Contaminants of Emerging Concern in U.S. Drinking Water



Presentation to the PA DEP Citizens Advisory Council

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The Water Center
University of Pennsylvania

Who We Are



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The Water Center at Penn is a community-focused research and policy center working to find integrated solutions to the multiple challenges facing our world's water systems and their watersheds. We strive to be a trusted, reliable partner whose work accelerates water equity by connecting, convening, and collaborating across the sector.

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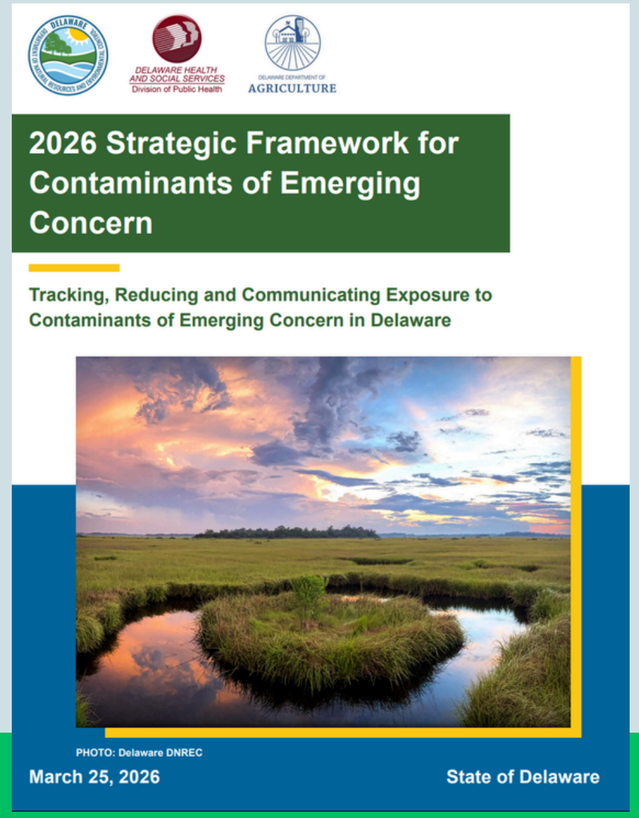
Research Focus Areas

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- Water infrastructure
- Community capacity building and water equity
- Drinking water treatment and source protection
- Freshwater policy and law
- Flood risk and stormwater management
- Water infrastructure financing and affordability
- Water's role in environmental health
- Water leadership
- Climate resilience



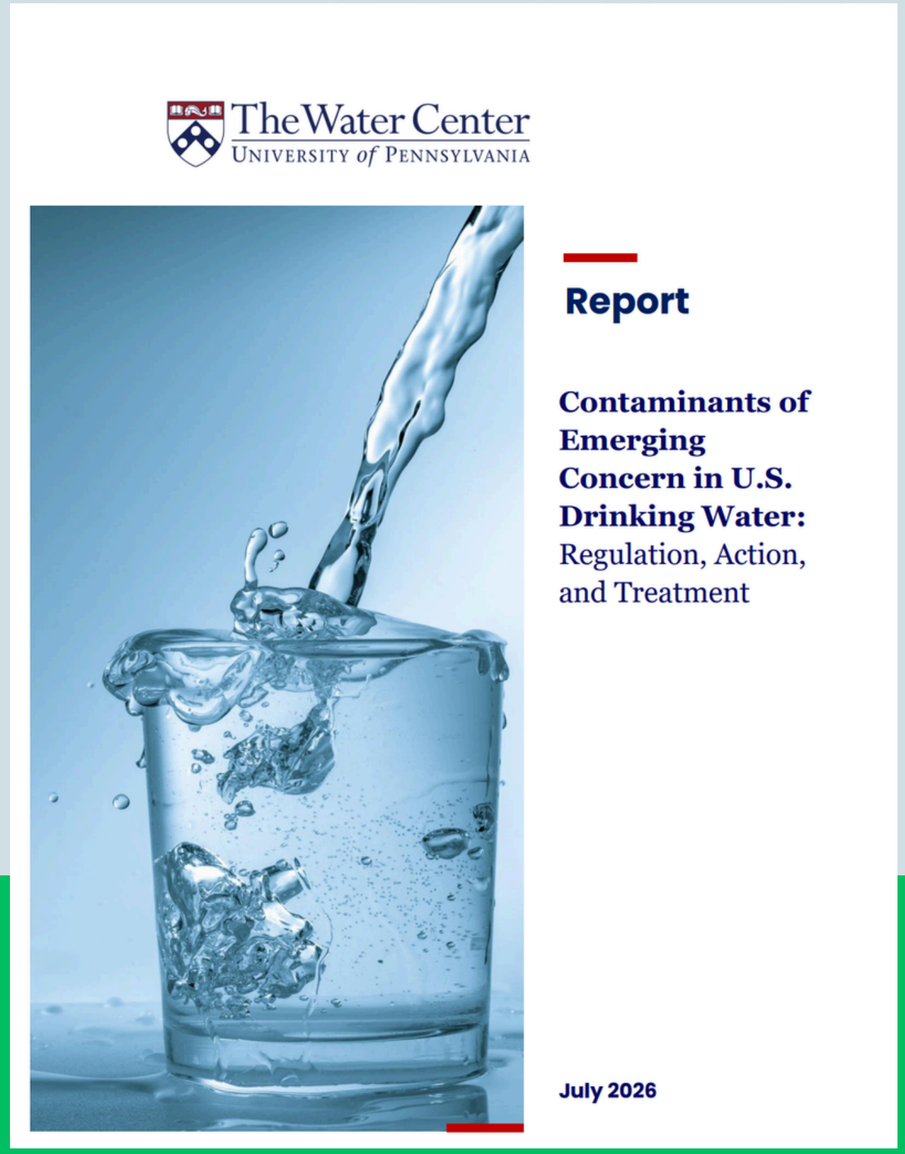
Our Interest in Contaminants of Emerging Concern



- Support of Delaware's 2026 Strategic Plan for Contaminants of Emerging Concern and 2026 PFAS Implementation Plan
- Research and projects on PFAS legislation and risk communication
- Increasing attention on microplastics in news headlines, research, and industry circles
- Continuing work on statewide planning for CECs

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CECs Report and Storymap



Report

Storymap

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Defining CECs

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Unregulated or newly regulated chemicals found in water with growing evidence of adverse health effects.

CECs covered in our report:

- 1,4-Dioxane
- TCP (1,2,3,-Trichloropropane)
- Microplastics
- Cyanotoxins
- 6PPD-q (6PPD-Quinone)
- Lithium
- Nitrosamines/NDMA
- Chromium-6 (Hexavalent chromium)
- Pharmaceuticals & personal care products



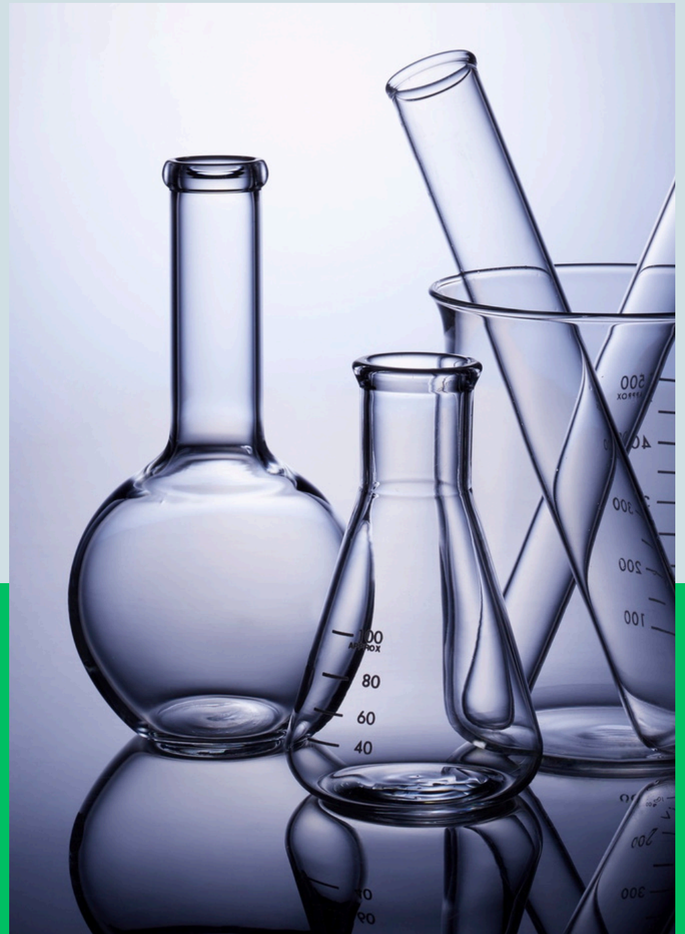
1,4-Dioxane

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Source: Synthetic chemical used in industry (mostly as a solvent stabilizer)

Health effects: Probable human carcinogen

Treatment: Advanced oxidation processes (AOPs) recommended



1,4-Dioxane

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Federal policy status:

MCL	HA	CCL	UCMR
☐	☑	☑	☑

State policy status:

- NY is the first state to set an MCL
- At least 15 states have taken some sort of action
  - Enforceable and non-enforceable drinking water guidelines
  - Groundwater standards
  - Product labelling requirements and bans

TCP

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Source: Synthetic chemical historically used for agricultural soil and industry

Health effects: Probable human carcinogen

Treatment: Granular activated carbon (GAC)



TCP

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Federal policy status:

MCL	HA	CCL	UCMR
☐	☑	☑	☐

State policy status:

- 3 states have an MCL: CA, HI, and NJ
- CA requires water systems to test quarterly
- NJ's Private Well Testing Act requires testing at point of sale
- MN has a non-enforceable guidance value

Microplastics

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Source: Fragments, fibers, films, and beads from degraded macroplastics

Health effects: Still being determined, but microplastics have been detected widely throughout the human body

Treatment: Reverse osmosis and ultrafiltration



Microplastics

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Federal policy status:

MCL	HA	CCL	UCMR
☐	☐	☑	☐

State policy status:

- No state has enacted an MCL
- At least 17 states have enacted product ban legislation
- At least 6 states are conducting testing and monitoring
- CA has a 4-year testing program and decided against setting thresholds due to the lack of health benchmarks

Cyanotoxins

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Source: Toxic compounds produced by algae during harmful algal blooms (HABs) in surface water

Health effects: Still being determined, but linked to liver damage, liver and colorectal cancer, and nervous system damage

Treatment: Activated carbon and advanced oxidation processes (AOPs)



Cyanotoxins

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Federal policy status:

MCL	HA	CCL	UCMR
☐	☑	☑	☑

*Not included in draft CCL 6

State policy status:

- RI is the only state with an MCL (4 cyanotoxins covered)
- At least 2 states have enforceable standards (OR, RI)
- At least 3 states have non-enforceable standards (OH, MN, VT)
- At least 6 states are monitoring for cyanotoxins

6PPD-q

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Source: Chemical antiozonant (6PPD) added to tires that reacts with ozone and washes off roadways

Health effects: Toxic to salmon and trout; Human health effects still being determined

Treatment: GAC, nanofiltration, and reverse osmosis



6PPD-q

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Federal policy status:

☐ MCL ☐ HA ☐ CCL ☐ UCMR

*Primarily regulated under TSCA, not SDWA



State policy status:

- WA and CA are in the process of regulating the use of 6PPD-q in tires
- No states appear to have enforceable or non-enforceable guidelines for 6PPD-q in water

Lithium

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Source: Naturally occuring in aquifer systems in the arid Western US; Unnaturally occuring in battery manufacturing

Health effects: Impaired thyroid function, kidney damage

Treatment: Ion exchange, reverse osmosis



Lithium

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Federal policy status:

MCL	HA	CCL	UCMR
☐	☑	☑	☑

*Non-regulatory health-based screening level

State policy status:

- No states appear to have an MCL
- MI has issued public guidance
- Non-enforceable health advisories are expected in Western states following the release of UCMR 5 data in August

Nitrosamines

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Source: Disinfection byproduct from chloramine water treatment

Health effects: Potent carcinogen

Treatment: UV



Nitrosamines

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Federal policy status:

MCL	HA	CCL	UCMR
☐	☐	☑	☑

State policy status:

- CA and MA have enforceable standards
- CA is in the process of issuing a rulemaking for an MCL for NDMA
- MN has a non-enforceable guidance value

Chromium-6

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Source: Naturally occurring in geologic formations; unnaturally occurring in industrial waste from electroplating, tanning, and metal finishing

Health effects: Known carcinogen, particularly for stomach and gastrointestinal cancers

Treatment: Ion exchange



Chromium-6

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Federal policy status:

MCL	HA	CCL	UCMR
☑	☐	☐	☐

*For total chromium

State policy status:

- CA has a total chromium MCL stricter than the federal MCL and its Chromium-6 MCL is currently being challenged in court
- No other states have a Chromium-6 MCL

PPCPs

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Source: Prescription and OTC drugs, cosmetics, fragrances, sunscreens, and personal hygiene products

Health effects: Still being determined; antibiotic resistance suspected

Treatment: Ozone, AOPs, reverse osmosis, nanofiltration



PPCPs

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Federal policy status:

MCL	HA	CCL	UCMR
☐	☐	☑	☑

State policy status:

- MN is evaluating health risks for public communication purposes
- CA is currently monitoring for PPCPs
- PA has monitored for PPCPs in the past

Takeaways

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- State action on CECs varies widely
  - CA, MN, and NJ are the most active, with CA leading the way
- 1,4-Dioxane and TCP have the strongest enforceable standards across states
- Only one contaminant studied (Chromium-6)* has a federal MCL
- More research on health effects, treatment technologies, and policy is needed before stronger regulations for CECs are enacted on both the federal and state levels



Moving Forward

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- What's needed?
  - More research on human health effects at chronic low exposure, particularly for microplastics, cyanotoxins, 6PPD-q, and PPCPs
  - More data collection
  - More education and communication about ways to reduce risk
  - More funding to water systems for advanced treatment technologies
- Examples from PFAS work
  - Delaware Continuing Medical Education workshops
  - DRBC data analysis and visualization app
  - Delaware fact sheets on PFAS



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