detected in 5 of 71 (7.04%) sites; maximum detected 0.02 ug/L



# Chlorination Disinfection Byproducts, Chlorinated Solvents, and Halogenated Pesticides/Herbicides

## EPA Method 551.1 (LLE/GC/ECD), 1995

***Determination of Chlorination Disinfection Byproducts, Chlorinated Solvents, and Halogenated Pesticides/Herbicides in Drinking Water by Liquid-Liquid Extraction and Gas Chromatography with Electron-Capture Detection***

Location: Stage 2 D/DBPR DS

| Analytes | |
|---|---|
| Bromochloroacetonitrile (BCAN) | Dibromoacetonitrile (DBAN) |
| Dichloroacetonitrile (DCAN) | Trichloroacetonitrile (TCAN) |

# Dichloroacetonitrile (DCAN): Background

| | |
|---|---|
| **CASRN** | 3018-12-0 |
| **Contaminant Group** | Haloacetonitrile (HAN); disinfection byproduct (DBP) |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 51% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BSA = Biodegrades slowly with acclimation; Note: may hydrolyze |



# Dichloroacetonitrile (DCAN): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

Studies below are summarized in USEPA's SYR3 Technical Support Document for Disinfectants/Disinfection Byproducts Rules, 2016:

- Lowest-observed-adverse-effect level (LOAEL) in rats of 55 mg/kg/day when DCAN was administered in tricaprylin (based on developmental toxicity) (Smith, 1986)
- Maternal and fetal no-observed-adverse-effect level (NOAEL) in rats of 15 mg/kg/day when DCAN was administered in tricaprylin (based on increased liver weight in the dams and decreased fetal weight and length and an increase in soft tissue malformations, respectively (Smith, 1989)
- Tolerable Daily Intake (TDI): 0.0027 mg/kg/day (based on increased relative liver weight in male and female rats), (WHO, 2004)
- Most genotoxic to the least genotoxic of the DBP classes haloacetonitriles > haloacetamides > HNMs > HALs > HAAs > >2C-haloacids > halomethanes (Plewa and Wagner, 2009)

# Dichloroacetonitrile (DCAN): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | DBP-ICR |
| **Additional Occurrence Data**<br>Distribution System:<br>• DBP-ICR: Detected in 70.1% PWSs; 50th percentile = 1.3 ug/L, 90th percentile = 4.4 ug/L<br>• Krasner, 1989: U.S. clear well quarterly medians range = 1.1- 1.2 ug/L | |



# Dibromoacetonitrile (DBAN): Background

| | |
|---|---|
| **CASRN** | 3252-43-5 |
| **Contaminant Group** | HAN; DBP |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 48% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BSA = Biodegrades slowly with acclimation; Note: may hydrolyze |

# Dibromoacetonitrile (DBAN): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

Studies below are summarized in USEPA's SYR3 Technical Support Document for Disinfectants/Disinfection Byproducts Rules, 2016:

- TDI: 0.11 mg/kg/day (based on decreased body weight in male rats) (WHO, 2004)
- Clear evidence of cancer of the oral cavity in male and female rats, of the glandular stomach in male rats and of the forestomach in male and female mice) (National Toxicology Program [NTP], 2010)
- Most genotoxic to the least genotoxic of the DBP classes haloacetonitriles > haloacetamides > HNMs > HALs > HAAs > >2C-haloacids > halomethanes (Plewa and Wagner, 2009)
- IARC Cancer Classification: Possibly carcinogenic to humans (Group 2B)



# Dibromoacetonitrile (DBAN): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | DBP-ICR |

**Additional Occurrence Data**

Distribution System:

- DBP-ICR: Detected in 48.6% PWSs; 50th percentile = <0.5 ug/L, 90th percentile = 2.3 ug/L
- Krasner, 1989: U.S. clear well quarterly medians range 0.46- 0.54 ug/L. At the utility with the highest bromide influent levels (2,800-3,000 ug/L), DBAN quarterly medians range 5.9-6.7 ug/L

# Bromochloroacetonitrile (BCAN): Background

| | |
|---|---|
| **CASRN** | 83463-62-1 |
| **Contaminant Group** | HAN; DBP |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 48% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BSA = Biodegrades slowly with acclimation; Note: may hydrolyze |



# Bromochloroacetonitrile (BCAN): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

Studies below are summarized in USEPA's SYR3 Technical Support Document for Disinfectants/Disinfection Byproducts Rules, 2016:

- Maternal NOAEL of 45 mg/kg/day and maternal LOAEL of 65 mg/kg/day in rats when BCAN was administered in tricaprylin (based on decreased maternal weight and increased dam mortality) (Christ, 1995)
- Maternal LOAEL of 5 mg/kg/day in rats, BCAN administered in tricaprylin (based on developmental and teratogenic effects) (Christ, 1995)
- Most genotoxic to the least genotoxic of the DBP classes haloacetonitriles > haloacetamides > HNMs > HALs > HAAs > >2C-haloacids > halomethanes (Plewa and Wagner, 2009)

# Bromochloroacetonitrile (BCAN): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | DBP-ICR |
| **Additional Occurrence Data**<br>Distribution System:<br>• DBP-ICR: Detected in 62.5% PWS; 50th percentile = 0.7 ug/L, 90th percentile = 2.6 ug/L<br>• Krasner, 1989: clear well quarterly medians range 0.50 - 0.70 ug/L. At the utility with the highest bromide influent levels (2,800 -3,000 ug/L), BCAN quarterly medians range 1.1-1.2 ug/L | |



# Trichloroacetonitrile (TCAN): Background

| | |
|---|---|
| **CASRN** | 545-06-2 |
| **Contaminant Group** | HAN; DBP |
| **PCCL/CCL Status** | PCCL |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 27% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BST = Biodegrades sometimes/recalcitrant |

# Trichloroacetonitrile (TCAN): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

Study below is summarized in USEPA's SYR3 Technical Support Document for Disinfectants/Disinfection Byproducts Rules, 2016:

- NOAEL in rats of 35 mg/kg/day and a LOAEL of 55 mg/kg/day when TCAN was administered in corn oil (based on developmental toxicity and teratogenicity) (Christ, 1996)
- Most genotoxic to the least genotoxic of the DBP classes haloacetonitriles > haloacetamides > HNMs > HALs > HAAs > >2C-haloacids > halomethanes (Plewa and Wagner, 2009)



# Trichloroacetonitrile (TCAN): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | DBP-ICR |

**Additional Occurrence Data**

Distribution System:

- DBP-ICR: Detected in 1.7% PWS; 50th percentile = <0.5 ug/L, 90th percentile = <0.5 ug/L
- Krasner, 1989: U.S. clear well quarterly medians range <0.012 - <0.029 ug/L

# Carbonyl Compounds

## EPA Method 556.1 (Fast GC), 1999

***Determination of Carbonyl Compounds in Drinking Water by Fast Gas Chromatography***

Location: EPTDS

| Analytes | |
|---|---|
| Acetaldehyde | Formaldehyde |



# Acetaldehyde: Background

| | |
|---|---|
| **CASRN** | 75-07-0 |
| **Contaminant Group** | Pesticide; food additive; chemical intermediate; DBP |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | BF = Biodegrades fast (BIODEG) |

# Acetaldehyde: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- CCL 4 NCAR Health Value = 23.3 µg/L, Registry of Toxic Effects of Chemical Substances (RTECS) RfD = 10 mg/kg-day
- Cancer Classification: Probable human carcinogen; indicates sufficient evidence in animals and inadequate or no evidence in humans (Group B2)
- IARC Cancer Classification: Possibly carcinogenic to humans (Group 2B)



# Acetaldehyde: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | DBP-ICR |

**Additional Occurrence Data**

Finished Water:

- DBP-ICR: Detected in 27 of 236 (11.44%) PWSs; maximum detected 18.3 ug/L

Production/Release:

- TRI: Total on and off site releases: 8,811,900 lbs in 39 states; TRI releases to water: 375,307 lbs in 29 states
- CDR: Production Volume: >100M - 500M lbs/yr (2002), 100M - < 500M lbs/yr (2006)

# Formaldehyde: Background

| | |
|---|---|
| **CASRN** | 50-00-0 |
| **Contaminant Group** | Naturally-occurring gas; pesticide; DBP |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Formaldehyde: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | IRIS, 1990; on 2018 DWSHA Table |
| **Critical Effect** | Reduced weight gain, histopathology in rats |
| **Reference Dose** | 0.2 mg/kg-day |
| **Health Value** | 1,000 ug/L (chronic) |

**Additional Health Values**

- 1993 HA: One day HA = 10,000 ug/L; Ten day HA = 5,000 ug/L; DWEL = 7,000 ug/L
- ATSDR Minimal Risk Level = 0.2 mg/kg-day
- EPA SYR3 Technical Support Document for Disinfectants/Disinfection Byproducts Rules, 2016:
  - o TDI: 350 ug/L, Health Canada, 1997
  - o TDI: 2,600 ug/L, WHO, 2005
- OEHHA CSF = 0.021 $(mg/kg\text{-}day)^{-1}$
- Cancer Classification: Probable human carcinogen (Group B1) based on inhalation exposure
- IARC Cancer Classification: Carcinogenic to humans (Group 1)

# Formaldehyde: Occurrence

| Best Available Occurrence Data | DBP-ICR |
|---|---|

**Additional Occurrence Data**

Finished Water:

- DBP-ICR: Detected in 126 of 227 (55.5%) PWSs; maximum detected 30.6 ug/L

Production/Release:

- TRI: Total on and off site releases: 19,339,492 lbs in 47 states; TRI releases to water: 177,890 lbs in 28 states
- CDR: Production Volume: > 1B lbs/yr (2002), ≥ 1B lbs/yr (2006)



# EPA Method 558 in Development (GC/MS)

Location: EPTDS

| Analytes | |
|---|---|
| N-Methyl-2-pyrrolidone | Urethane |

# N-Methyl-2-pyrrolidone: Background

| | |
|---|---|
| **CASRN** | 872-50-4 |
| **Contaminant Group** | Chemical industry solvent |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 42% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BF = Biodegrades fast |



# N-Methyl-2-pyrrolidone: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- CCL 4 NCAR Health Value = 4,200 µg/L, WHO, 2001 TDI = 0.6 mg/kg-day (decreased weight gain, neurobehavioral effects, sedative effects)
- 2015 TSCA Assessment (inhalation)

# N-Methyl-2-pyrrolidone: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | TRI |
| **Additional Occurrence Data**<br>Production/Release:<br>• TRI: Total on and off site releases: 9,459,164 lbs in 43 states; TRI releases to water: 14,861 lbs in 6 states<br>• CDR: Production Volume: >100M – 500M lbs/yr (2002), 100M - < 500M lbs/yr (2006) | |



# Urethane: Background

| | |
|---|---|
| **CASRN** | 51-79-6 |
| **Contaminant Group** | Paint ingredient |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 40% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BS = Biodegrades slowly (PBT) |

# Urethane: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- CCL 4 NCAR Health Value = 6.3 ug/L, Supplemental NOAEL = 0.9 mg/kg-day
- CCL 4 Carcinogenicity (CAR) Health Value = 0.035 ug/L, OEHHA CSF = 1 $(mg/kg\text{-}d)^{-1}$
- Cancer Classification: Probable human carcinogen; indicates sufficient evidence in animals and inadequate or no evidence in humans (Group B2)
- IARC Cancer Classification: Probably carcinogenic to humans (Group 2A)



# Urethane: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | TRI |

**Additional Occurrence Data**

Production/Release:

- CDR: Production Volume: No reports in 1998 or 2002
- TRI total on and off-site releases: 50,280 lbs in 8 states

# Alkylphenols

## EPA Method 559 in Development (LC/MS/MS)

***Analysis of nonylphenol in drinking water by solid phase extraction and LC/MS/MS***

Location: EPTDS

| Analytes | |
|---|---|
| Nonylphenol | Octylphenol |



# Nonylphenol: Background

| | |
|---|---|
| **CASRN** | 25154-52-3 |
| **Contaminant Group** | Used in the preparation of lubricating oil additives, resins, plasticizers, surface active agents; antioxidants for plastics and rubber |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | PBT Profiler (2009) predicts 18% will partition to water when modeled in a four-compartment system (water, air, soil and sediment); BST = biodegrades sometimes/recalcitrant; aerobic only |

# Nonylphenol: Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- CCL 4 NCAR Health Value = 105 µg/L, WHO 2004, NOAEL = 15 mg/kg-day (reproductive effects)



# Nonylphenol: Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |

**Additional Occurrence Data**

Finished Water

- Padhye, 2014: DW: Detected in 8 of 8 samples (100%) from one PWS; detection range 0.0124±0.0053 ug/L to 0.0606±0.0192 ug/L

Ambient Water

- Benotti, 2009: Detected in 2 of 5 sites; maximum detected 100 ug/L
- Klosterhaus, 2013: Detected in 60.0% of 5 sites; detection range <RL-72.9 ug/L
- Kolpin, 2002: Detected in 43 of 85 (50.60%) sites; maximum detected 40 ug/L
- Padhye, 2014 SW: Detected in 8 of 8 samples (100%) from one PWS; detection range 0.0534±0.0058 ug/L to 0.1856±0.020 ug/L
- Snyder, 2008: Detected in 17.0% of 20 samples; maximum detected 0.104 ug/L

Production/Release:

- CDR: Production Volume: No reports (2002), < 500K lbs/yr (2006)

# Octylphenol: Background

| | |
|---|---|
| **CASRN** | 29-94-3 |
| **Contaminant Group** | Alkylphenols; chemical intermediate |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Other Methods in Development

| Analytes | |
|---|---|
| Legionella pneumophila | Mycobacterium avium |

# Legionella pneumophila: Background

| | |
|---|---|
| **CASRN** | NA |
| **Contaminant Group** | Microbe |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | • Naturally found in the environment and generally considered ubiquitous<br>• Engineered systems such as drinking water distribution systems and building water systems provide opportunities for proliferation of these pathogens<br>• An important biofilm-related opportunistic pathogen |



# Legionella pneumophila: Health Effects

| | |
|---|---|
| **Health Assessment** | Health Criteria Document (1999) and Health Advisory (2001) |
| **Critical Effect** | Pneumonia |
| **Reference Dose** | NA |
| **Health Value** | MCLG = 0 |

**Additional Health Values**

- There are two forms of legionellosis, Pontiac fever and Legionnaires' disease
- Pontiac fever is less severe, characterized by flu-like symptoms, and lasts 2-5 days
- Legionnaires' disease is a potentially fatal illness involving pneumonia
- 6,141 cases of legionellosis were reported in 2016 and 7,458 in 2017 (CDC)
- An estimated 98% of legionellosis is Legionnaires' disease with a mortality rate of approximately 10% (CDC)
- Major risk factors for legionellosis: immunosuppression, smoking, travel, chronic heart or lung disease, chronic renal failure, and people aged 50 years or older
- Community or hospital acquired legionellosis can occur

# Legionella pneumophila: Occurrence

| Best Available Occurrence Data | Non-national |
|---|---|

**Additional Occurrence Data**

- Can colonize plumbing fixtures, hot water tanks, warm water spas, cooling towers, and other water features
- Colonization of hot water systems in hospitals has resulted in numerous hospital outbreaks
- Community acquired cases have been associated with cooling towers and finished water storage tanks
- Documented outbreaks associated with drinking water exposure mostly due to premise plumbing colonization



# Legionella pneumophila: Occurrence

**Additional Occurrence Data (cont'd)**

- In CDC's Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water in the United States in 2013–2014, Legionella was implicated in 57% outbreaks, 13% cases, 88% hospitalizations, and all deaths (13)
- Eighty-three percent of these outbreaks were associated with public, community or noncommunity water systems. Fourteen outbreaks occurred in drinking water systems with groundwater sources and an additional 14 occurred in drinking water systems with surface water sources

# Mycobacterium avium: Background

| | |
|---|---|
| **CASRN** | NA |
| **Contaminant Group** | Microbe |
| **PCCL/CCL Status** | |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | • Non-tuberculosis mycobacteria (NTM) have been found to be ubiquitous in the environment, including water<br>• Biofilms may serve as a reservoir for the opportunistic pathogens |



# Mycobacterium avium: Health Effects

| | |
|---|---|
| **Health Assessment** | Mycobacteria Health Advisory (1999) |
| **Critical Effect** | Infection |
| **Reference Dose** | NA |
| **Health Value** | MCLG = 0 |

**Additional Health Values**

- Common clinical syndromes include: pulmonary infection, lymphadenitis, skin and soft tissue infection, whole body (e.g., blood) infection
- Major risk factors: traumatic breaches of the skin, pre-existing pulmonary disease, immunosuppression

# Mycobacterium avium: Occurrence

| **Best Available Occurrence Data** | Non-national |
|---|---|

**Additional Occurrence Data**

- No reported outbreaks between 1990 and 2008 (CDC Morbidity and Mortality Weekly Report [MMWR]), but not a listed reportable disease
- CDC estimates that NTM disease (non-AIDS related) occur in 1.8 out of 100,000 individuals per year in the U.S., of which approximately 72% are attributable to *M. avium* complex (2002, EPA fact sheet)



# PFAS

- Group of man-made chemicals manufactured and used in a variety of industries globally
- Exposure to certain PFAS can lead to adverse human health effects
- PFOS and PFOA have been most extensively produced and studied
  - Very persistent in the environment and human body
  - Voluntarily phased out by U.S. Manufacturers
  - GenX chemicals are a common replacement for PFOA
  - PFBS is a common replacement for PFOS

# PFAS Method Scope

| Draft Method 533 | Both Methods | Method 537.1 |
|---|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)[1] | N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) |
| 1H, 1H, 2H, 2H- perfluorohexane sulfonic acid (4:2 FTS) | 9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)[2] | N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | 4,8-dioxa-3H-perfluorononanoic acid (ADONA)[3] | Perfluorotetradecanoic acid (PFTA) |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | Hexafluoropropylene oxide dimer acid (HFPO-DA)* | Perfluorotridecanoic acid (PFTrDA) |
| Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA) | Perfluorodecanoic acid (PFDA) | |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | Perfluorododecanoic acid (PFDoA) | |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | Perfluorohexanoic acid (PFHxA) | |
| Perfluorobutanoic acid (PFBA) | Perfluoroundecanoic acid (PFUnA) | |
| Perfluoroheptanesulfonic acid (PFHpS) | **Perfluorobutanesulfonic acid (PFBS)** | |
| Perfluoropentanesulfonic acid (PFPeS) | **Perfluoroheptanoic acid (PFHpA)** | |
| Perfluoropentanoic acid (PFPeA) | **Perfluorohexanesulfonic acid (PFHxS)** | |
| | **Perfluorononanoic acid (PFNA)** | |
| | **Perfluorooctanoic acid (PFOA)** | |
| | **Perfluorooctanesulfonic acid (PFOS)** | |

[1] 11Cl-PF3OUdS is also available as potassium salt
[2] 9Cl-PF3ONS is also available as potassium salt
[3] ADONA is also available as sodium salt and ammonium salt

**Bold**= monitored under UCMR 3
* GenX chemical

# Per- and Polyfluorinated Alkyl Substances

## EPA Method 533 in Development (SPE LC/MS/MS)

Location: EPTDS

| Analytes | |
|---|---|
| 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS) | 4,8-dioxa-3H-perfluorononanoic acid (ADONA) (537.1) |
| 1H, 1H, 2H, 2H-perfluorohexane sulfonic acid (4:2 FTS) | Hexafluoropropylene oxide dimer acid (HFPO-DA) (537.1) |
| 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS) | Perfluorodecanoic acid (PFDA) (537.1) |
| Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) | Perfluorododecanoic acid (PFDoA) (537.1) |
| Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA) | Perfluorohexanoic acid (PFHxA) (537.1) |
| Perfluoro-3-methoxypropanoic acid (PFMPA) | Perfluoroundecanoic acid (PFUnA) (537.1) |
| Perfluoro-4-methoxybutanoic acid (PFMBA) | Perfluorobutanesulfonic acid (PFBS) (537.1) |
| Perfluorobutanoic acid (PFBA) | Perfluoroheptanoic acid (PFHpA) (537.1) |
| Perfluoroheptanesulfonic acid (PFHpS) | Perfluorohexanesulfonic acid (PFHxS) (537.1) |
| Perfluoropentanesulfonic acid (PFPeS) | Perfluorononanoic acid (PFNA) (537.1) |
| Perfluoropentanoic acid (PFPeA) | Perfluorooctanoic acid (PFOA) (537.1) |
| 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS) (537.1) | Perfluorooctanesulfonic acid (PFOS) (537.1) |
| 9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS) (537.1) | |

# 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS): Background

| | |
|---|---|
| **CASRN** | 39108-34-4 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# 1H, 1H, 2H, 2H-perfluorohexane sulfonic acid (4:2 FTS): Background

| | |
|---|---|
| **CASRN** | 757124-72-4 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

## 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS): Background

| | |
|---|---|
| **CASRN** | 27619-97-2 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



## Nonafluoro-3,6-dioxaheptanoic acid (NFDHA): Background

| | |
|---|---|
| **CASRN** | 151772-58-6 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA): Background

| | |
|---|---|
| **CASRN** | 113507-82-7 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluoro-3-methoxypropanoic acid (PFMPA): Background

| | |
|---|---|
| **CASRN** | 377-73-1 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluoro-4-methoxybutanoic acid (PFMBA): Background

| | |
|---|---|
| **CASRN** | 863090-89-5 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluorobutanoic acid (PFBA): Background

| | |
|---|---|
| **CASRN** | 375-22-4 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluorobutanoic acid (PFBA): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**
- IRIS in process (public comment fiscal year (FY) 20; external peer-review FY 21)



# Perfluorobutanoic acid (PFBA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |

**Additional Occurrence Data**
Finished Water:
- Boone, 2019: Detected in 88% of partially treated samples from 25 PWSs; median detected 0.00362 ug/L

Ambient Water:
- Boone, 2019: Detected in 92% of samples from 25 PWSs; median detected 0.00305 ug/L

# Perfluoroheptanesulfonic acid (PFHpS): Background

| | |
|---|---|
| **CASRN** | 375-92-8 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluoropentanesulfonic acid (PFPeS): Background

| | |
|---|---|
| **CASRN** | 2706-91-4 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluoropentanoic acid (PFPeA): Background

| | |
|---|---|
| **CASRN** | 2706-90-3 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluoropentanoic acid (PFPeA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |
| **Additional Occurrence Data**<br>Finished Water:<br>• Boone, 2019: Detected in 96% of partially treated samples from 25 PWSs; median detected 0.00178 ug/L<br>Ambient Water:<br>• Boone, 2019: Detected in 92% of samples from 25 PWSs; median detected 0.00195 ug/L | |

## 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS): Background

| | |
|---|---|
| **CASRN** | 763051-92-9 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



## 9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS): Background

| | |
|---|---|
| **CASRN** | 756426-58-1 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# 4,8-dioxa-3H-perfluorononanoic acid (ADONA): Background

| | |
|---|---|
| **CASRN** | 919005-14-4 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Hexafluoropropylene oxide dimer acid (HFPO-DA): Background

| | |
|---|---|
| **CASRN** | 13252-13-6 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |

# Hexafluoropropylene oxide dimer acid (HFPO-DA): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |
| **Additional Health Values**<br>• 2018 Draft EPA Chronic RfD = 0.00008 mg/kg-day<br>• 2018 Draft EPA subchronic RfD = 0.0002 mg/kg-day | |



# Perfluorodecanoic acid (PFDA): Background

| | |
|---|---|
| **CASRN** | 335-76-2 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluorodecanoic acid (PFDA): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- IRIS in process (public comment FY 20; external peer-review FY 21)



# Perfluorodecanoic acid (PFDA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |

**Additional Occurrence Data**

Finished Water:

- Boone, 2019: Detected in 52% of partially treated samples from 25 PWSs; median detected 0.00033 ug/L.

Ambient Water

- Boone, 2019: Detected in 60% of samples from 25 PWSs; median detected 0.00043 ug/L

# Perfluorododecanoic acid (PFDoA): Background

| | |
|---|---|
| **CASRN** | 307-55-1 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluorododecanoic acid (PFDoA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |
| **Additional Occurrence Data**<br>Finished Water:<br>• Boone, 2019: Detected in 4% of partially treated samples from 25 PWSs; median detected 0.00009 ug/L<br>Ambient Water<br>• Boone, 2019: Detected in 8% of samples from 25 PWSs; median detected 0.00021 ug/L | |

# Perfluorohexanoic acid (PFHxA): Background

| | |
|---|---|
| **CASRN** | 307-24-4 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluorohexanoic acid (PFHxA): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |
| **Additional Health Values**<br>• IRIS in process (public comment FY 20; external peer-review FY 21) | |

# Perfluorohexanoic acid (PFHxA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |
| **Additional Occurrence Data**<br>Finished Water:<br>• Boone, 2019: Detected in 100% of partially treated samples from 25 PWSs; median detected 0.00143 ug/L<br>Ambient Water<br>• Boone, 2019: Detected in 96% of samples from 25 PWSs; median detected 0.00202 ug/L. | |



# Perfluoroundecanoic Acid (PFUnA): Background

| | |
|---|---|
| **CASRN** | 2058-94-8 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluoroundecanoic Acid (PFUnA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |
| **Additional Occurrence Data**<br>Finished Water:<br>• Boone, 2019: Detected in 16% of partially treated samples from 25 PWSs; median detected 0.00054 ug/L<br>Ambient Water:<br>• Boone, 2019: Detected in 32% of samples from 25 PWSs; median detected 0.00014 ug/L | |



# Perfluorobutanesulfonic acid (PFBS): Background

| | |
|---|---|
| **CASRN** | 375-73-5 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluorobutanesulfonic acid (PFBS): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | PPRTV, 2014 |
| **Critical Effect** | Kidney hyperplasia |
| **Provisional Reference Dose** | 0.02 mg/kg/day |
| **Health Value** | NA |

**Additional Health Values**

- PPRTV oral subchronic RfD: 0.2 mg/kg-day
- 2018 Draft EPA chronic RfD = 0.01 mg/kg-day (thyroid or kidney)
- 2018 Draft EPA subchronic RfD = 0.04 (thyroid) and 0.1 (kidney) mg/kg-day
- Cancer Classification: Inadequate information to assess carcinogenic potential (I)



# Perfluorobutanesulfonic acid (PFBS): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | UCMR 3 |

**Additional Occurrence Data**

Finished Water:

- UCMR 3: Detected in 0.16% of PWSs at concentrations greater than or equal to 0.09 ug/L (Minimum Reporting Level [MRL])
- Boone, 2019: Detected in 96% of partially treated samples from 25 PWSs; median detected 0.00117 ug/L

Ambient Water

- Boone, 2019: Detected in 96% of samples from 25 PWSs; median detected 0.00112 ug/L

# Perfluoroheptanoic acid (PFHpA): Background

| | |
|---|---|
| **CASRN** | 375-85-9 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluoroheptanoic acid (PFHpA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | UCMR 3 |
| **Additional Occurrence Data**<br>Finished Water:<br>• UCMR 3: Detected in 1.75% of PWSs at greater than or equal to 0.01 ug/L (MRL)<br>• Boone, 2019: Detected in 92% of partially treated samples from 25 PWSs; median detected 0.00079 ug/L<br>Ambient Water<br>• Boone, 2019: Detected in 96% of samples from 25 PWSs; median detected 0.00113 ug/L | |

# Perfluorohexanesulfonic acid (PFHxS): Background

| | |
|---|---|
| **CASRN** | 355-46-4 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluorohexanesulfonic acid (PFHxS): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- Draft ATSDR intermediate duration; Minimal Risk Level = 0.00002 mg/kg-day (thyroid follicular cell damage)
- IRIS in process (public comment FY 20; external peer-review FY 21)

# Perfluorohexanesulfonic acid (PFHxS): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | UCMR 3 |
| **Additional Occurrence Data**<br>Finished Water:<br>• UCMR 3: Detected in 1.12% of PWSs at greater than or equal to 0.03 ug/L (MRL).<br>• Boone, 2019: Detected in 80% of partially treated samples from 25 PWSs; median detected 0.00079 ug/L<br>Ambient Water<br>• Boone, 2019: Detected in 92% of samples from 25 PWSs; median detected 0.00086 ug/L | |



# Perfluorononanoic acid (PFNA): Background

| | |
|---|---|
| **CASRN** | 375-95-1 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluorononanoic acid (PFNA): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | NA |
| **Critical Effect** | NA |
| **Reference Dose** | NA |
| **Health Value** | NA |

**Additional Health Values**

- Draft ATSDR intermediate duration; Minimal Risk Level = 0.000003 mg/kg-day (decreased pup body weight and developmental delays)
- IRIS in process (public comment FY 20; external peer-review FY 21)



# Perfluorononanoic acid (PFNA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | UCMR 3 |

**Additional Occurrence Data**

Finished Water:

- UCMR 3: Detected in 0.28% of PWSs at greater than or equal to 0.02 ug/L (MRL)
- Boone, 2019: Detected in 88% of partially treated samples from 25 PWSs; median detected 0.00074 ug/L

Ambient Water

- Boone, 2019: Detected in 96% of samples from 25 PWSs; median detected 0.00086 ug/L

# Perfluorooctanoic acid (PFOA): Background

| | |
|---|---|
| **CASRN** | 335-67-1 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluorooctanoic acid (PFOA): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OW Health Effects Support Document, 2016 |
| **Critical Effect** | Pup reduced ossification and accelerated male puberty, decreased antibody protection and increased adult kidney weight with decreased body weight |
| **Reference Dose** | 0.00002 mg/kg-day |
| **Health Value** | 0.07 ug/L (chronic) |

**Additional Health Values**

- 2016, Health Effects Support Document: $10^{-4}$ Cancer Risk = 50 ug/L
- 2019, Health Canada: MAC (2018) = 0.2 ug/L
- Draft ATSDR intermediate duration; Minimal Risk Level = 0.000003 mg/kg-day
- Cancer Classification: Suggestive evidence of carcinogenic potential (S)
- IARC Cancer Classification: Possibly carcinogenic to humans (Group 2B)

# Perfluorooctanoic acid (PFOA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | UCMR 3 |
| **Additional Occurrence Data**<br>Finished Water:<br>• UCMR 3: Detected in 2.38% of PWSs at greater than or equal to 0.02 ug/L (MRL)<br>• Boone, 2019: Detected in 76% of partially treated samples from 25 PWSs; median detected 0.00415 ug/L<br>• State-specific PFOA data from community water systems and private wells<br>Ambient Water:<br>• Boone, 2019: Detected in 76% of samples from 25 PWSs; median detected 0.00632 ug/L<br>• U.S. PWS Study: Detected in 6 sites; detection range <0.005-0.12 ug/L<br>• Targeted PFOA data from specific ambient water locations<br>Production/Release:<br>• CDR: Production Volume: 10K - 500K lbs/yr (2002), < 500K lbs/yr (2006) | |



# Perfluorooctanesulfonic acid (PFOS): Background

| | |
|---|---|
| **CASRN** | 1763-23-1 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | CCL 4 |
| **Health and Occurrence Data Status** | • EPA health assessment available<br>• Nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluorooctanesulfonic acid (PFOS): Health Effects

| | |
|---|---|
| **EPA Health Assessment** | OW Health Effects Support Document, 2016 |
| **Critical Effect** | Reduced pup body weight in the two-generation study in rats |
| **Reference Dose** | 0.00002 mg/kg-day |
| **Health Value** | 0.07 ug/L (chronic) |

**Additional Health Values**

- 2019, Health Canada: MAC (2018) = 0.6 ug/L
- Draft ATSDR intermediate duration; Minimal Risk Level = 0.000002 mg/kg-day
- Cancer Classification: Suggestive evidence of carcinogenic potential (S)



# Perfluorooctanesulfonic acid (PFOS): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | UCMR 3 |

**Additional Occurrence Data**

Finished Water:

- UCMR 3: Detected in 1.93% of PWSs at greater than or equal to 0.04 ug/L (MRL)
- Boone, 2019: Detected in 80% of partially treated samples from 25 PWSs; median detected 0.00162 ug/L
- State-specific PFOS data from community water systems and private wells

Ambient Water:

- Boone, 2019: Detected in 88% of samples from 25 PWSs; median detected 0.00228 ug/L
- Targeted PFOS data from specific ambient water locations

Production/Release:

- CDR: Production Volume: 10K - 500K lbs/yr (2002), 0 lbs/yr (2003)

# PFAS Analytes Unique to EPA Method 537.1 (LC/MS/MS), 2018

***Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)***

Location: EPTDS

| Analytes |
|---|
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) |
| Perfluorotetradecanoic acid (PFTA) |
| Perfluorotridecanoic acid (PFTrDA) |



# N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA): Background

| | |
|---|---|
| **CASRN** | 2991-50-6 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA): Background

| | |
|---|---|
| **CASRN** | 2355-31-9 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Lacking finished or ambient water occurrence data |
| **Persistence/Mobility/Fate/Transport** | NA |



# Perfluorotetradecanoic acid (PFTA): Background

| | |
|---|---|
| **CASRN** | 376-06-7 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

# Perfluorotetradecanoic acid (PFTA): Occurrence

| | |
|---|---|
| **Best Available Occurrence Data** | Supplemental |
| **Additional Occurrence Data**<br>Finished Water:<br>• Boone, 2019: Detected in 0% of partially treated samples from 25 PWSs<br>Ambient Water:<br>• Boone, 2019: Detected in 0% of samples from 25 PWSs | |



# Perfluorotridecanoic acid (PFTrDA): Background

| | |
|---|---|
| **CASRN** | 72629-94-8 |
| **Contaminant Group** | PFAS |
| **PCCL/CCL Status** | Not Listed |
| **Health and Occurrence Data Status** | • Lacking an EPA health assessment<br>• Non-nationally representative finished or ambient water occurrence data available |
| **Persistence/Mobility/Fate/Transport** | NA |

## Perfluorotridecanoic acid (PFTrDA): Occurrence

| Best Available Occurrence Data | Supplemental |
|---|---|
| **Additional Occurrence Data**<br>Finished Water:<br>• Boone, 2019: Detected in 0% of partially treated samples from 25 PWSs<br>Ambient Water:<br>• Boone, 2019: Detected in 0% of samples from 25 PWSs | |



## Anticipated Process for Approval of Laboratories Supporting UCMR 5

Paul Grimmett, U.S. EPA
Office of Ground Water and Drinking Water
Standards and Risk Management Division
Technical Support Center

## Overview

- Applying for EPA approval to support UCMR
- Maintaining approval
- Minimum Reporting Level



## General Expectations

- Laboratory Approval Program expected to be similar to the process used for all previous UCMR cycles
- Only EPA approved laboratories can analyze UCMR samples collected at PWSs
  - Approval is by method and by individual laboratory locations
  - A laboratory may apply for approval for any method(s)
- Laboratories need to meet:
  - UCMR 5 approval program criteria
  - Required equipment criteria
  - Laboratory performance criteria
  - Data reporting in text file format to SDWARS
- Labs would still need to be approved to support UCMR 5 even if already certified by state, primacy entity or accredited through the National Environmental Laboratory Accreditation Program (NELAP) for a particular method

## Laboratory Approval General Procedure

- Step 1: Request to Participate
- Step 2: Registration
- Step 3: Application Package
- Step 4: EPA Review of Application Package
- Step 5: Proficiency Testing (PT)
- Step 6: Written EPA approval



## Step 1 – Request to Participate

- Interested laboratories submit a written request to the UCMR_Sampling_Coordinator@epa.gov
- EPA provides registration material
- EPA provides a custom application package based on registration information

## Step 2 – Registration

- Complete registration sheet typically includes:
  - List of the UCMR methods, for which the laboratory sought approval
  - Laboratory information
  - Mailing and shipping address
  - Contact information



## Step 3 – Application Package

- Separate application for each method
- Application typically required to include:
  - Proof of current drinking water laboratory certification (for select compliance monitoring methods)
  - Personnel information
  - Quality Assurance (QA) information
  - Information regarding analytical equipment and sample handling procedures
  - Data submission for each method (e.g., Initial Demonstration of Capability (IDC) study, QC sample results, quantification reports)
- Lab would receive a copy of the Laboratory Approval Manual

## Step 4 – Review of Application Package

- EPA reviews application package
  - If deficiencies are identified EPA gives the lab an opportunity to make corrective actions and submit new application information
  - If all requested information is present and acceptable, EPA notifies the laboratory that they are eligible to participate in corresponding PT studies



## Step 5 – Proficiency Testing

- EPA provides method-specific PT samples
- Laboratories:
  - Analyze PT sample(s) for each analyte and method
  - One successful PT per method
  - Successfully report PT data to SDWARS using text file format
  - No PT studies after monitoring begins but audits on-going during monitoring

## Step 6 – Written EPA Approval

- After successful participation in a PT study for a specific method, EPA notifies the laboratory in writing
- EPA posts a list of approved laboratories and associated methods at: https://www.epa.gov/dwucmr



## Laboratory Approval Manual

- Procedures for obtaining UCMR approval and procedures for revocation of approval
- QA requirements
- QC requirements
  - Minimum reporting level (MRL) verification
  - Initial demonstration of capability
  - Initial calibration
  - Continuing calibration checks
  - Surrogate and internal standard criteria
  - Reagent blanks and fortified blanks
  - QC samples
  - Spiked field samples
  - Field blank criteria (if required by the method)
- Sample handling requirements

## Typical Criteria for Maintaining Approval

- Adhere to QA/QC measures in the methods, rule language, and the Laboratory Approval Manual
- Post occurrence data and required QC data via SDWARS within prescribed timeframe
- Respond to inquires or requests from the Laboratory Approval Coordinator
- Participate and pass on-site and/or paper audits



## MRL Background

- MRL is an estimate of the quantitation level, achievable with a 95% confidence, by at least 75% of laboratories nationwide
- EPA establishes the MRL using data from several laboratories performing Lowest Concentration Minimum Reporting Level (LCMRL) studies
- LCMRL is an estimate of lowest concentration at which measurements of specified quality can be repeatedly made by a particular laboratory
  - Simultaneous application of precision and accuracy

## MRLs

- Established to achieve quality and consistency across all UCMR laboratories, while allowing for appropriate national laboratory capacity
- MRLs are generally established as low as is feasible; typically lower than current HRLs and health advisories
- EPA will consider raising MRLs if there is evidence that an MRL is unattainable/impractical



## Closing Remarks

Brenda Bowden, U.S. EPA

Thank you for participating in the UCMR discussion today

## If You Have Questions Following This Webinar

- UCMR Homepage:
  - https://www.epa.gov/dwucmr
- Contacts:
  - Brenda Bowden: bowden.brenda@epa.gov
  - Melissa Simic: simic.melissa@epa.gov
- Lab Approval Program:
  - UCMR_Lab_Approval@epa.gov
- Safe Drinking Water Hotline:
  - https://www.epa.gov/ground-water-and-drinking-water/safe-drinking-water-information
- Meeting materials were sent to all registered participants
- If you did not receive a copy, please email UCMRwebinar@cadmusgroup.com and we will send you a copy






## Webinar Participant Questions

- Click on "+" next to "Questions" in the control panel (Figure 1) to submit questions/comments
  - You may need to unhide the control panel to ask a question (Figure 2)
- Type a question in the box; click send (Figure 3)

Figure 1

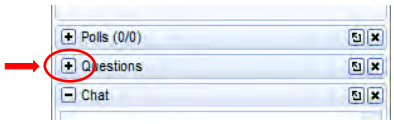
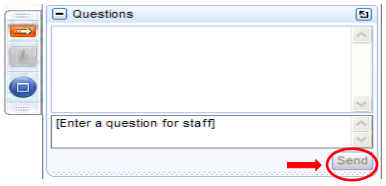



Figure 2




Figure 3



## Questions and Discussion

- Statements from Stakeholders that registered ahead of time
- Statements from Stakeholders in the room or online
  - Subject to availability of time
- Additional statements or questions from attendees can be provided to EPA via email: UCMRWebinar@cadmusgroup.com after the public meeting and webinar



## Break

# Thank You

Brenda Bowden, U.S. EPA

Thank you for participating in the UCMR discussion today. If you have additional statements that you would like to make: please send them to UCMRWebinar@cadmusgroup.com after the public meeting and webinar.

# Abbreviations and Acronyms

## Abbreviations and Acronyms

- **11Cl-PF3OUdS** – 11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid
- **4:2 FTS** – 1H, 1H, 2H, 2H-Perfluorohexane Sulfonic Acid
- **6:2 FTS** – 1H, 1H, 2H, 2H-Perfluorooctane Sulfonic Acid
- **8:2 FTS** – 1H, 1H, 2H, 2H-Perfluorodecane Sulfonic Acid
- **9Cl-PF3ONS** – 9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid
- **AM** – Assessment Monitoring
- **ADI** – Acceptable Daily Intake
- **ADONA** – 4,8-Dioxa-3H-Perfluorononanoic Acid
- **ATSDR** – Agency for Toxic Substances and Disease Registry



## Abbreviations and Acronyms

- **AWIA** – America's Water Infrastructure Act
- **BCAN** – Bromochloroacetonitrile
- **BF** – Biodegrades Fast
- **BS** – Biodegrades Slowly
- **BSA** – Biodegrades Slowly with Acclimation
- **BST** – Biodegrades Sometimes/Recalcitrant
- **CAL DHS** – California Department of Health Services
- **CAR** – Carcinogenicity
- **CCL** – Contaminant Candidate List
- **CDC** – Centers for Disease Control and Prevention

## Abbreviations and Acronyms

- **CDR** – Chemical Data Reporting
- **CFR** – Code of Federal Regulations
- **CSF** – Cancer Slope Factor
- **CWS** – Community Water System
- **DAI/HPLC** – Direct Aqueous Injection/High Performance Liquid Chromatography
- **DAI-LC/MS/MS** – Direct Aqueous Injection- Liquid Chromatography/Tandem Mass Spectrometry
- **DBAN** – Dibromoacetonitrile
- **DBP** – Disinfection Byproduct



## Abbreviations and Acronyms

- **DBP-ICR** – Disinfection Byproduct Information Collection Rule
- **DCAN** – Dichloroacetonitrile
- **D/DBPR** – Disinfectants and Disinfection Byproducts Rules (including Stage 1 and Stage 2 D/DBPRs)
- **DF** – Degrades Fast
- **DFA** – Degrades Fast with Acclimation
- **DS** – Distribution System
- **DSMRT** – Distribution System Maximum Residence Time
- **DWEL** – Drinking Water Equivalent Level
- **DWPD** – Drinking Water Protection Division
- **DWSHA** – Drinking Water Standards and Health Advisories

## Abbreviations and Acronyms

- **EPA** – Environmental Protection Agency
- **EPTDS** – Entry Point to the Distribution System
- **et al.** – And Others
- **FDA** – United States Food and Drug Administration
- **FR** – Federal Register
- **FY** – Fiscal Year
- **GAMA** – Groundwater Ambient Monitoring and Assessment Program
- **GC** – Gas Chromatography
- **GC/MS** – Gas Chromatography/Mass Spectrometry



## Abbreviations and Acronyms

- **GenX** – Trade Name for a Technology Used to Make High-Performance Fluoropolymers Without the Use of PFOA
- **GW** – Ground Water
- **GWRMPs** – Ground Water Representative Monitoring Plans
- **HA** – Office of Water Health Advisory
- **HAAs** – Haloacetic Acids
- **HAA5** – Group of 5 Brominated Haloacetic Acids
- **HANs** – Haloacetonitriles
- **HALs** – Haloacetaldehydes
- **Health Canada** – Health Canada Guidelines for Canadian Drinking Water Quality

## Abbreviations and Acronyms

- **HFPO-DA** – Hexafluoropropylene Oxide Dimer Acid
- **HHBP** – Human Health Benchmark for Pesticides
- **HNMs** – Halonitromethanes
- **HSDB** – Hazardous Substances Data Bank
- **IARC** – International Agency for Research on Cancer
- **ICP-AES** – Inductively Coupled Plasma- Atomic Emission Spectrometry
- **IDC** – Initial Demonstration of Capability
- **IRIS** – Integrated Risk Information System
- **kg** – Kilograms



## Abbreviations and Acronyms

- **L** – Liter
- **lbs** – Pounds
- **LC/ESI-MS/MS** – Liquid Chromatography/Electrospray Ionization/Tandem Mass Spectrometry
- **LC/MS/MS** – Liquid Chromatography/Tandem Mass Spectrometry
- **LCMRL** – Lowest Concentration Minimum Reporting Level
- **LLE/GC/ECD** – Liquid-Liquid Extraction/Gas Chromatography/Electron Capture Detection
- **LOAEL** – Lowest-Observed-Adverse-Effect Level
- **LSI** – Large System Inventory
- **MAC** – Maximum Acceptable Concentration
- **MCLG** – Maximum Contaminant Level Goal

## Abbreviations and Acronyms

- **mg** – Milligrams
- **MMWR** – Morbidity and Mortality Weekly Report
- **MRDD** – Maximum Recommended Daily Dose
- **MRL** – Minimum Reporting Level
- **NAWQA** – National Water-Quality Assessment
- **NCAR** – Non-Carcinogenic
- **NEtFOSAA** – N-Ethyl Perfluorooctanesulfonamidoacetic Acid
- **NFDHA** – Nonafluoro-3,6-Dioxaheptanoic Acid
- **NMeFOSAA** – N-Methyl Perfluorooctanesulfonamidoacetic Acid
- **NCFAP** – National Center for Food and Agricultural Policy



## Abbreviations and Acronyms

- **NCOD** – National Contaminant Occurrence Database
- **NELAP** – National Environmental Laboratory Accreditation Program
- **NIRS** – National Inorganics and Radionuclides Survey
- **NOAEL** – No-Observed-Adverse-Effect Level
- **NPDWRs** – National Primary Drinking Water Regulations
- **NREC** – National Reconnaissance of Emerging Contaminants
- **NTM** – Nontuberculous Mycobacteria
- **NTNCWS** – Non-Transient Non-Community Water System
- **NTP** – National Toxicology Program
- **OEHHA** – California Office of Environmental Health Hazard Assessment

## Abbreviations and Acronyms

- **OGWDW** – Office of Ground Water and Drinking Water
- **OPP** – Office of Pesticide Programs
- **PA** – Partnership Agreement
- **PBT** – Persistent, Bioaccumulative, and Toxic
- **PDP** – Pesticide Data Program
- **PCCL** – Preliminary Contaminant Candidate List
- **PFAS** – Per- and Polyfluoroalkyl Substances
- **PFBA** – Perfluorobutanoic Acid
- **PFBS** – Perfluorobutanesulfonic Acid
- **PFDA** – Perfluorodecanoic Acid



## Abbreviations and Acronyms

- **PFDoA** – Perfluorododecanoic Acid
- **PFEESA** – Perfluoro (2-Ethoxyethane) Sulfonic Acid
- **PFHpA** – Perfluoroheptanoic Acid
- **PFHpS** – Perfluoroheptanesulfonic Acid
- **PFHxA** – Perfluorohexanoic Acid
- **PFHxS** – Perfluorohexanesulfonic Acid
- **PFMBA** – Perfluoro-4-Methoxybutanoic Acid
- **PFMPA** – Perfluoro-3-Methoxypropanoic Acid
- **PFNA** – Perfluorononanoic Acid

## Abbreviations and Acronyms

- **PFOA** – Perfluorooctanoic Acid
- **PFOS** – Perfluorooctanesulfonic Acid
- **PFPeA** – Perfluoropentanoic Acid
- **PFPeS** – Perfluoropentanesulfonic Acid
- **PFTA** – Perfluorotetradecanoic Acid
- **PFTrDA** – Perfluorotridecanoic Acid
- **PFUnA** – Perfluoroundecanoic Acid
- **PMP** – Pesticide Monitoring Program
- **PPCP** – Pharmaceutical and Personal Care Product



## Abbreviations and Acronyms

- **PPRTV** – Provisional Peer-Reviewed Toxicity Values
- **PST** – Pre-Screen Testing
- **PT** – Proficiency Testing
- **PWS** – Public Water System
- **QA** – Quality Assurance
- **QC** – Quality Control
- **RAIS HE CSF** – Risk Assessment Information System – Health Effects Data Cancer Slope Factor
- **RBC ChE** – Red Blood Cell Cholinesterase
- **RED** – Reregistration Eligibility Decision
- **RfD** – Reference Dose

## Abbreviations and Acronyms

- **RTECS** – Registry of Toxic Effects of Chemical Substances
- **SDWA** – Safe Drinking Water Act
- **SDWARS** – Safe Drinking Water Accession and Review System
- **SMP** – State Monitoring Plan
- **SPE** – Solid Phase Extraction
- **SS** – Screening Survey
- **SSI** – Small System Inventory
- **SW** – Surface Water
- **TCAN** – Trichloroacetonitrile



## Abbreviations and Acronyms

- **TDI** – Tolerable Daily Intake
- **TNCWS** – Transient Non-Community Water System
- **TRI** – Toxic Release Inventory
- **TSCA** – Toxic Substance Control Act
- **TTHM** – Total Trihalomethanes
- **UCM** – Unregulated Contaminant Monitoring
- **UCMR** – Unregulated Contaminant Monitoring Rule
- **ug** – Micrograms
- **USDA** – United States Department of Agriculture
- **USGS** – United States Geological Survey
- **WHO** – World Health Organization