EMERGING CONTAMINANTS IN NEW YORK'S DRINKING WATER SYSTEMS

WHAT'S IN MY WATER?

NEW YORK PUBLIC INTEREST RESEARCH GROUP

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Acknowledgements

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About New York Public Interest Research Group
Established in 1976, the New York Public Interest Research Group Fund (NYPIRG) is a nonpartisan, not-for-profit organization whose mission is to educate the public on policy issues and advance reforms, while training New Yorkers to be advocates. Consumer protection, environmental preservation, health care, higher education, public health, and mass transit are among NYPIRG's principal areas of concern.

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www.nypirg.org

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Executive Summary

New York is renowned for having high quality drinking water and an abundance of fresh water. The public has the basic expectation that when they go to turn on the tap, the water will be safe to drink. But due to a number of emerging threats, particularly chemicals from a post-industrial legacy, this basic expectation has been jeopardized.

New Yorkers need better tools to monitor drinking water quality and more aggressive action from the state to comprehensively protect water supplies. This report reviews data collected by the federal government. While the data is available to the public, it is too often almost impossible for interested New York residents to obtain and understand. **This analysis reviewed the federal data to help educate New Yorkers about the public health and policy implications with respect to New York's drinking water. In addition, NYPIRG has made the federal data more easily accessible through its website.**[1]

The United States Environmental Protection Agency (EPA) collects water quality data for both regulated contaminants and a select number of unregulated contaminants; this second category is also known as "emerging contaminants." It is this second category, disclosed under EPA's third Unregulated Contaminant Monitoring Rule (UCMR-3), that this report examines in detail. All across New York State, from Hoosick Falls to Long Island, there has been considerable public debate over the three specific emerging contaminants – PFOA, PFOS and 1,4-dioxane. But there are over 20 additional emerging contaminants that have been monitored. This report examines all of these and offers information on the extent these contaminants have been found in public drinking water supplies.

One note: The mere existence of an emerging contaminant in a drinking water supply does not necessarily put consumers' health at risk; however, the presence of emerging contaminants should spur a rapid science-based response by public officials. Additionally, it is critical that New Yorkers know of their exposure, particularly in comparison to any existing health information, and that state policymakers must act to better regulate those contaminants.

Summary of Findings:

- Nearly 16 million New Yorkers are served by water systems that detected one or more UCMR-3 contaminants.[2]
- The Long Island region has, by far, the most detections of emerging contaminants found in drinking water. While it is unclear if certain detections are health concerns, some detected contaminants, like 1,4-dioxane, were detected above EPA's reference concentrations, which are based on health assessments.
- Seven UCMR-3 emerging contaminants were detected above EPA's reference concentrations.
- 6.4 million New York State residents are served water which has not been tested for emerging contaminants. New York has failed to implement a more than two-year old law to require statewide emerging contaminant testing.

[1] "What's in My Water?," NYPIRG, https://nypirg.org/whatsinmywater/.

[2] See page 34, "Methodology," in the Appendix section for how population was calculated.

Recommendations:

1. The New York State Department of Health (DOH) must immediately begin statewide testing of emerging contaminants for every public water system, regardless of size. New York lawmakers passed the Emerging Contaminant Monitoring Act in the SFY2017-18 budget, which requires DOH to create a list of emerging contaminants for New York and test statewide. However, more than two years later, DOH has yet to implement any portion of the law. New York has data from UCMR-3 testing – contaminants from UCMR-3 that have already been detected in some New York water systems should be tested in systems statewide. The longer there isn't testing, the longer communities may be getting exposed to unsafe levels of contaminants.

2. Establish stringent drinking water standards for chemicals that may be unsafe for public health. Unfortunately, it is commonplace in New York, and the country, to wait to take action on potentially dangerous chemicals only after a contamination crisis unfolds – and even then, sometimes action is never taken. New York has recommended Maximum Contaminant Levels (MCLs) for PFOA, PFOS, and 1,4-dioxane, but has yet to formally establish these MCLs into regulation. DOH should move as quickly as possible to set stringent MCLs for these chemicals that align with the most protective health recommendations, and begin a process to establish MCLs for additional chemicals. The sooner DOH begins emerging contaminant testing, the easier starting this process will be.

3. Require testing for private household wells. Four million New Yorkers - twenty percent of New York's population - receives drinking water from a private household well, yet no testing is ever required for these wells. A model for testing can be found in New Jersey. New Jersey's Private Well Testing Act requires testing for certain contaminants prior to the sale or lease of property.[3]

4. Create a statewide public database for drinking water information. The public expects to be able to easily find out basic information about the quality of their drinking water. Unfortunately, this information isn't always easily available in every community. The first step in ensuring that drinking water supplies are adequately protecting the public is to empower New Yorkers through access to drinking water quality information. NYPIRG has a tool available that does that – the State should adopt a similar model that would be able to include additional data.[4] NYPIRG's database is limited to data reported to EPA, but the State could offer a more complete database that includes data the State has collected.

5. Adopt precautionary approaches to source water protection and chemicals. Emerging contaminants shouldn't be detected in drinking water at all. New York must prevent water from becoming contaminated in the first place by preserving land around source water, using New York City's program as a statewide model, and prohibiting the use of certain chemicals *until they can be proven to be safe*, instead of waiting until people get sick.

[3] "PWTA Frequently Asked Questions," State of New Jersey Department of Environmental Protection, March 26, 2019, https://www.state.nj.us/dep/watersupply/pwta/pwta_faq.htm#1q1.

[4] "What's in My Water?," NYPIRG, https://nypirg.org/whatsinmywater/.

New York State Data Results

Overview

Part of the federal Safe Drinking Water Act is the Unregulated Contaminant Monitoring Rule (UCMR). This rule requires EPA to come up with a list of up to 30 emerging contaminants every few years, and requires that water systems serving 10,000 or more residents, and select smaller systems, test for those chemicals.[5] "Emerging contaminants" are unregulated contaminants that may have health risks and are suspected to be in drinking water supplies. There have been four rounds of monitoring through UCMR since 2001.

Smaller water systems not specially selected by EPA and private wells do not have any required UCMR testing.

As demonstrated in Table 1 (page 5) and Table 2 (page 6), of the contaminants required to be tested under UCMR-3, 23 distinct emerging contaminants were detected in New York State. In New York, 196 water systems participated in UCMR-3 testing.

One or more emerging contaminants were detected in 176 water systems, affecting 15,979,381 New Yorkers.

There were a total of 30 contaminants monitored under UCMR-3, but only 21 contaminants, referred to as "List 1" by EPA, were monitored in systems serving 10,000 or more residents, plus select smaller systems that were required to monitor.[6] In New York, 173 water systems monitored for List 1 contaminants, and 171 had detections.

Additionally, very large systems (100,000+) and select smaller systems were required to monitor for seven hormones included on EPA's "List 2." In New York, 48 water systems in New York tested for List 2 contaminants, including 25 very large systems which also tested for List 1, and 23 systems which did not test for List 1 contaminants. Eight systems detected List 2 contaminants.

Monitoring for two viruses was required only in select small systems that do not disinfect and had wells in known risk areas. In New York, there were three such systems that tested for enteroviruses and noroviruses, but had no detections.

There were 2,075 water systems that did not have any UCMR-3 testing, leaving 2,373,089 New Yorkers, plus approximately 4 million residents relying on private wells, in the dark.

[5] Information on all UCMR-3 emerging contaminants can be found in the Appendix, "Table 3: UCMR-3 Contaminants Information."

[6] "Third Unregulated Contaminant Monitoring Rule," EPA, https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule

Table 1 lists the 23 detected UCMR-3 emerging contaminants and identifies the number of water systems that detected a given chemical in the various regions in New York State.[7]

Table 2 lists every contaminant required to be tested under UCMR-3.[8] The columns of this chart indicate the number of detections reported, the number of water systems that had detections, and the total population served by the systems impacted. The chart also includes EPA's reference concentrations, "EPA health guidance," for the chemicals that have such guidance and the highest detected levels of the various chemicals.[9]

Some key findings from these tables, detailed in subsequent sections:

- The water supplies serving a total of 15,979,381 New Yorkers detected one or more UCMR-3 contaminants.
- Water supplies for 6,373,089 New Yorkers, which includes small public water systems without testing and New Yorkers relying on private wells, did not have any emerging contaminant testing.
- Long Island had the most systems with detections, followed closely by the Hudson Valley, with the third highest number of systems with detections in Western New York.
- The top five most prevalent emerging contaminants detected in New York, in order, are: strontium, hexavalent chromium (chromium-6), chlorate, chromium, and vanadium.[10]
- Seven contaminants (1,2,3-trichloropropane, 1,4-dioxane, chlorate, cobalt, PFOA, PFOS, and strontium) were detected at, or above, EPA's reference concentrations.[11]

[7] Pages 12 through 21 breaks down this data by region and county.
[8] Information on all UCMR-3 emerging contaminants can be found in the Appendix, "Table 3: UCMR-3 Contaminants Information."
[9] More details on page 6, "detections above EPA guidance," and pages 24-26, "Loophole #3."
[10] More details on page 7, "frequently detected contaminants."
[11] Same as footnote 9.

Table 1: UCMR-3 Data by Region – number of water systems with detections

Contaminant	Capital Region	Central	Hudson Valley	Long Island	North Country	NYC	Southern Tier	Western
1,1-dichloroethane	0	0	1	25	0	0	1	1
1,2,3-trichloropropane	0	0	0	10	0	0	0	0
1,4-dioxane	1	1	5	34	0	1	4	2
4-androstene-3,17-dione	0	2	0	0	2	0	0	2
aerobic spores	0	0	1	0	0	0	0	0
bromomethane	2	0	0	1	0	0	0	0
chlorate	16	14	37	36	6	1	11	14
chloromethane	3	0	0	1	0	0	0	1
chromium	14	14	31	35	5	1	9	24
chromium-6	18	17	42	36	8	1	11	30
cobalt	0	0	1	22	0	0	1	0
HCFC-22	2	0	1	13	0	0	1	0
manganese	2	3	13	2	2	0	1	5
molybdenum	3	7	7	4	4	0	0	24
n-propylbenzene	0	0	0	0	1	0	0	0
PFHpA	0	0	2	1	1	0	0	0
PFHxS	0	0	2	1	1	0	0	0
PFNA	0	0	0	1	0	0	0	0
PFOA	0	0	2	3	1	0	0	0
PFOS	0	0	2	2	0	0	0	0
strontium	18	17	46	37	8	1	11	32
testosterone	1	1	0	0	1	0	0	2
Vanadium	16	12	14	25	6	0	2	17

Table 2: UCMR-3 Statewide Data

CONTAMINANT	DETECTIONS	SYSTEMS	POPULATION	HIGHEST LEVEL DETECTED (ppb)	EPA HEALTH GUIDANCE (ppb)
1,1-dichloroethane	283	28	2,337,238	4.09	6.14 to 614
1,2,3-trichloropropane	57	10	1,559,592	1.02	0.0004 to 0.04
1,4-dioxane	516	49	11,595,918	34	0.35 to 35
4-androstene-3,17-dione	8	6	501,411	0.0041	NA
aerobic spores	1	1	25	1	NA
bromomethane	7	4	326,885	0.92	140
chlorate	1,844	135	14,984,975	1223.85	210
chloromethane	9	5	340,135	1.92	2.69 to 69
chromium	1,428	134	14,755,552	31	100
chromium-6	2,205	163	15,878,647	7.3	NA
cobalt	180	24	2,390,599	84	70
HCFC-22	54	17	2,149,497	5	NA
manganese	148	27	88,227	160	NA
molybdenum	297	49	3,961,659	25.42	40
n-propylbenzene	1	1	600	0.06	NA
PFHpA	12	4	1,192,000	0.082	NA
PFHxS	13	4	1,192,000	0.14	NA
PFNA	1	1	120,000	0.032	NA
PFOA	12	6	337,500	0.048	0.07
PFOS	13	4	1,170,500	0.53	0.07
strontium	2,653	170	15,966,772	2660	1500
testosterone	6	5	228,091	0.0022	NA
vanadium	707	92	5,277,408	6.97	21
1,3-butadiene	0	0	0	0	.0103 to 1.03
17-alpha-ethynylestradiol	0	0	0	0	0.035
17-beta-estradiol	0	0	0	0	.0009 to .09
enteroviruses (cell culture)	0	0	0	0	NA
enteroviruses (RT-qPCR)	0	0	0	0	NA
equilin	0	0	0	0	0.35
estriol	0	0	0	0	0.35
estrone	0	0	0	0	0.35
halon 1011	0	0	0	0	90
male specific phage	0	0	0	0	NA
noroviruses GIA	0	0	0	0	NA
noroviruses GIB	0	0	0	0	NA
noroviruses GII	0	0	0	0	NA
PFBS	0	0	0	0	NA
tellurium	0	0	0	0	NA
total coliforms	0	0	0	0	NA

Detections Above EPA Guidance

The mere existence of a contaminant in a drinking water supply does not necessarily put consumers' health at undue risk. However, it is important to note the level of the detection and whether or not that level is above existing health information for a given chemical or substance. For this reason, EPA establishes "reference concentrations" (listed as "EPA Health Guidance" in Chart 1 and Table 2), so the public can compare detected levels in comparison to levels that might be considered safe. These reference concentrations are derived from EPA health advisories and other health and risk assessments.[12]

"Loophole #3," – As discussed further on page 26, EPA and other federal agencies do not always issue health advisory levels or other regulatory guidance for chemicals due in part to limited science in some cases, and in others, due to EPA lagging behind the latest science. Additionally, even when drinking water standards and other guidance is set by EPA or state agencies, those levels are not always aligned with the most stringent health recommendations.

Chart 1 demonstrates the UCMR-3 chemicals detected in New York that were found at levels equal to, or above, EPA's reference concentrations. Most of the substances on EPA's UCMR-3 do not have reference concentrations; however, of the ones that do, seven contaminants were detected above EPA's reference concentrations.

1,4-dioxane, at 238 reported detections, was detected above the health reference level more than any other contaminant. The highest level detected of 1,4-dioxane, at 34 parts per billion (ppb) in the Hicksville Water District on Long Island, is *97 times higher than EPA's health guidance*.

The second chemical most frequently detected above EPA's health reference level was chlorate, a byproduct formed during the water disinfection process. The highest level detected, at 1223.85 ppb in Garrison, is six times higher than EPA's guidance.

Chart 1: Detections at, or above, EPA's health guidance

Contaminant	Highest level detected (ppb)	EPA health guidance (ppb)	# of detections at, or above, EPA health guidance
1,2,3-trichloropropane	1.02	0.0004 to 0.04	48
1,4-dioxane	34	0.35 to 35	238
chlorate	1223.85	210	178
cobalt	84	70	1
PFOA/PFOS	0.53	0.07	11
strontium	2660	1500	8

[12] "The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017," U.S EPA, p. 6, January, 2017, https://www.epa.gov/sites/production/files/2017-02/documents/ucmr3-data-summary-january-2017.pdf.

"Loophole #3," – As discussed in more detail starting on page 26, it is possible there are other chemicals detected above safe levels, but EPA has yet to set any guidance or regulatory enforcement. For example, as discussed further in the section, three chemicals, "PFOA, PFOS, and 1,4-Dioxane," were detected at levels above the most stringent levels recommended by advocates based on recent science (see "Chart 2").

Frequently Detected Contaminants

The top five most frequently detected contaminants in New York, in order, are: strontium, hexavalent chromium (chromium-6), chlorate, chromium, and vanadium.[13] Additionally, chemicals that have garnered national attention, PFOA, PFOS, and 1,4-dioxane, were detected in numerous water supplies, often above EPA's health guidance.

Strontium, the most frequently detected emerging contaminant in New York water supplies, is a naturally occurring element in the environment. EPA has a health reference level at 1500 ppb. While there is debate within the scientific community, there is some science that indicates that high exposure to strontium for infants and children can impact bone growth and cause dental changes.[14] The highest detected level of strontium was 2660 ppb in the Station Road Square water system in Orange County, a small public water system that serves at least 25 people at least 6 months per year.[15] The second highest was 2600 ppb in the Clifton Park water system in Albany County. Three water systems had a total of eight detections that exceeded EPA's reference level (see Chart 1).

Chromium-6, the second most frequently detected emerging contaminant, gained notoriety after environmental activist Erin Brockovich confronted a company in Hinkley, California for polluting the community's tap water with high levels of the carcinogenic chemical. chromium-6 occurs naturally in the environment, but higher levels can be found due to industrial pollution. Chromium-6 can cause stomach cancer, and potentially other illnesses, particularly if inhaled.[16]

EPA does not currently have a health reference level for chromium-6; however, California has a public health goal of 0.02 ppb, and had a maximum contaminant level of 10 ppb.[17] North Carolina has a health screening level of 0.07 ppb and a groundwater standard of 10 ppb.[18] By comparison, in New York, there

[13] More information about these chemicals can be found starting on page 36 in the appendix section, "Table 3: UCMR-3 Contaminants Information".
[14] "Strontium," American Water Works Association, https://drinktap.org/Water-Info/Whats-in-My-Water/Strontium.
[15] "Orange County Contact Report 2018," New York Department of Health, https://www.health.ny.gov/environmental/water/drinking/pws_contacts/oran_contacts.htm
[16] "Final public health goal for hexavalent chromium," OEHHA, July, 2011, https://oehha.ca.gov/media/downloads/water/chemicals/cr6phgfacts072711.pdf.
[17] "Chromium-hexavalent," OEHHA, https://oehha.ca.gov/chemicals/chromium-hexavalent.
[18] Mina Shehee, PhD, "DHHS Hexavalent Chromium Summary," North Carolina Department of Health and Human Services, April 30, 2018, https://files.nc.gov/ncdeq/GenX/SAB/DHHS%20Hexavalent%20Chromium%20Presentation%20043018.pdf and https://files.nc.gov/ncdeq/document-library/07.28.15_Risk%20explanation%20FAQ.pdf

were 2,205 detections of chromium-6, with the highest level detected at 7.3 ppb in the Greenlawn Water District on Long Island.

Chlorate, the third most frequently detected contaminant, is formed as a byproduct of the drinking water disinfection process when chlorine dioxide or sodium hypochlorite are used. Chlorate can also be released in drinking water from the reactions of other compounds, such as those in some herbicides, fireworks, and other explosives.[19]

Chlorate was detected 1,844 times in New York, and 178 of those detections exceeded EPA's health guidance (see Chart 1).

Chromium, the fourth most frequently detected contaminant, is a measurement of total chromium. Chromium-6, or hexavalent chromium, is just one of various forms of chromium. Other forms of chromium include chromium-3 and chromium 0. Chromium is the 21st most abundant element in the Earth's crust and, as a result, can be found in various forms in plants, soil, volcanic dust, humans, and water.

EPA has a drinking water standard for total chromium of 100 ppb, but this is to manage risk from chromium-6, which poses the most significant public health concern of the various forms of chromium.[20] There were 1,428 detections of chromium in New York, and none exceeded EPA's drinking water standard.

Vanadium, the fifth most frequently detected contaminant, is a metal that is naturally occurring in numerous minerals and fossil fuel deposits. It has been used industrially to strengthen steel.[21] The International Agency for Research on Cancer (IARC) has classified vanadium as possibly carcinogenic to humans.[22]

There 707 detections of vanadium in New York, and no detections exceeded EPA's guidance level of 21 ppb.

PFOA, PFOS, and 1,4-Dioxane, are contaminants that are part of UCMR-3 that have caught national interest due to the frequency by which they are being detected in water supplies across the country.

Due to their common use in water-resistant, stain-proof, and nonstick products, as well as firefighting foam, PFOA (perfluorooctanoic acid) and PFOS (perfluorooctanesulfonic acid) are increasingly being detected in New York's drinking water. PFOA and PFOS endanger public health at very low levels of

[19] "Chlorate," American Water Works Association, https://drinktap.org/Water-Info/Whats-in-My-Water/Chlorate
[20] "Chromium," American Water Works Association, https://drinktap.org/Water-Info/Whats-in-My-Water/Chromium
[21] "Vanadium," American Water Works Association, https://drinktap.org/Water-Info/Whats-in-My-Water/Vanadium
[22] "ToxFAQs™ for Vanadium," ATSDR, October, 2012, https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=275&tid=50

exposure, resulting in developmental effects to fetuses, thyroid disorders, ulcerative colitis, high-cholesterol, preeclampsia, and kidney and testicular cancer.[23]

1,4 dioxane is an industrial solvent manufactured in large quantities for numerous uses. Decades of improper use, disposal, and storage have led to widespread drinking water contamination. Studies find that exposure to 1,4 dioxane can cause liver cancer and chronic kidney and liver effects, which has led EPA to designate the chemical as a likely human carcinogen.[24]

While it is known that there have been more detections of these chemicals than what was reported through UCMR, 25 detections of PFOA and PFOS were reported, and 516 detections were reported of 1,4-dioxane, impacting 1.5 million and 11.6 million New Yorkers, respectively.

Recently, NYPIRG conducted a review of federal data specifically to examine the extent that PFOA, PFOS, and 1,4-dioxane were found in New York drinking water supplies. As seen in Chart 2 below, NYPIRG found that drinking water for over 2.8 million New Yorkers have levels of 1,4-dioxane in their drinking water supplies above 0.3 parts per billion (the health guidance level in Massachusetts)[25], and drinking water for more than 1.4 million New Yorkers contained levels of PFOA/PFOS above the most stringent levels recommended.[26]

Chart 2: Population impacted by PFOA/PFOS and 1,4-dioxane

	1,4 dioxane health risk limit (ppb)	Population affected by 1,4-dioxane	PFOA/PFOS health risk limit	Population affected by PFOA/PFOS
Environmental groups' recommended limit[27]	.3 parts per billion	2,840,646	4-10 parts per trillion	1,450,000
U.S. EPA findings	.35 parts per billion[28]	2,793,492	.07 parts per billion[29]	1,170,500

The highest reported level detected of PFOA was 48 ppt in the Town of Hempstead Water District, 12 times higher than the 4 ppt recommended by advocacy organizations. For PFOS, the highest reported

[23] Judith Schreiber, "PFOA Exposure and Health Risk Synopsis," February 26, 2018, https://www.nrdc.org/sites/default/files/pfoa-exposure-health-risk-analysis-20180226.pdf.
[24] "Public Health Statement for 1,4 Dioxane," Agency for Toxic Substances & Disease Registry, https://www.atsdr.cdc.gov/phs/phs.asp?id=953&tid=199.
[25] "FAQ's: 1,4-dioxane," Mass DEP, https://www.mass.gov/service-details/faqs-14-dioxane
[26] Judith Schrieber, "PFOA Exposure and Health Risk Synopsis," February 26, 2018, https://www.nrdc.org/sites/default/files/pfoa-exposure-health-risk-analysis-20180226.pdf.
[27] Coalition letter to New York State Health Commissioner Howard Zucker, MD, September 5, 2018.
[28] Rates of 0.35 ppb raises the cancer risk to one additional cancer per million, according to the US EPA, https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0326_summary.pdf#nameddest=canceroral
[29] Rates of 0.07 ppb or more for PFOA and PFOS combined exceed the EPA lifetime drinking water health advisory https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos

level detected was 530 ppt in the Suffolk County Water Authority, 7 times higher than EPA's health reference level of 70 ppt and over 130 times higher than levels advocated by environmental organizations (4 ppt as of October 2018, but has since been lowered to 2 ppt).[30] The highest reported level detected of 1,4-dioxane was in the Hicksville Water District at 34 ppb, 97 times higher than EPA's health reference level of .35 ppb.

While these findings are concerning, members of the public should examine how local officials are acting to minimize the risk posed by these contaminants. The existence of these contaminants should be of concern, and how officials act to protect the public should be the driving factor in whether consumers should be alarmed.

[30] Anne Reade, Ph.D., Tracy Quinn, P.E, Judith S. Schreiber, Ph.D., "Scientific and Policy Assessment for Addressing Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water," NRDC, p.49 and p.65, March 15, 2019 https://www.nrdc.org/sites/default/files/assessment-for-addressing-pfas-chemicals-in-michigan-drinking-water.pdf.

Data by Region[31]

Table 1 demonstrates all of the UCMR-3 contaminants detected in water systems in New York by region. The following tables detail what was found in each region by county. The numbers by county represent the number of systems in that county that detected a given contaminant, not the total number of detections in a county.

The county columns with "N/A" did conduct testing under UCMR-3 because, during the time period UCMR-3 testing was conducted, there weren't systems serving 10,000 or more residents, and none were specifically selected by EPA to conduct testing. Eleven counties in New York did not test under UCMR-3.

Capital Region (page 14): Twelve distinct emerging contaminants were detected in public water systems in the Capital Region. Chromium-6 and strontium were detected most frequently. Saratoga County had the highest number of systems with detections, with Albany County following closely behind. 1,4-dioxane was detected in Albany and Schenectady Counties. There was no UCMR-3 testing conducted in Columbia, Greene, or Washington Counties.

Central (page 15): Ten distinct emerging contaminants were detected in public water systems in Central New York. Chromium-6 and strontium were detected most frequently. Onondaga County had the highest number of systems with detections. 1,4-dioxane was detected in Onondaga County. There was no UCMR-3 testing in Herkimer and Schoharie Counties.

Hudson Valley (page 16): Sixteen distinct emerging contaminants were detected in public water systems in the Hudson Valley. Strontium was detected most frequently, followed closely by chromium-6. Orange and Westchester Counties had the highest number of systems with detections. 1,4-dioxane was detected in four counties. PFOA and PFOS were detected in Orange County.

Long Island (page 17): Long Island had more systems with detections for emerging contaminants than any other region. Nineteen distinct emerging contaminants were detected. Strontium was detected most frequently, followed closely by chromium-6, chlorate, chromium, and 1,4-dioxane. Nassau County had the highest number of systems with detections. 1,4-dioxane, PFOA, and PFOS were detected in both Nassau and Suffolk Counties. Two other PFAS chemicals were detected in Suffolk County.

New York City (page 18): Five distinct emerging contaminants were detected in New York City's water system (which covers Bronx, Kings, New York, Queens, and Richmond Counties). Those contaminants include 1,4-dioxane, chromium, chromium-6, chlorate, and strontium. All detections were below EPA's health guidance where such guidance exists. There was only one detection of 1,4-dioxane, which came in at .082 ppb, far lower than the most stringent health guidance recommended by advocates. Chlorate was detected 13 times, highest detection at 200 ppb; total chromium 12 times, highest detection 31

[31] Note: counties with the highest number of systems with reported detections may also be an indicator that those counties are more populous, and, consequently, have a larger number of systems serving more than 10,000 residents that have to test.

ppb; chromium-6 31 times, highest detection at .057 ppb; and strontium 32 times, highest detection at 97 ppb.

New York City has the fewest detections compared to the rest of the state because of its renowned, and unique, source water protection program. The lands surrounding New York City's three upstate aquifers have been purchased and maintained by the City, which prevents unsafe development or discharges into their water supply (more on this on page 31, "Case Study #2").

North Country (page 19): Thirteen distinct emerging contaminants were detected in public water systems in the North Country. Strontium and chromium-6 were detected most frequently. Jefferson County had the highest number of systems with detections. PFOA and two other PFAS chemicals were detected. There was no UCMR testing in Hamilton and Lewis Counties.

Southern Tier (page 20): Ten distinct emerging contaminants were detected in public water systems in the Southern Tier. Strontium, chlorate, and chromium-6 were detected most frequently. Broome County had the highest number of systems with detections. 1,4-dioxane was detected in Broome County. There was no UCMR testing in Chenango, Delaware, Schuyler, and Tioga Counties.

Western (page 21): Twelve distinct emerging contaminants were detected in public water systems in Western New York. Strontium was detected most frequently, followed closely by chromium-6. Molybdenum, which was the tied as the third most frequently detected chemical with chromium, was detected more frequently in Western New York than any other region in the state.[32] Erie County had the highest number of systems with detections. 1,4-dioxane was detected in Erie and Genesee Counties.

[32] More information on molybdenum can be found in the appendix, Table 3.

Capital Region Counties

Contaminants	Albany	Columbia	Greene	Rensselaer	Saratoga	Schenectady	Warren	Washington	Totals
1,1-dichloroethane	0	N/A	N/A	0	0	0	0	N/A	0
1,2,3-trichloropropane	0	N/A	N/A	0	0	0	0	N/A	0
1,4-dioxane	1	N/A	N/A	0	0	1	0	N/A	2
4-androstene-3,17-dione	0	N/A	N/A	0	0	0	0	N/A	0
aerobic spores	0	N/A	N/A	0	0	0	0	N/A	0
bromomethane	1	N/A	N/A	0	2	0	0	N/A	3
chlorate	5	N/A	N/A	2	5	2	2	N/A	16
chloromethane	1	N/A	N/A	0	2	0	0	N/A	3
chromium	5	N/A	N/A	2	3	3	1	N/A	14
chromium-6	5	N/A	N/A	2	5	4	2	N/A	18
cobalt	0	N/A	N/A	0	0	0	0	N/A	0
HCFC-22	0	N/A	N/A	0	1	1	0	N/A	2
manganese	0	N/A	N/A	0	2	0	0	N/A	2
molybdenum	1	N/A	N/A	0	2	0	0	N/A	3
n-propylbenzene	0	N/A	N/A	0	0	0	0	N/A	0
PFHpA	0	N/A	N/A	0	0	0	0	N/A	0
PFHxS	0	N/A	N/A	0	0	0	0	N/A	0
PFNA	0	N/A	N/A	0	0	0	0	N/A	0
PFOA	0	N/A	N/A	0	0	0	0	N/A	0
PFOS	0	N/A	N/A	0	0	0	0	N/A	0
strontium	5	N/A	N/A	2	5	4	2	N/A	18
testosterone	1	N/A	N/A	0	0	0	0	N/A	1
vanadium	5	N/A	N/A	2	4	3	2	N/A	16

Central NY Counties

Contaminants	Cayuga	Cortland	Fulton	Herkimer	Madison	Montgomery	Oneida	Onondaga	Oswego	Otsego	Schoharie	Totals
1,1-dichloroethane	0	0	0	N/A	0	0	0	0	0	0	N/A	0
1,2,3-trichloropropane	0	0	0	N/A	0	0	0	0	0	0	N/A	0
1,4-dioxane	0	0	0	N/A	0	0	0	1	0	0	N/A	1
4-androstene-3,17-dione	0	0	0	N/A	0	0	1	1	0	0	N/A	2
Aerobic spores	0	0	0	N/A	0	0	0	0	0	0	N/A	0
bromomethane	0	0	0	N/A	0	0	0	0	0	0	N/A	0
chlorate	1	0	0	N/A	1	2	1	5	2	2	N/A	14
chloromethane	0	0	0	N/A	0	0	0	0	0	0	N/A	0
chromium	1	1	1	N/A	1	2	1	5	1	1	N/A	14
chromium-6	1	1	1	N/A	1	2	2	5	2	2	N/A	17
cobalt	0	0	0	N/A	0	0	0	0	0	0	N/A	0
HCFC-22	0	0	0	N/A	0	0	0	0	0	0	N/A	0
manganese	0	0	0	N/A	0	1	0	0	1	1	N/A	3
molybdenum	0	0	0	N/A	0	0	0	5	1	1	N/A	7
n-propylbenzene	0	0	0	N/A	0	0	0	0	0	0	N/A	0
PFHpA	0	0	0	N/A	0	0	0	0	0	0	N/A	0
PFHxS	0	0	0	N/A	0	0	0	0	0	0	N/A	0
PFNA	0	0	0	N/A	0	0	0	0	0	0	N/A	0
PFOA	0	0	0	N/A	0	0	0	0	0	0	N/A	0
PFOS	0	0	0	N/A	0	0	0	0	0	0	N/A	0
strontium	1	1	1	N/A	1	2	2	5	2	2	N/A	17
testosterone	0	0	0	N/A	0	0	0	1	0	0	N/A	1
vanadium	0	0	0	N/A	1	2	2	5	1	1	N/A	12

Hudson Valley Counties

Contaminants	Dutchess	Orange	Putnam	Rockland	Sullivan	Ulster	Westchester	Totals
1,1-dichloroethane	0	0	0	1	0	0	0	1
1,2,3-trichloropropane	0	0	0	0	0	0	0	0
1,4-dioxane	1	1	0	2	0	0	1	5
4-androstene-3,17-dione	0	0	0	0	0	0	0	0
aerobic spores	0	0	1	0	0	0	0	1
bromomethane	0	0	0	0	0	0	0	0
chlorate	5	12	2	3	1	1	13	37
chloromethane	0	0	0	0	0	0	0	0
chromium	6	9	0	3	1	1	11	31
chromium-6	6	12	1	3	1	1	18	42
cobalt	0	1	0	0	0	0	0	1
HCFC-22	0	0	0	1	0	0	0	1
manganese	1	7	1	0	1	0	3	13
molybdenum	2	2	1	1	0	0	1	7
n-propylbenzene	0	0	0	0	0	0	0	0
PFHpA	0	2	0	0	0	0	0	2
PFHxS	0	2	0	0	0	0	0	2
PFNA	0	0	0	0	0	0	0	0
PFOA	0	2	0	0	0	0	0	2
PFOS	0	2	0	0	0	0	0	2
strontium	7	14	2	3	1	1	18	46
testosterone	0	0	0	0	0	0	0	0
vanadium	3	3	1	2	0	1	4	14

Long Island Counties

Contaminants	Nassau	Suffolk	Totals
1,1-dichloroethane	19	6	25
1,2,3-trichloropropane	5	5	10
1,4-dioxane	25	9	34
4-androstene-3,17-dione	0	0	0
aerobic spores	0	0	0
bromomethane	1	0	1
chlorate	27	9	36
chloromethane	1	0	1
chromium	26	9	35
chromium-6	27	9	36
cobalt	18	4	22
HCFC-22	11	2	13
manganese	1	1	2
molybdenum	1	3	4
n-propylbenzene	0	0	0
PFHpA	0	1	1
PFHxS	0	1	1
PFNA	1	0	1
PFOA	3	0	3
PFOS	0	2	2
strontium	28	9	37
testosterone	0	0	0
vanadium	19	6	25

New York City

Contaminants	Aggregate all boroughs of New York City [33]
1,1-dichloroethane	0
1,2,3-trichloropropane	0
1,4-dioxane	1
4-androstene-3,17-dione	0
aerobic spores	0
bromomethane	0
chlorate	1
chloromethane	0
chromium	1
chromium-6	1
cobalt	0
HCFC-22	0
manganese	0
molybdenum	0
n-propylbenzene	0
PFHpA	0
PFHxS	0
PFNA	0
PFOA	0
PFOS	0
strontium	1
testosterone	0
vanadium	0

[33] All New York City boroughs and counties are served by New York City's water system, which is served by three aquifers in upstate New York.

North Country Counties

Contaminants	Clinton	Essex	Franklin	Hamilton	Jefferson	Lewis	St. Lawrence	Totals
1,1-dichloroethane	0	0	0	N/A	0	N/A	0	0
1,2,3-trichloropropane	0	0	0	N/A	0	N/A	0	0
1,4-dioxane	0	0	0	N/A	0	N/A	0	0
4-androstene-3,17-dione	0	1	0	N/A	1	N/A	0	2
aerobic spores	0	0	0	N/A	0	N/A	0	0
bromomethane	0	0	0	N/A	0	N/A	0	0
chlorate	1	0	0	N/A	2	N/A	3	6
chloromethane	0	0	0	N/A	0	N/A	0	0
chromium	1	0	1	N/A	2	N/A	1	5
chromium-6	1	0	1	N/A	3	N/A	3	8
cobalt	0	0	0	N/A	0	N/A	0	0
HCFC-22	0	0	0	N/A	0	N/A	0	0
manganese	0	0	0	N/A	1	N/A	1	2
molybdenum	0	0	0	N/A	1	N/A	3	4
n-propylbenzene	0	0	0	N/A	1	N/A	0	1
PFHpA	0	0	0	N/A	1	N/A	0	1
PFHxS	0	0	0	N/A	1	N/A	0	1
PFNA	0	0	0	N/A	0	N/A	0	0
PFOA	0	0	0	N/A	1	N/A	0	1
PFOS	0	0	0	N/A	0	N/A	0	0
strontium	1	0	1	N/A	3	N/A	3	8
testosterone	0	0	0	N/A	1	N/A	0	1
vanadium	0	0	1	N/A	3	N/A	2	6

Southern Tier Counties

Contaminants	Broome	Chemung	Chenango	Delaware	Schuyler	Steuben	Tioga	Tompkins	Totals
1,1-dichloroethane	1	0	N/A	N/A	N/A	0	N/A	0	1
1,2,3-trichloropropane	0	0	N/A	N/A	N/A	0	N/A	0	0
1,4-dioxane	4	0	N/A	N/A	N/A	0	N/A	0	4
4-androstene-3,17-dione	0	0	N/A	N/A	N/A	0	N/A	0	0
aerobic spores	0	0	N/A	N/A	N/A	0	N/A	0	0
bromomethane	0	0	N/A	N/A	N/A	0	N/A	0	0
chlorate	5	2	N/A	N/A	N/A	1	N/A	3	11
chloromethane	0	0	N/A	N/A	N/A	0	N/A	0	0
chromium	3	2	N/A	N/A	N/A	1	N/A	3	9
chromium-6	5	2	N/A	N/A	N/A	1	N/A	3	11
cobalt	1	0	N/A	N/A	N/A	0	N/A	0	1
HCFC-22	1	0	N/A	N/A	N/A	0	N/A	0	1
manganese	1	0	N/A	N/A	N/A	0	N/A	0	1
molybdenum	0	0	N/A	N/A	N/A	0	N/A	0	0
n-propylbenzene	0	0	N/A	N/A	N/A	0	N/A	0	0
PFHpA	0	0	N/A	N/A	N/A	0	N/A	0	0
PFHxS	0	0	N/A	N/A	N/A	0	N/A	0	0
PFNA	0	0	N/A	N/A	N/A	0	N/A	0	0
PFOA	0	0	N/A	N/A	N/A	0	N/A	0	0
PFOS	0	0	N/A	N/A	N/A	0	N/A	0	0
strontium	5	2	N/A	N/A	N/A	1	N/A	3	11
testosterone	0	0	N/A	N/A	N/A	0	N/A	0	0
vanadium	1	0	N/A	N/A	N/A	0	N/A	1	2

Western New York Counties[34]

Contaminants	Allegany	Cattaraugus	Chautaqua	Erie	Genessee	Livingston	Monroe	Niagara	Ontario	Orleans	Seneca	Wayne	Wyoming	Yates	Totals
1,1-dichloroethane	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
1,2,3-trichloropropane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,4-dioxane	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
4-androstene-3,17-dione	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
aerobic spores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bromomethane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chlorate	0	2	1	2	2	0	3	1	2	2	0	0	0	0	14
chloromethane	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
chromium	0	2	2	5	2	0	2	6	3	2	0	1	0	0	24
chromium-6	1	2	3	8	2	0	3	6	2	2	0	1	1	0	30
cobalt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HCFC-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
manganese	1	0	0	2	0	0	0	0	0	1	0	0	1	0	5
molybdenum	0	0	3	8	2	0	3	6	0	2	0	1	0	0	24
n-propylbenzene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PFHpA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PFHxS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PFNA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PFOA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PFOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
strontium	1	2	3	8	2	0	3	6	4	2	0	1	1	0	32
testosterone	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
vanadium	0	1	1	4	2	0	2	5	0	2	0	1	0	0	17

[34] MCWA (PWSID NY2701047) serves both Monroe and Orleans county. For the purposes of this table, the detections for this water system are included in both Monroe and Orleans Counties, but were only counted once to calculate the totals for the Western NY region.

Drinking Water Laws and Regulations

New York Drinking Water: New York State has 2,324 active community-based public water systems that collectively provide the tap water to about 80% of the state's population, or 16 million people. Another four million New Yorkers use private household wells. Drinking water in New York is regulated by the New York State Department of Health (DOH).[35]

Safe Drinking Water Act: Every public water system, unless a specific exemption has been granted by the EPA or a designated state-level authority, is required to monitor levels of all contaminants that have been regulated under the federal Safe Drinking Water Act (SDWA) and report those levels to the EPA. Federally, and in New York State, private household wells do not have required testing.

Maximum Contaminant Level (MCL): When chemicals are regulated under the SDWA, or related state laws, they have a legal ceiling limit, known as a Maximum Contaminant Level (MCL), on the amount allowable in a drinking water supply. Once an MCL is established, the chemical has corresponding monitoring and reporting requirements. Federally, 78 chemicals are regulated with MCLs.[36]

Unregulated Contaminant Monitoring Rule (UCMR): Part of the Safe Drinking Water Act is the Unregulated Contaminant Monitoring Rule (UCMR). This rule requires EPA to come up with a list of up to 30 emerging contaminants every few years, and water systems serving 10,000 or more residents are required to test for those chemicals. "Emerging contaminants" are unregulated chemicals (there are over 80,000 chemicals available for market use that are unregulated) that may have health risks and are suspected to be in drinking water supplies.[37] There have been four rounds of monitoring through UCMR since 2001.

The data in this report is from the third Unregulated Contaminant Monitoring Rule (UCMR-3), which required testing for 30 different contaminants between 2013 to 2016 (see appendix for full list of UCMR-3 chemicals and descriptions). Since participation in the UCMR is required only in "large" systems serving 10,000 people or more, and in a limited sample of smaller systems, not all New York communities have performed testing for UCMR-3 chemicals.

[35] Thomas P. Dinapoli, "Federal and New York State Regulation of Drinking Water Contaminants," Office of the New York State Comptroller, June 2017, p. 5, https://osc.state.ny.us/reports/environmental/drinking-water-contaminants.pdf.
[36] Thomas P. Dinapoli, "Federal and New York State Regulation of Drinking Water Contaminants," Office of the New York State Comptroller, June 2017, p. 8, https://osc.state.ny.us/reports/environmental/drinking-water-contaminants.pdf.
[37] Mark Scialla, "It could take centuries for EPA to test all the unregulated chemicals under a new landmark bill," PBS News Hour, June 22, 2016, https://www.pbs.org/newshour/science/it-could-take-centuries-for-epa-to-test-all-the-unregulated-chemicals-under-a-new-landmark-bill

Case Study #1: The Hoosick Falls PFOA Contamination Crisis

Hoosick Falls, New York is a small, rural community close to the border of Vermont, about an hour from the State's Capital. There's a road sign leading into the village: "Village of Hoosick Falls, Home of New York State's Best Tasting Water, 1987." It's a sign that became chilling after, in November 2015, residents of Hoosick Falls were notified by the U.S Environmental Protection Agency (EPA) that their drinking water was unsafe due to elevated levels of perfluorooctanoic acid (PFOA).[38]

PFOA is an unregulated chemical that can't be smelled, tasted, or seen in drinking water. But it can have devastating health impacts. Exposure to PFOA has been linked to diseases such as thyroid disorders, ulcerative colitis, high-cholesterol, preeclampsia, and kidney and testicular cancer.[39]

The contamination was not uncovered due to testing conducted by the EPA, or New York's health department, but because a resident, Michael Hickey, took the initiative to have water tested in March 2014 after observing an alarmingly high number of suspicious cancers in his community, including the death of his father from kidney cancer.[40] Hickey knew that for decades Teflon was produced at the factories in the village and he discovered PFOA was a chemical used in the production process.[41]

Samples from Hoosick Falls tested as high as 580 parts per trillion (ppt). By comparison, EPA's advisory level for short-term exposure at the time was 400 ppt.[42] The two companies being held responsible for the pollution are Honeywell and Saint-Gobain Performance Plastics.[43]

PFOA wasn't only discovered in the drinking water – it was also found at extremely high levels in peoples' blood. Levels 15 times the national average were found in blood samples of over 2,000 residents.[44]

Residents took another blow when they learned that they were exposed to unsafe levels of PFOA for over a year after state regulators became aware of the problem. The state health department was first made aware of the contamination in August 2014. According the county and state health

[38] "Hoosick Falls Special Report Timeline," Times Union, May 5, 2016, https://www.timesunion.com/tuplus-local/article/Hoosick-Falls-Special-Report-timeline-7246804.php.
[39] Judith Schreiber, "PFOA Exposure and Health Risk Synopsis," February 26, 2018, https://www.nrdc.org/sites/default/files/pfoa-exposure-health-risk-analysis-20180226.pdf.
[40] Jesse McKinley, "After Months of Anger in Hoosick Falls, Hearings on Tainted Water Begin," New York Times, August 30, 2016, https://www.nytimes.com/2016/08/31/nyregion/hoosick-falls-tainted-water-hearings.html.
[41] Ibid.
[42] "Hoosick Falls Special Report Timeline," Times Union, May 5, 2016, https://www.timesunion.com/tuplus-local/article/Hoosick-Falls-Special-Report-timeline-7246804.php.
[43] New York State Department of Environmental Conservation State Superfund Program, Order on Consent and Administrative Settlement, http://www.dec.ny.gov/docs/regions_pdf/stgobainco632016.pdf.
[44] Jesse McKinley, "After Months of Anger in Hoosick Falls, Hearings on Tainted Water Begin," New York Times, August 30, 2016, https://www.nytimes.com/2016/08/31/nyregion/hoosick-falls-tainted-water-hearings.html.

officials, action was not taken because: The department felt levels detected were safe for public health, despite exceeding EPA's guidance levels;[45] and, the department blamed EPA for having inconsistent regulations and guidance for PFOA.[46]

> **"I do believe our citizens were advised incorrectly to consume water that was unsafe for at least for 12 months."**
>
> Dr. Marcus Martinez, Hoosick Falls Doctor, citation 46

Months after PFOA was uncovered in Hoosick Falls, it was also uncovered in excess levels in nearby Petersburgh, and a related chemical, perfluorooctanesulfonic acid (PFOS), was found in Newburgh at levels exceeding new EPA guidance. It became clear Hoosick Falls was only the beginning of drinking water contamination issues in the state.

EPA lowered its health advisory from 400 ppt to 70 ppt, and the state legislature held hearings on water quality in August and September 2016.[47] These hearings lead to the passage of critical pieces of legislation in the SFY2017-18 budget, designed with the intent to prevent situations like Hoosick Falls, including:

- The Clean Water Infrastructure Act of 2017, a $2.5 billion, 5-year program that funds source water protection, water infrastructure, treatment for emerging contaminants, and more;
- The New York State Drinking Water Quality Council (§ 1113 of the public health law) which was created with the intent to be an independent entity to aid the state in assessing emerging contaminants; and,
- The Emerging Contaminant Monitoring Act (§ 1112 of the public health law), which requires the Commissioner of the Department of Health to promulgate an emerging contaminant list for New York and requires all public water systems, regardless of the population size served, to test for contaminants on the list.

Hoosick Falls changed the narrative around drinking water protections in New York State. But the State has a lot more work to do to prevent future crises and to resolve the water contamination in Hoosick Falls and other affected communities. Unfortunately, the state has yet to implement the Emerging Contaminant Monitoring Act, or regulate PFOA and PFOS in drinking water.

[45] Brendan Lyons, "Emails show early confusion over Hoosick Falls water pollution," Times Union, February 8, 2016, https://www.timesunion.com/local/article/EPA-and-state-warned-of-Hoosick-Falls-water-6812774.php#photo-4248454.
[46] Scott Waldman, "At Hoosick Falls hearings, Cuomo administration blames EPA," Politico, August 30, 2016, https://www.politico.com/states/new-york/albany/story/2016/08/at-hearings-cuomo-administration-places-hoosick-falls-blame-on-epa-105069.
[47] Ibid.

Loopholes: What the Data Doesn't Include

Due to weaknesses in federal and state law, the data offered in this report cannot provide the full picture of contamination in New York State – there's likely more emerging contaminants in drinking water supplies than this data indicates. The consequences of which mean one-third of New York's population, or 6.4 million residents, are in the dark about emerging contaminants in their drinking water supply.[48]

These loopholes may create the impression that residents in these communities are not exposed to any emerging contaminants, or that detected levels are safe. That is misleading. There simply isn't data for every community in New York State because neither the federal or state regulators require testing.

Loophole #1: Only public water systems serving 10,000 or more residents have to test for UCMR emerging contaminants. As a result, there isn't data for 11 of New York's counties. These counties do not have public water systems that serve 10,000 or more residents and did not have smaller systems selected by EPA to conduct testing. Approximately 2.4 million New Yorkers on public water systems and 4 million New Yorkers relying on private wells do not benefit from UCMR testing.

Hoosick Falls, a small community of 3,500 residents in rural upstate New York, is the poster child for the consequences of this loophole. In November 2015, residents in Hoosick Falls were made aware of the fact that dangerously high levels of perfluorooctanoic acid (PFOA) were detected in their drinking water and that it was unsafe for residents to consume.[49] PFOA is an unregulated chemical that can cause diseases such as thyroid disorders, ulcerative colitis, high-cholesterol, preeclampsia, and kidney and testicular cancer.[50]

Even though PFOA is listed on the third Unregulated Contaminant Monitoring Rule (UCMR-3), this chemical was discovered in the Hoosick Falls drinking water supply not because of required state or federal testing, but because an individual resident took the initiative to have his water tested after observing a number of illnesses in the community.[51]

The highest level of PFOA reported through UCMR was 48 ppt in the Town of Hempstead Water District. By comparison, levels of PFOA found in Hoosick Falls tested as high as 540 ppt.[52]

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[48] "Governor Cuomo Calls For Aggressive New Water Quality Protections," Governor Andrew M. Cuomo, September 7, 2016, https://www.governor.ny.gov/news/governor-cuomo-calls-aggressive-new-water-quality-protections.
[49] Brendan Lyons, "Top Stories 2016: PFOA water pollution in Hoosick Falls," Times Union, December 30, 2016, https://www.timesunion.com/tuplus-local/article/Top-Stories-2016-PFOA-water-pollution-in-Hoosick-10825849.php.
[50] Judith Schreiber, "PFOA Exposure and Health Risk Synopsis," February 26, 2018, https://www.nrdc.org/sites/default/files/pfoa-exposure-health-risk-analysis-20180226.pdf.
[51] Brendan Lyons, "Emails show early confusion over Hoosick Falls water pollution," Times Union, February 8, 2016, https://www.timesunion.com/local/article/EPA-and-state-warned-of-Hoosick-Falls-water-6812774.php#photo-4248454.
[52] "Hoosick Falls Special Report Timeline," Times Union, May 5, 2016, https://www.timesunion.com/tuplus-local/article/Hoosick-Falls-Special-Report-timeline-7246804.php.

Had Hoosick Falls tested under UCMR, it's possible effective action would have been taken sooner. In May 2016, the then-City Manager of the City of Newburgh declared a state of emergency upon learning that the levels of perfluorooctanesulfonic acid (PFOS) found in Newburgh's drinking water source would be higher than EPA's new guidance level for PFOA and PFOS of 70 ppt.[53] Newburgh's water system serves a population of more than 10,000 residents, and unlike Hoosick Falls, benefited from UCMR testing.

Loophole #2: Minimum Reporting Levels (MRLs) are sometimes higher than the levels that can be detected. The Safe Drinking Water Act stipulates that public water supplies participating in the UCMR program report contaminant levels to EPA if they exceed an established Minimum Reporting Level (MRL). MRLs are not health standards and usually reflect the lowest concentration that can be detected by the laboratory methods approved by the EPA.

When an unregulated contaminant does not appear in the data, it does not mean that the contaminant is not present in water supplies. Levels below established MRLs may have significant health impacts without being detected by EPA's approved laboratory methods. Additionally, some chemicals have MRLs that do not reflect the latest technology's detection capabilities.

For example, PFOA has an MRL of 20 parts per trillion (ppt).[54] However, under EPA Method 537.1, PFOA can be detected at levels as low as 0.53 ppt.[55] This means that, under UCMR-3, there are communities that detected levels of PFOA, but did not report them.

EPA's data from UCMR-3 backs this up. All of the reported PFOA detections in New York are levels above the 20 ppt. However, testing and reporting done outside of the UCMR process uncovered numerous water systems with PFOA levels below 20 ppt. The data in this report shows 13 detections for PFOA across New York State; however, through a Freedom of Information Law request, it was found that the Suffolk County Water Authority alone had 844 detections for PFOA and five other related chemicals (collectively known as PFAS chemicals).[56]

Loophole #3: Without Maximum Contaminant Levels, action isn't legally required. As Table 2 (page 6) demonstrates, not every chemical listed has a health guidance level issued by EPA, due in part to limited science in some cases, and in others, due to EPA lagging behind the latest science. As a result, many chemicals are detected above health guidance, but because a corresponding Maximum

[53] Brigette Sayegh, "State of Emergency in Newburgh as PFOS Discovered in Water," Spectrum News, May 3, 2016, https://spectrumlocalnews.com/nys/jamestown/news/2016/05/2/state-of-emergency-in-newburgh-as-pfos-discovered-in-water.

[54] "The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017," U.S EPA, p. 8, January, 2017, https://www.epa.gov/sites/production/files/2017-02/documents/ucmr3-data-summary-january-2017.pdf.

[55] Anne Reade, Ph.D., Tracy Quinn, P.E, Judith S. Schreiber, Ph.D., "Scientific and Policy Assessment for Addressing Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water," NRDC, p.49 and p.65, March 15, 2019.

[56] Suffolk County Water Authority lab results between January 1, 2013 to October 31, 2017 – documents obtained via FOIL request.

Contaminant Level (MCL) may not yet be established, remedial action is not required to prevent exposure to unsafe levels.

The "health guidance level" column in Table 2 is based on EPA's "reference concentration," which EPA derived from the following sources: 2012 Drinking Water Standards and Health Advisories, the CCL 4 Contaminant Information Sheets, the Human Health Benchmark for Pesticides (HHBPs), the Integrated Information Risk System (IRIS), or the 2014 Preliminary Regulatory Determinations for Contaminants on CCL 3.[57] According to EPA:

"The draft reference concentration does not represent an 'action level' (EPA requires no particular action based simply on the fact that UCMR monitoring results exceed draft reference concentrations), nor should the draft reference concentration be interpreted as any indication of an Agency intent to establish a future drinking water regulation for the contaminant at this or any other level."[58]

For example, while Hoosick Falls did not find PFOA in their drinking water due to UCMR testing, levels were detected well above EPA's 400 ppt health advisory for PFOA at the time.[59] Despite this, New York's Department of Health did not take any action for more than a year after learning of the high levels of PFOA in Hoosick Falls' drinking water. Action wasn't taken until EPA stepped in and issued a letter to residents.[60]

NY Needs a Precautionary Approach to Chemicals

New York, like most of the country, does not usually take action to ban or regulate chemicals until well after a crisis unfolds and people get sick.

The Precautionary Principle stipulates that until a process, or use of a chemical, is proven to be safe for the environment and public health, it cannot move forward, or be used. This principle is used in parts of law of the European Union.

A well-known example where this principle was used in New York was when the state announced a ban on the practice of high-volume hydraulic fracturing for natural gas ("fracking"). In a report on fracking, the Commissioner of New York's Department of Health wrote, "Until the science provides sufficient information to determine the level of risk to public health from HVHF to all New Yorkers and whether the risks can be adequately managed, DOH recommends that HVHF should not proceed in NYS."

New York adopting an approach like this for chemicals will end the age-old practice of waiting until people get sick to regulate chemicals.

[57] "The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017," U.S EPA, p. 6, January, 2017, https://www.epa.gov/sites/production/files/2017-02/documents/ucmr3-data-summary-january-2017.pdf.
[58] Ibid.
[59] Brendan Lyons, "EPA sets new level for chemical PFOA in drinking water," Times Union, May 20, 2016, https://www.timesunion.com/local/article/EPA-sets-new-level-for-chemical-in-local-water-7716825.php.
[60] Scott Waldman, "Cuomo administration moves to declare Hoosick Falls a Superfund site," Politico, January 27, 2016, https://www.politico.com/states/new-york/albany/story/2016/01/cuomo-administration-moves-to-declare-hoosick-falls-a-superfund-site-030601.

EPA's health advisory for PFOA and PFOS have since been lowered to 70 ppt.[61] However, the federal Agency for Toxic Substances and Disease Registry (ATSDR) released a report in June 2018 that recommended minimum risk levels of 7 ppt for PFOS and 11 ppt for PFOA. Minimum risk levels are not enforceable regulatory standards, but they are used by ATSDR to screen whether or not certain exposures represent a potential health hazard.[62]

Additional science from NRDC indicates that no level of PFOA (or other related chemicals, known as PFAS chemicals) can be proven to be safe for public health (advocates recommend a combined MCL of 2 ppt for PFOA, PFOS, PFNA, and PFHxS).[63] New York's Drinking Water Quality Council recommended MCLs of 10 ppt for PFOA and PFOS, each, in December 2018.[64]

PFOA and PFOS are not the only examples. Chromium-6, also known as hexavalent chromium, does not have a health guidance level from EPA, despite being classified by the agency as a known carcinogen.[65] Chromium-6 occurs naturally in the environment, but higher levels can be found due to industrial pollution. According to scientists with the California Office of Environmental Health Hazard Assessment, a public health goal of 0.02 parts per billion (ppb) is what may be safe for public health.[66] At 0.03 ppb, EPA's MRL for chromium-6 is higher than California's health goal. As a result, every reported detection of chromium-6 in New York exceeded this health goal. There were 2,205 detections of chromium-6, with the highest level detected at 7.3 ppb in the Greenlawn Water District on Long Island.

It is critical for public health and the environment to have MCLs that align with the most stringently recommended health levels. **Without MCLs for contaminants that have the potential to harm human health, communities can go for decades without any required testing or remedial action when unsafe levels are detected.**

[61] Brendan Lyons, "EPA sets new level for chemical PFOA in drinking water," Times Union, May 20, 2016, https://www.timesunion.com/local/article/EPA-sets-new-level-for-chemical-in-local-water-7716825.php.
[62] Garrett Ellison, "Blocked report drops PFAS safety level into single digits," MLive, June 20, 2018, https://www.mlive.com/news/2018/06/atsdr_pfas_toxprofiles_study.html.
[63] Anne Reade, Ph.D., Tracy Quinn, P.E, Judith S. Schreiber, Ph.D., "Scientific and Policy Assessment for Addressing Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water," NRDC, p.49 and p.65, March 15, 2019.
[64] "Drinking Water Quality Council Recommends Nation's Most Protective Maximum Contaminant Levels for Three Unregulated Contaminants in Drinking Water," NY DOH, December 18, 2018, https://www.health.ny.gov/press/releases/2018/2018-12-18_drinking_water_quality_council_recommendations.htm.
[65] Courtney Norris, "What is chromium-6 and how did it infiltrate America's drinking water?," PBS News Hour, September 21, 2016, https://www.pbs.org/newshour/science/chromium-6-wash-many-drinking-supplies
[66] "Final Technical Support Document on Public Health Goal for Hexavalent Chromium in Drinking Water," OEHHA, July 29, 2011, https://oehha.ca.gov/water/public-health-goal-fact-sheet/final-technical-support-document-public-health-goal-hexavalent.

New York Can Close the Loopholes

In September 2016, the New York Legislature held joint hearings on water quality. The goal of these hearings was to better understand water quality issues throughout the state, but to also uncover what went wrong in Hoosick Falls and why, and, critically, what New York needs to do to prevent situations like what happened in Hoosick Falls in the future.[67]

The day of the water quality hearing in Albany, Governor Cuomo announced his office would, in the face of federal inaction, pursue:[68]

> Testing all public systems, regardless of size, for unregulated contaminants; and,
> Require testing for private wells.

Emerging Contaminant Monitoring Act: In the SFY2017-18 budget, the "emerging contaminant monitoring act," § 1112 of New York's Public Health Law, was passed. The law requires the Department of Health to create a list of emerging contaminants in New York and the testing of all public water systems for those contaminants every three years, regardless of the population size served.

The law also requires the Department of Health Commissioner to establish notification levels for each emerging contaminant listed, which would have to be equal to, or lower, than any federal lifetime health advisory level. Should an emerging contaminant be detected in a public water system at, or above, the notification level, the Department would be notified within 24 hours, and the public served by the system would be notified no later than 90 days after discovery.

Additionally, every three years, the Commissioner is required to review the list of emerging contaminants to determine if the Department should establish maximum contaminant levels for any of the substances.

Two years since this legislation was signed into law, and the Department has yet to implement it.

Private Well Testing: The Governor proposed legislation in his SFY2017-18 executive budget that would require private well testing prior to the sale of property and upon construction of a new well; however, it did not end up in the final budget.

Private well testing has not been legislatively advanced by the Governor since that budget proposal.

[67] Scott Waldman, "Assembly to hold two water quality hearings in September," Politico, July 6, 2016, https://www.politico.com/states/new-york/albany/story/2016/07/state-assembly-agrees-to-hold-water-quality-hearings-after-months-of-pressure-103583.

[68] "Governor Cuomo Calls for Aggressive New Water Quality Protections," Governor Andrew M. Cuomo, September 7, 2019, https://www.governor.ny.gov/news/governor-cuomo-calls-aggressive-new-water-quality-protections.

Stand-alone legislation to do this, modeled closely after New Jersey's Private Well Testing Act, is pending in the State Legislature.[69] As of the writing of this report, this legislation has yet to pass both the state Assembly and Senate.

Drinking Water Quality Council: After the public and state legislators learned that the Department of Health delayed responding to Hoosick Falls' drinking water contamination, and when they did respond, it gave out misleading health information,[70] the Senate recommended the creation of an independent entity to prevent future Hoosick Falls scenarios.[71] Thus, the Drinking Water Quality Council ("the Council"), was created in the SFY2017-18.

The Drinking Water Quality Council, § 1113 of New York's Public Health Law, is a twelve-member body tasked with making recommendations to the Department on emerging contaminants, which should be included on New York's list, corresponding notification levels, and timeframes and frequency for testing. A specific requirement of the council in the law is the following:

> (iv) The council shall provide the department with its first list of recommended emerging contaminants and corresponding notification levels for which testing shall be required no later than one year from the initial meeting of the council, and the council shall update the list and recommend notification levels annually thereafter.

The Council missed this deadline, and the Department has yet to recommend a list of emerging contaminants for testing.

The Council held its first meeting on October 2, 2017. The body recommended MCLs for PFOA, PFOS, and 1,4-dioxane during its last meeting on December 18, 2018. The Department has not yet adopted the recommended MCLs, and the Council has not met, or announced an upcoming meeting, since then.

[69] New York State Assembly Bill, A1103, 2019.
[70] Scott Waldman, "At Hoosick Falls hearings, Cuomo administration blames EPA," Politico, August 30, 2016, https://www.politico.com/states/new-york/albany/story/2016/08/at-hearings-cuomo-administration-places-hoosick-falls-blame-on-epa-105069.
[71] "Water Quality and Contamination," New York State Senate, January 3, 2017, p. 22, https://www.nysenate.gov/newsroom/articles/kemp-hannon/water-quality-report.

Case Study #2: New York City's Successful Watershed Protections

Serving more than eight million New York City residents and one million residents in Westchester, Putnam, Orange, and Ulster Counties, the New York City drinking water supply is the largest unfiltered water supply in the country. The City maintains 19 different reservoirs in the Croton, Catskill, and Delaware watersheds.[72]

There's a clear reason why New York City had the fewest emerging contaminant detections compared to the rest of the regions of New York State – it's unique source water protection program. If Hoosick Falls, Newburgh, or any other of the communities now contending with water contamination crises had a program like New York City's, they would likely not be in their present situations. This program should serve as a model for the rest of New York.

To maintain the safety of the city's drinking water, in 1997 New York City, along with state and federal agencies and organizational partners (which included NYPIRG), agreed to the New York City Watershed Agreement (MOA). This agreement spelled out how the City would be able to obtain a Filtration Avoidance Determination (FAD) from EPA, which allows the city to serve unfiltered water to residents.[73]

Under the Safe Drinking Water Act, New York City must "'demonstrate control over all human activities that could adversely impact water quality' through ownership or control of adequate buffer lands."[74] The Agreement has three major components: watershed regulations, land acquisition, and partnership programs. These components include measures such as partnerships with municipalities within the watershed to fund septic system repairs, partnerships with organizations to prevent agricultural pollution, regulations preventing septic system installation in proximity to wetlands or any reservoirs, and buying land from willing landowners.[75]

All of these components make for a comprehensive program to protect source water. Similar policies statewide should be adopted, and municipalities with public water systems should be enabled to enact similar powers.

[72] "Facts About The NYC Watershed," NYS DEC, https://www.dec.ny.gov/lands/58524.html.
[73] "NYC Watershed: Protection," Riverkeeper, https://www.riverkeeper.org/nyc-watershed/protection/.
[74] Ibid.
[75] Ibid.

Conclusion

Twenty-three emerging contaminants, including several that have known detrimental health impacts, have already been detected in New York, and that is with very limited testing. Every region of New York has been impacted by emerging contaminants, affecting nearly 16 million New Yorkers, but 6.4 million New Yorkers still don't know if there are emerging contaminants in their water due to federal loopholes that New York has yet to close

Many of the chemicals included in UCMR-3 have been associated with negative health impacts, some of which can result at very low levels of exposure. The longer New York State goes without testing and regulating these chemicals, the longer the public will remain in the dark about the quality of their drinking water. Even worse, people may needlessly continue to be exposed to unsafe levels of chemicals.

Contaminants that are suspected to be unsafe for public health should not be detected in drinking water. New York already has many of the tools at its disposal to test statewide for emerging contaminants and begin regulating them in drinking water. To prevent future water contamination crises, New York should finally use these tools as well as adopt new policies to strengthen and add water protections. The following are recommended solutions:

1. The Department of Health must immediately begin statewide testing of emerging contaminants, starting with UCMR-3 contaminants that have already shown up in New York water systems, for every public water system, regardless of size.

2. Establish stringent drinking water standards for chemicals that may be unsafe for public health. Require testing for private household wells.

3. Create a statewide public database for drinking water information.

4. Adopt precautionary approaches to source water protection and chemicals by prohibiting use of chemicals until they can be proven safe, and preserving watershed.

APPENDIX

Methodology

Data: Testing data of unregulated contaminants were obtained from the EPA's Third Unregulated Contaminant Monitoring Rule (UCMR-3).[76] UCMR-3 testing took place between 2013 to 2015. The rule requires the EPA to periodically identify no more than 30 contaminants which might warrant future regulation and require monitoring for those specified contaminants in all large systems (serving 10,000 people or more) and in a select sampling of smaller systems. Therefore, some systems do not go through this monitoring process. Federal law does not stipulate an enforceable health standard for unregulated contaminants.

The Safe Drinking Water Act stipulates that public water supplies participating in the UCMR program report contaminant levels to EPA if they exceed an established Minimum Reporting Level (MRL). MRLs are not health standards and usually reflect the lowest concentration that can be detected by the laboratory methods approved by the EPA. Levels below established MRLs may have significant health impacts without being detected by EPA's approved laboratory methods. Additionally, most of New York's water systems were not required to participate in the UCMR-3 and so no testing for these contaminants is included in the data shared in this report.

Population: People can be served by more than one water system (e.g., one at home, and one at work or school), which is why people are occasionally counted more than once. Using EPA's data, New York's active, community-based water systems serve a total of 18.2 million New Yorkers, whereas only about 20 million people live in New York and approximately 4 million use private wells.

[76] "Occurrence Data for the Unregulated Contaminant Monitoring Rule," EPA, https://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule

Frequently Used Terms and Acronyms

Aquifer: Underground layer of water-bearing rocks or materials, such as gravel, sand, or silt with the potential to supply water from wells or springs.

Contaminant: Any substance that in a sufficient concentration is capable of producing negative health effects.

Emerging Contaminant: Unregulated contaminants that may have health risks and are suspected to be in drinking water supplies.

Maximum Contaminant Level (MCL): The maximum permissible level, as defined by law, of a contaminant in drinking water which is delivered to any user of a public water system. For each regulated contaminant, the Safe Drinking Water Act requires EPA to set an MCL "as close as feasible" to the level expected to cause no adverse health impacts. MCLs are enforceable health standards under the law.

Minimum Reporting Level (MRL): The lowest concentration of a substance that can be reliably measured by EPA's approved analytical methods. MRLs are not health standards; they represent the level below which contaminant information is less reliable due to limitations in the instruments or testing methods being used. EPA sets an MRL for each unregulated contaminant it monitors.

Public Water System (PWS): A company or public utility that supplies water to the public.

Reference Concentration: EPA develops reference concentrations to provide the public context for detections of emerging contaminants based on various health assessments. Reference concentrations are based on publically-available health information found in the following EPA resources: 2012 Drinking Water Standards and Health Advisories, the CCL 4 Contaminant Information Sheets, the Human Health Benchmark for Pesticides (HHBPs), the Integrated Information Risk System (IRIS), or the 2014 Preliminary Regulatory Determinations for Contaminants on CCL 3.

Regulated Contaminant: Contaminants for which the EPA has established Maximum Contaminant Levels to protect public health. When a regulated contaminant is found above the MCL it has to be reported to the Department of Health. Public advisories — which can cover a range of actions, such as boil before use or stop use — are issued and the Public Water Supplier is issued a violation.

Unregulated Contaminant: Contaminants that do not have an established enforceable maximum concentration level, or any other regulatory guidelines, under law.

Watershed: Also called a "drainage basin," a watershed is land that channels rainfall and snowmelt into surrounding creeks, streams, and rivers.

Table 3: UCMR-3 Contaminants Information

UCMR3 Contaminants	Description[77]	Potential health impacts[78]	Minimum Reporting Level (MRL) (µg/L unless otherwise indicated)	EPA Health Guidance[79]
1,1-dichloroethane	Used to make plastic wrap, adhesives, and synthetic fibers. Sometimes used as a solvent for paints and degreasers. Very water soluble.	May cause liver and kidney damage and circulatory issues. Possible human carcinogen.	0.03	6.14 to 614
1,2,3-trichloropropane	Primarily used to make other chemicals. Also used as an industrial solvent, paint and varnish remover, degreasing agent, and pesticide. Moderately soluble in water.	Suspected to be a human carcinogen.	0.03	0.0004 to 0.04
1,3-butadiene	Made from the processing of petroleum. Used to make synthetic rubber for car and truck tires and to make plastics including acrylics. Small amounts found in gasoline.	May cause genetic defects and cancer.	0.1	0.0103 to 1.03
1,4-dioxane	Very soluble in water. Primarily used as a solvent in the manufacturing of chemicals and as a laboratory reagent. Has been used in paints, fumigants, deodorants, and preservatives. Can be found in cosmetics, detergents, and shampoos.	May cause liver cancer and chronic kidney and liver effects.	0.07	0.35 to 35
17-alpha-ethynylestradiol	Used in oral contraceptive pills, for treatment of moderate to severe vasomotor symptoms associated with menopause, female hypogonadism, prostatic carcinoma-palliative therapy of advanced disease, breast cancer, and is used in emergency contraceptives.	May cause cancer, damage fertility, and harm to breastfed children.	0.0009	0.035

[77] The following citation applies to all descriptions unless otherwise noted: "Explore Chemistry," PubChemistry U.S. National Library of Medicine, https://pubchem.ncbi.nlm.nih.gov/.
[78] Ibid.
[79] "The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017," United States Environmental Protection Agency, January 2017, https://www.epa.gov/sites/production/files/2017-02/documents/ucmr3-data-summary-january-2017.pdf.

17-beta-estradiol	Used in medications for the treatment of symptoms from menopause, for the treatment of hypoestrogenism due to hypogonadism, castration, or primary ovarian failure, and for the prevention of postmenopausal osteoarthritis. Also sometimes used to treat breast cancer.	May cause cancer, damage fertility, and harm to breastfed children.	0.0004	0.0009 to 0.09
4-androstene-3,17-dione	Used as a medicine or dietary supplement. Steroid hormone.	May disrupt normal sexual development, increase risk for breast and uterine cancer, damage fertility, and cause harm to breastfed children.	0.0003	NA
aerobic spores	A strain of bacteria.		1 SFO[1]/100mL[2]	NA
bromomethane	Used as a soil fumigant to control pests in the agriculture sector, to make other chemicals as a solvent, or to get oil out of nuts, seeds and wool.	Suspected of causing genetic defects and damage to the organs through long term exposure.	0.2	140
chlorate	Disinfection byproduct, also can enter water supplies from compounds that react from herbicides, fireworks, explosives.	Can lead to an enlarged thyroid.[80]	20	210
chloromethane	Very soluble in water. Used to make other chemicals and as an industrial solvent, aerosol propellant and local anesthetic.	Suspected of causing cancer.	0.2	2.69 to 269
chromium	Naturally occurring element. Used by industrial processes to make steel, dyes and pigments and for leather tanning and wood preserving.	May cause allergy or asthma symptoms.	0.2	100
chromium-6	Used in industrial settings.[81]	May cause skin burns, pneumonia, complications	0.03	NA

[80] "Chlorate," American Water Works Association, https://drinktap.org/Water-Info/Whats-in-My-Water/Chlorate.
[81] Courtney Norris, "What is chromium-6 and how did it infiltrate America's drinking water?" PBS, September 21, 2016, https://www.pbs.org/newshour/science/chromium-6-wash-many-drinking-supplies.

		during childbirth and stomach cancer.[82]		
cobalt	Used to produce alloys in the manufacturing of aircraft engines, magnets, grinding and cutting tools, and artificial hip and knee joints. Cobalt compounds are also used to color glass, ceramics and paints, and used as a drier for porcelain enamel and paints.	Anticipated to be a human carcinogen. Confirmed animal carcinogen.	1	70
enteroviruses (cell culture)	Illness caused by food or water contaminated with fecal matter. [83]	Causes flu-like symptoms- fever, bodyache, rash.[84]	0.002 MPN/L[4]	NA
enteroviruses (RT-qPCR)	Illness caused by food or water contaminated with fecal matter.[85]	Causes flu-like symptoms- fever, bodyache, rash.[86]	0.398 GC[6]/L	NA
equilin	Used for many treatments, including symptoms associated with menopause, ovarian failure, breast cancer, and more.	May cause cancer, harm to fertility, or harm to breastfed children.	0.004	0.35
estriol	Used in testing to determine the general health of an unborn fetus, and to treat hormone disorders.	May cause cancer, harm to fertility, or harm to breastfed children.	0.0008	0.35
estrone	Used for management of premenopausal and postmenopausal symptoms.	May cause cancer, harm to fertility, or harm to breastfed children	0.002	0.35
halon 1011	Very soluble in water. Used as a fire-extinguishing fluid and as a solvent in the manufacturing of pesticides. Is also formed as a byproduct when chlorine is added to drinking water.	Causes injury to the kidney and liver. May also affect the brain and be a toxin to developing fetuses.[87]	0.06	90
HCFC-22	Used primarily as a refrigerant gas.	May cause kidney and spleen injury and is dangerous to	0.08	NA

[82] Ibid.
[83] "Factsheet about enteroviruses," European Centre for Disease Prevention and Control, July 10, 2010, https://ecdc.europa.eu/en/enteroviruses/facts.
[84] Ibid.
[85] Ibid.
[86] Ibid.
[87] "Toxic Substances Portal," Agency for Toxic Substances and Disease Registry, June 20, 2018, https://www.atsdr.cdc.gov/substances/index.asp.

		the cardiovascular system and central nervous system.		
male specific phage	A strain of bacteria.		1 PFU[7]/100 mL	NA
manganese	Used in pesticides and as a fuel additive in some gasolines.	May cause damage to the respiratory system, the central nervous system, kidneys, and blood.	0.2[88]	NA
molybdenum	Used as an alloying agent in steel and cast iron.	May damage fertility or the unborn child.	1	40
noroviruses GIA	The most common cause of noroviruses is fecal contamination of food and water. [89]	A very contagious virus that causes vomiting, diarrhea, and stomach pain.[90]	0.398 GC/L	NA
noroviruses GIB	The most common cause of noroviruses is fecal contamination of food and water.[91]	A very contagious virus that causes vomiting, diarrhea, and stomach pain.[92]	0.398 GC/L	NA
noroviruses GII	The most common cause of noroviruses is fecal contamination of food and water. [93]	A very contagious virus that causes vomiting, diarrhea, and stomach pain.[94]	0.398 GC/L	NA
n-propylbenzene	Used in chemical manufacturing and in textile dyeing and printing.[95]	May cause harm to the central nervous system.[96]	0.5[97]	NA
PFBS	Used as a surfactant in industrial processes and in water resistant or stain resistant products such as fabrics, carpets, and paper.[98]	May cause developmental effects, female reproductive effects, thyroid disorders, and kidney damage.[99]	0.09	NA

[88] "Water," Weck Labrotories Inc., http://www.wecklabs.com/Resources/MethodReportingLimits/Metals.aspx.
[89] "Norovirus," Center for Disease Control and Prevention, April 5, 2019, https://www.cdc.gov/norovirus/index.html.
[90] Ibid.
[91] Ibid.
[92] Ibid.
[93] Ibid.
[94] Ibid,
[95] "EWG's Tap Water Drinking Base," Environmental Working Group, https://www.ewg.org/tapwater/.
[96] Ibid.
[97] "n-Propylbenzene," ALS Environmental, http://www.caslab.com/n-Propylbenzene.php5.
[98] "PFBS and Drinking Water," State of Minnesota Department of Health, December 2017, https://www.health.state.mn.us/communities/environment/risk/docs/guidance/gw/pfbsinfo.pdf.
[99] Ibid.

PFHpA	Used in many consumer products.[100]	May cause cancer, endocrine disruption, accelerated puberty, liver and immune system damage, and thyroid changes.[101]	0.01	NA
PFHxS	Used to make firefighting foam, water and stain coatings for carpets, paper and cloth, and other organic chemicals containing fluorine.	Increased risk of asthma and behavior and learning problems in children. In adults may cause liver damage, harm to the immune system, and harm to the reproductive system.	0.03	NA
PFNA	Used in industrial and consumer products for protective coating for fabrics and coating, paper coatings, incesticide formulations, and surfactants.	May cause cancer, harm to the immune system, hormone disruption, harm to fetal growth and child development, and harm to the liver.[102]	0.02	NA
PFOA	Used in the production of many industrial and consumer products such as food packaging, insecticides, electronics, stain repellents, paints, plumbing tape, non-stick cooking pans, and firefighting foams.[103]	May cause developmental effects to fetuses during pregnancy, cancer, liver effects, immune effects, and thyroid disorders.[104]	0.02	0.07
PFOS	Used in the production of many industrial and consumer products such as food packaging, insecticides, electronics, stain repellents, paints, plumbing tape, non-	May cause developmental effects to fetuses during pregnancy, cancer, liver effects, immune effects, and thyroid disorders.[106]	0.04	0.07

[100] "EWG's Tap Water Drinking Base," Environmental Working Group, https://www.ewg.org/tapwater/.
[101] Ibid.
[102] Ibid.
[103] "PFOA/PFOS In Drinking Water," The Public Health and Safety Organization, http://www.nsf.org/consumer-resources/water-quality/drinking-water/perfluorooctanoic-acid-and-perfluorooctanesulfonic-acid-in-drinking-water.
[104] Ibid.
[106] Ibid.

	stick cooking pans, and firefighting foams.[105]			
strontium	Used in making ceramics, glass products, pyrotechnics, paint pigments, fluorescent lights, and medicines.	May affect bone growth and cause dental changes in children. Has been linked to bone cancers and leukemia.[107]	0.3	1500
tellurium	Used as a coloring agent for glass, enamels, porcelains, and silverware.	May damage the central nervous system and cause harm to fertility or the unborn child.	0.5	NA
testosterone	Used as a medication or supplement.	May impact hormonal balances.	0.0001	NA
total coliforms	Total coliforms are a group of bacteria that are naturally found in the environment. However, E.coli is a member of the total coliform group and is found in the intestines of animals. Contaminates water through improperly treated sewage and septic discharges, leaching of animal manure, and storm water runoff.[108]	May cause nausea, vomiting, and diarrhea. In extreme cases it may infect the liver, kidneys, nervous system, or lungs and may even be fatal.[109]	1 MPN/100 mL	NA
vanadium	Used in producing steel, to make ceramics, and in dietary supplements.	May cause stomach cramps, diarrhea, and nausea.[110]	0.2	21

[105] Ibid.
[107] "What's in My Water?" American Water Works Association, https://drinktap.org/Water-Info/Whats-in-My-Water/Strontium.
[108] "Facts on Drinking Water," New Nouveau Brunswick, http://www.rpc.ca/english/pdf/water/Coliforme.pdf.
[109] Ibid.
[110] "Toxic Substances Portal," Agency for Toxic Substances and Disease Registry, June 20, 2018, https://www.atsdr.cdc.gov/substances/index.asp.