The Fourth Unregulated Contaminant Monitoring Rule (UCMR 4) Data Summary: 2018–2020

Background

The EPA uses the Unregulated Contaminant Monitoring Rule (UCMR) program to collect nationally representative data for contaminants that may be present in drinking water but do not have regulatory standards set under the Safe Drinking Water Act (SDWA). This monitoring is used by the agency to understand the frequency and level of occurrence of unregulated contaminants in the nation's drinking water systems. Every five years, taking into consideration the EPA's Contaminant Candidate List (CCL), the agency develops a new list of UCMR contaminants for monitoring. SDWA calls for the EPA to:

- Issue a list of unregulated contaminants to be monitored by certain public water system (PWS) types[1] every five years
- Require large PWSs (*i.e.*, those that serve more than 10,000 people) to monitor their water for the contaminants
- Require a nationally representative sample of small PWSs serving 10,000 or fewer people to monitor[2]
- Make analytical results available in a National Contaminant Occurrence Database (NCOD) for drinking water

UCMR 4 required monitoring between 2018 and 2020 for the 30 chemical contaminants listed in Table 1. UCMR 4 contaminants were monitored under the UCMR Assessment Monitoring (AM) design. However, certain contaminant groups (*e.g.*, cyanotoxins, haloacetic acids [HAAs]) had different monitoring requirements (*e.g.*, applicable PWSs, timeframe and frequency, sample locations). For more information, refer to the EPA's UCMR 4 website. Contaminant health effects information that was available at the time of UCMR 4 monitoring is provided in Table 2. The health information presented may no longer be current or publicly available from the original reference. Summary details for contaminant occurrence are shown in Table 3 and represent the final release of UCMR 4 analytical results. Before conducting your own assessment of the data, please review the Data Considerations section**.**

[1] UCMR 4 requirements applied to community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). They did not apply to transient non-community water systems (TNCWSs). The use of "PWS" throughout this document refers to participating CWSs and NTNCWSs. For more information on PWS types, visit the agency's website.

[2] SDWA, as amended by Section 2021 of America's Water Infrastructure Act of 2018, calls for the EPA to require small PWSs serving between 3,300 and 10,000 people to monitor for UCMR contaminants, subject to the availability of EPA appropriations and sufficient laboratory capacity, and to require a nationally representative sample of small PWSs serving fewer than 3,300 people to monitor. This expansion in small PWS monitoring applies to the fifth UCMR (UCMR 5) and subsequent monitoring cycles.

Table 1. Contaminants and Methods

Contaminant[1]	CASRN[2]	EPA Method	Contaminant Classification
germanium	7440-56-4	200.8	Metal
manganese	7439-96-5	200.8	Metal
alpha-hexachlorocyclohexane	319-84-6	525.3	Pesticide
chlorpyrifos	2921-88-2	525.3	Pesticide
dimethipin	55290-64-7	525.3	Pesticide
ethoprop	13194-48-4	525.3	Pesticide
oxyfluorfen	42874-03-3	525.3	Pesticide
profenofos	41198-08-7	525.3	Pesticide
tebuconazole	107534-96-3	525.3	Pesticide
total permethrin (cis- & trans-)	52645-53-1	525.3	Pesticide
tribufos	78-48-8	525.3	Pesticide
butylated hydroxyanisole	25013-16-5	530	Consumer products; industrial chemical
o-toluidine	95-53-4	530	Chemical intermediate
quinoline	91-22-5	530	Chemical intermediate
1-butanol	71-36-3	541	Consumer products; industrial chemical
2-methoxyethanol	109-86-4	541	Solvent
allyl alcohol (2-propen-1-ol)	107-18-6	541	Pesticide
microcystin-LA	96180-79-9	544[3]	Cyanotoxin[4]
microcystin-LF	154037-70-4	544	Cyanotoxin
microcystin-LR	101043-37-2	544	Cyanotoxin
microcystin-LY	123304-10-9	544	Cyanotoxin
microcystin-RR	111755-37-4	544	Cyanotoxin
microcystin-YR	101064-48-6	544	Cyanotoxin
nodularin-R	118399-22-7	544	Cyanotoxin
anatoxin-a	64285-06-9	545	Cyanotoxin
cylindrospermopsin	143545-90-8	545	Cyanotoxin
total microcystins	NA	546	Cyanotoxin
HAA5 (five regulated haloacetic acids)	NA	552.3, 557	Disinfection byproducts[5]
HAA6Br (six brominated haloacetic acids)	NA	552.3, 557	Disinfection byproducts
HAA9 (nine haloacetic acids)	NA	552.3, 557	Disinfection byproducts

[1] UCMR 4 contaminants were monitored under the UCMR Assessment Monitoring (AM) design. For more information, refer to the EPA's UCMR 4 website.

[2] CASRN – Chemical Abstracts Service Registry Number, NA – Not Available

[3] EPA Method 544 samples for the six microcystin congeners and nodularin-R were only analyzed if the EPA Method 546 total microcystins result was ≥0.3 µg/L. See FAQ for more information.

[4] UCMR 4 cyanotoxin monitoring applied only to PWSs using surface water or ground water under the direct influence of surface water; PWSs using ground water were excluded from cyanotoxin monitoring.

[5] UCMR 4 haloacetic acid (HAA) monitoring applied only to PWSs that were subject to Disinfectants and Disinfection Byproducts Rules (D/DBPRs) HAA5 monitoring requirements.

Information About UCMR 4 Results

The purpose of this document is to (1) summarize UCMR 4 results and (2) provide context around UCMR 4 results in relation to EPA-established UCMR minimum reporting levels (MRLs) and, if available, reference concentrations in drinking water.

The UCMR 4 MRLs are the lowest concentrations that laboratories were permitted to report to the EPA during UCMR 4 monitoring. UCMR MRLs are determined using data from multiple laboratories that participate in the EPA's MRL-setting studies and are not associated with contaminant health effects information. The EPA establishes UCMR MRLs to ensure consistency in the quality of the information reported to the agency.

Depending on the available health and toxicological information for a UCMR 4 contaminant, a reference concentration in drinking water may have been available. The reference concentrations identified in this document do not represent regulatory limits or action levels and should not be interpreted as an indication of future agency actions. Some UCMR 4 contaminants had reference concentrations associated with short-term exposure. Therefore, large PWSs may have requested results for these contaminants early (*i.e.*, before their laboratory posted the results to the UCMR web-based reporting system) so they could inform consumers in a timely manner. The EPA managed the laboratory analysis for small PWSs and communicated results in a timely manner.

Community water systems (CWSs) required to monitor under UCMR must inform their customers of UCMR results (including the average and range of results) in their annual Consumer Confidence Report (CCR). See 40 CFR 141.153(d)(7) for the CCR regulatory requirements and Section IV of the EPA's guidance Preparing Your Drinking Water Consumer Confidence Report for details on the content of the report. Additional resources are available on the EPA's CCR Compliance Help webpage.

Non-transient non-community water systems (NTNCWSs) (*e.g.*, a school that operates its own drinking water system) and CWSs required to monitor under UCMR must inform their customers of the availability of UCMR results through Tier 3 Public Notification (PN). See 40 CFR 141.207 for the PN regulatory requirements and the EPA's PN Compliance Help webpage for guidance.

UCMR occurrence data are used to inform the agency's Regulatory Determination process (*i.e.*, the process that addresses potential regulatory actions for unregulated contaminants). State and local officials may also use the UCMR data to assess the need for actions to protect public health. States may establish requirements or levels (regulatory or non-regulatory) for drinking water contaminants not yet regulated by the EPA. PWSs are responsible for being aware of and complying with their state's requirements, if any.

Reference Concentrations

Table 2 provides reference concentrations for each contaminant monitored under UCMR 4, if available at the time of monitoring (2018–2020). **Information cited was current as of January 2022** with the publication of the final dataset. Thus, the health information may no longer be current or publicly available from the original reference. Many of the references are hyperlinked to where the most recent information can be found.

To identify reference concentrations, the EPA applied the following principles:

(1) Reference concentrations were based on the following publicly available resources:
   a. 2018 Edition of the Drinking Water Standards and Health Advisories Tables,
   b. CCL 4 Contaminant Information Sheets, and
   c. 2017 Human Health Benchmarks for Pesticides (HHBPs)

   The above resources are the products (or compilation) of peer-reviewed health assessments. The reference concentrations are subject to change as new health assessments are completed; they are not legally enforceable federal standards.

(2) If health information was available from more than one of the resources listed above, the most recent health information was used.

(3) If both cancer and non-cancer reference concentrations were available from the most recent resource, the lower (more conservative) of the two concentrations was used, except for oxyfluorfen, a "Group C" possible human carcinogen (per 1986 Cancer Guidelines). As noted in the Regulatory Determination protocol, regulatory decision making for Group C chemicals typically considers the non-cancer health value. Please review the references and footnotes in Table 2 for additional health effects information.

(4) If non-cancer health effects were the basis for the reference concentration, and both chronic and short-term exposure values were available from the most recent resource, the lower concentration (associated with the chronic exposure) was used. In those cases where the chronic and short-term exposure values were the same, both are noted in the table. Please review the references and footnotes in Table 2 for additional health effects information (*e.g.*, additional short-term, subchronic, or chronic values).

(5) For chemicals with reference concentrations based on a cancer endpoint, the table presents a range of concentrations associated with risks of 10^{-6} (1 in 1,000,000) to 10^{-4} (1 in 10,000) over a lifetime.

(6) For chemicals with reference concentrations based on a non-cancer endpoint, the exposure duration (short-term, intermediate/long-term, chronic) associated with the toxic effect is shown.

Please review the references and footnotes in Table 2 for additional health effects information. Recognizing that additional health effects information will become available over time, those attempting to assess UCMR occurrence data are encouraged to visit the EPA's Non-Regulatory Health-Based Drinking Water Levels webpage for the most recent information

Table 2. UCMR Minimum Reporting Levels (MRLs) and Reference Concentrations at the Time of Monitoring (2018–2020)

Contaminant	UCMR MRL (µg/L)	Reference Concentration (µg/L)[1]	Reference Concentration based on a Cancer Endpoint (Y/N)[1]	EPA References[1]
germanium[2]	0.3	-	-	-
manganese[3]	0.4	300	N (chronic and short -term exposure [10-day infants])	2004 Health Advisory for Manganese
alpha-hexachlorocyclohexane[4,5]	0.01	0.006 to 0.6	Y	Contaminant Information Sheets for the Final CCL 4
chlorpyrifos[6]	0.03	2	N (chronic exposure)	2018 Edition of the Drinking Water Standards and Health Advisories Tables
dimethipin[7]	0.2	140	N (chronic exposure)	2017 Human Health Benchmarks for Pesticides (HHBPs)
ethoprop[5,8]	0.03	1.14 to 114	Y	2017 Human Health Benchmarks for Pesticides (HHBPs)
oxyfluorfen[9]	0.05	200	N (chronic exposure)	2017 Human Health Benchmarks for Pesticides (HHBPs)
profenofos[10]	0.3	0.3	N (chronic exposure)	2017 Human Health Benchmarks for Pesticides (HHBPs)
tebuconazole	0.2	190	N (chronic and short-term exposure [1-day children])	2017 Human Health Benchmarks for Pesticides (HHBPs)
total permethrin[5,11]	0.04	3.344 to 334.4	Y	2017 Human Health Benchmarks for Pesticides (HHBPs)

[1] The health information reflects what was available during UCMR 4 monitoring (2018–2020). Information cited was current as of January 2022 with the publication of the final dataset. Thus, the health information may no longer be current or publicly available from the original reference. Many of the references are hyperlinked to where the most recent information can be found.

[2] The CCL 4 Contaminant Information Sheets provide a reference concentration for this contaminant, but it is based on a single study. Therefore, no reference concentration is provided for UCMR 4.

[3] Manganese also has a non-mandatory secondary drinking water standard based on aesthetic factors (taste and color) and staining (plumbing fixtures and laundry).

[4] 10^{-6} cancer risk < MRL < 10^{-4} cancer risk. The MRL was established based on the capability of the analytical method at the time of monitoring (2018–2020).

[5] Reference concentration range based on cancer risk of 10^{-6} to 10^{-4}.

[6] The 2006 Office of Pesticide Programs (OPP) Reregistration Eligibility Decision is the basis for the Health Advisory. Additional OPP health effects information is available for chlorpyrifos.

[7] Dimethipin does not have any actively registered pesticide products and is not scheduled for review under the registration review program, per the agency's 2015 Federal Register Notice; dimethipin is no longer a registered pesticide under the EPA's program.

[8] Additional OPP health effects information is available for ethoprop.

[9] Since oxyfluorfen is classified as Group C (possible human carcinogen), and not as Group A (human carcinogen) or Group B (probable human carcinogen), the reference concentration is based on the non-cancer value.

[10] Profenofos is undergoing voluntary cancellation; see the agency's 2017 Federal Register Notice for the cancellation order and the final decision/case closure. Additional OPP health effects information is available for profenofos.

[11] Additional OPP health effects information is available for total permethrin.

Contaminant	UCMR MRL (µg/L)	Reference Concentration (µg/L)[1]	Reference Concentration based on a Cancer Endpoint (Y/N)[1]	EPA References[1]
tribufos[12]	0.07	0.6	N (chronic exposure)	2017 Human Health Benchmarks for Pesticides (HHBPs)
butylated hydroxyanisole[2]	0.03	-	-	-
o-toluidine[2,13]	0.007	-	-	-
quinoline[4,5]	0.02	0.01 to 1	Y	Contaminant Information Sheets for the Final CCL 4
1-butanol	2.0	700	N (chronic exposure)	Contaminant Information Sheets for the Final CCL 4
2-methoxyethanol[2,13]	0.4	-	-	-
2-propen-1-ol[13]	0.5	35	N (chronic exposure)	Contaminant Information Sheets for the Final CCL 4
microcystin-LA[14]	0.008	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins
microcystin-LF[14]	0.006	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins
microcystin-LR[14]	0.02	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins
microcystin-LY[14]	0.009	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins
microcystin-RR[14]	0.006	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins
microcystin-YR[14]	0.02	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins
nodularin-R[14]	0.005	-	-	-
anatoxin-a[14,15]	0.03	-	-	-
cylindrospermopsin[14]	0.09	0.7 (bottle-fed infants and young children); 3 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins

[12] Additional OPP health effects information is available for tribufos.

[13] The EPA's Provisional Peer-Reviewed Toxicity Values (PPRTVs) assessment includes health effects information for this contaminant that is more recent than that used in the development of the CCL 4 Contaminant Information Sheets.

[14] The EPA's Cyanotoxins in Drinking Water website includes "Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water" and additional resources.

[15] The Health Effects Support Document for the Cyanobacterial Toxin Anatoxin-A concluded that the data from the oral toxicity studies evaluated contained too few dose levels and study endpoints to derive a reference dose.

Contaminant	UCMR MRL (µg/L)	Reference Concentration (µg/L)[1]	Reference Concentration based on a Cancer Endpoint (Y/N)[1]	EPA References[1]
total microcystins[14, 16]	0.3	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N (short-term exposure [10-day])	2015 Drinking Water Health Advisory Documents for Cyanobacterial Toxins
HAA5[17]	-	60	Y/N (chronic exposure)	The MCL for the National Primary Drinking Water Regulation
HAA6Br[18]	-	-	-	-
HAA9[19]	-	-	-	-

[16] The term "total microcystins" is used in UCMR 4 to represent the results of EPA Method 546. The method uses enzyme-linked immunosorbent assay (ELISA) to detect the Adda amino acid side chain, which is common to microcystin and nodularin congeners.
[17] Since HAA5 is regulated, the EPA is using a different authority (Section 1445(a)(1)(A) of SDWA) as the basis for UCMR 4 monitoring. The MCL was based on a consideration of cancer and non-cancer effects. HAA5 = Dibromoacetic Acid, Dichloroacetic Acid, Monobromoacetic Acid, Monochloroacetic Acid, and Trichloroacetic Acid.
[18] HAA6Br = Bromochloroacetic Acid, Bromodichloroacetic Acid, Dibromoacetic Acid, Dibromochloroacetic Acid, Monobromoacetic Acid, and Tribromoacetic Acid.
[19] HAA9 = Bromochloroacetic Acid, Bromodichloroacetic Acid, Chlorodibromoacetic Acid, Dibromoacetic Acid, Dichloroacetic Acid, Monobromoacetic Acid, Monochloroacetic Acid, Tribromoacetic Acid, and Trichloroacetic Acid.

Terms and Definitions

a) **UCMR MRL** – EPA-established UCMR Minimum Reporting Level. The lowest concentration that laboratories may report to the EPA during UCMR 4 monitoring. MRLs are not associated with health effects information. More specifically, an MRL is the quantitation limit for a contaminant that is considered achievable, with 95% confidence, by at least 75% of laboratories nationwide using a specified analytical method (recognizing that individual laboratories may be able to measure at lower levels). **[Note: The Agency for Toxic Substances and Disease Registry (ATSDR) uses the term "MRL" for a different purpose (*i.e.*, to describe "Minimal Risk Level"). The UCMR term and the ATSDR term have no relationship to each other.]**

b) **Ref Conc** – Reference Concentration. Based on publicly available health information found in the following EPA resources: 2018 Edition of the Drinking Water Standards and Health Advisories Tables [*i.e.*, Health Advisories (HA)], the CCL 4 Contaminant Information Sheets [*i.e.*, Health Reference Levels (HRLs)], and the 2017 Human Health Benchmarks for Pesticides (*i.e.*, HHBPs). These reference concentrations are derived from peer-reviewed health assessments published by the EPA or other governmental agencies. They are not legally enforceable federal standards and are subject to change as new health assessments are completed. Depending on available health effects information, a reference concentration in drinking water can be derived from a reference dose (*i.e.*, a non-cancer endpoint) or a cancer slope factor (CSF) (*i.e.*, a cancer endpoint), and considers additional assumptions about body weight and drinking water intake.

c) **HA** – Health Advisory. Provides information on a contaminant that can cause negative human health effects and is known or anticipated to occur in drinking water. SDWA authorizes the EPA to issue HAs for contaminants that are not subject to a National Primary Drinking Water Regulation (NPDWR). The EPA's HAs are non-enforceable and non-regulatory and provide technical information to state agencies and other public health officials on health effects, analytical methods, and treatment technologies associated with drinking water contaminants. The HA documents include the derivation of the HA levels, which are the concentrations of contaminants at or below which adverse health effects are not anticipated to occur over specific exposure durations, such as one day, 10 days, or a lifetime. The lifetime HA for the drinking water contaminant is calculated from its associated Drinking Water Equivalent Level (DWEL), obtained from its reference dose, and incorporates a drinking water Relative Source Contribution (RSC) factor of contaminant-specific data or a default of 20% of total exposure from all sources.

d) **HRL** – Health Reference Level. Derived during the Contaminant Candidate List (CCL) process for screening purposes. HRLs are used in the EPA's Regulatory Determination process as risk-derived concentrations against which to evaluate occurrence data to determine if contaminants occur at levels of public health concern. HRLs are not final determinations about the level of a contaminant in drinking water that is necessary to protect any particular population and, in some cases, are derived prior to development of a complete exposure assessment using the best available data. HRLs are not legally enforceable federal standards. To determine the HRL for a chemical, the agency considers adverse health effects that may pose a greater risk to specific lifestages and other sensitive groups which represent a meaningful portion of the population.

e) **HHBP** – Human Health Benchmarks for Pesticides. The EPA has developed HHBPs for informational purposes for use by states, PWSs, and the public to assist with risk management decisions and to prioritize monitoring efforts for pesticides that have no drinking water standards or Health Advisories. All benchmarks for the contaminants on UCMR 4 were calculated with updated exposure assumptions [body weight (80 kg) and drinking water intake (2.5 L/day)]. The HHBPs are not legally enforceable federal standards.

f) **MCL** – Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

g) **Cancer Risk of 10^{-6} to 10^{-4} (chronic exposure)** – The concentration of a contaminant in drinking water corresponding to an excess estimated lifetime cancer risk of one-in-a-million (1×10^{-6}) to one-in-ten thousand (1×10^{-4}). The 2018 Edition of the Drinking Water Standards and Health Advisories Tables provide the cancer risk at 1×10^{-4}. The CCL 4 Contaminant Information Sheets provide the cancer risk at 1×10^{-6}. The Human Health Benchmarks for Pesticides provide a risk range (10^{-6} to 10^{-4}). Cancer risk is derived using drinking water exposure assumptions, risk level, and a cancer slope factor (CSF), a toxicity value for evaluating the probability of an individual developing cancer from exposure to a certain level of a contaminant over a lifetime. Generally, when evaluating risk for health endpoints associated with chronic exposures,

averages from multiple measurements (potentially spanning a period of time) are more representative of a lifetime risk than results from a single measurement.

h) **Non-cancer (short-term exposure)** – Based on a reference dose, which is a non-cancer estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects after short-term exposure. Short-term exposure typically refers to animal toxicological studies with an exposure duration of days to weeks. One-day is protective for up to 1 day of exposure and is typically based on an animal study with a duration of 7 days or less. Ten-day is protective for up to 10 days of exposure and is typically based on an animal study with a duration of 7 to 30 days. Generally, when evaluating risk for health endpoints associated with short-term exposures, a single detection is more relevant.

i) **Non-cancer (chronic exposure)** – Based on a reference dose, which is a non-cancer estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects after long-term exposure. Chronic exposure typically refers to animal toxicological studies with an exposure duration of months to years, representing a lifetime exposure in humans. Generally, when evaluating risk for health endpoints associated with chronic exposures, averages from multiple measurements (potentially spanning a period of time) are more representative of a lifetime risk than results from a single measurement.

Table 3. UCMR 4 Data Summary[1]

Contaminant	UCMR MRL[2] (µg/L)	Ref Conc[3] (µg/L)	Total number of results[4]	Number of results ≥MRL	Number of results >Ref Conc	% of total results >Ref Conc	Total number of PWSs with results[4]	Number of PWSs with results ≥MRL	Number of PWSs with results >Ref Conc	% of PWSs with results >Ref Conc
germanium	0.3	-	37,965	2,671	-	-	5,034	654	-	-
manganese	0.4	300	37,963	26,334	198	0.5%	5,034	4,527	106	2.1%
alpha-hexachlorocyclohexane	0.01	0.006 / 0.6[5]	37,287	25	25 / 0[6]	0.07% / 0%[6]	5,028	25	25 / 0[6]	0.5% / 0%[6]
chlorpyrifos	0.03	2	37,291	2	0	0%	5,028	2	0	0%
dimethipin	0.2	140	37,286	5	0	0%	5,028	5	0	0%
ethoprop	0.03	1.14 / 1145[5]	37,276	5	0 / 0[6]	0% / 0%[6]	5,028	5	0 / 0[6]	0% / 0%[6]
oxyfluorfen	0.05	200	37,286	7	0	0%	5,028	7	0	0%
profenofos	0.3	0.3	37,287	4	4	0.01%	5,028	4	4	0.08%
tebuconazole	0.2	190	37,286	3	0	0%	5,028	3	0	0%
total permethrin	0.04	3.344 / 334.45[5]	37,291	16	0 / 0[6]	0% / 0%[6]	5,028	13	0 / 0[6]	0% / 0%[6]
tribufos	0.07	0.6	37,269	3	0	0%	5,027	3	0	0%
butylated hydroxyanisole	0.03	-	37,462	7	-	-	5,030	7	-	-
o-toluidine	0.007	-	37,517	117	-	-	5,030	86	-	-
quinoline	0.02	0.01 / 15[5]	37,466	116	116 / 1[6]	0.3% / 0.003%[6]	5,030	76	76 / 1[6]	1.5% / 0.02%[6]
1-butanol	2.0	700	37,564	308	0	0%	5,029	204	0	0%
2-methoxyethanol	0.4	-	37,567	82	-	-	5,029	65	-	-
2-propen-1-ol	0.5	35	37,567	36	0	0%	5,029	26	0	0%
microcystin-LA	0.008	0.3 / 1.6[7]	5[8]	1	0 / 0[6]	0% / 0%[6]	5[8]	1	0 / 0[6]	0% / 0%[6]
microcystin-LF	0.006	0.3 / 1.6[7]	5[8]	1	0 / 0[6]	0% / 0%[6]	5[8]	1	0 / 0[6]	0% / 0%[6]
microcystin-LR	0.02	0.3 / 1.6[7]	5[8]	1	0 / 0[6]	0% / 0%[6]	5[8]	1	0 / 0[6]	0% / 0%[6]
microcystin-LY	0.009	0.3 / 1.6[7]	5[8]	0	0 / 0[2]	0% / 0%[6]	5[8]	0	0 / 0[6]	0% / 0%[6]
microcystin-RR	0.006	0.3 / 1.6[7]	5[8]	1	0 / 0[2]	0% / 0%[6]	5[8]	1	0 / 0[6]	0% / 0%[6]
microcystin-YR	0.02	0.3 / 1.6[7]	5[8]	0	0 / 0[2]	0% / 0%[6]	5[8]	0	0 / 0[6]	0% / 0%[6]

[1] Analytical results from the UCMR program are reported by laboratories and provided by the agency in micrograms/liter (µg/L, or parts per billion). To convert results in µg/L to nanograms/liter (ng/L, or parts per trillion), multiply the value by 1,000. UCMR results are presented as single measurements and do not represent a locational running annual average (LRAA).

[2] UCMR MRL – EPA-established UCMR Minimum Reporting Level. Based on laboratory capability; not related to contaminant health effects information.

[3] Ref Conc – Reference Concentration. See Terms and Definitions.

[4] UCMR 4 contaminants were monitored under the UCMR Assessment Monitoring (AM) design. However, certain contaminant groups (*e.g.*, cyanotoxins, haloacetic acids [HAAs]) had different monitoring requirements (*e.g.*, applicable PWSs, timeframe and frequency, sample locations), affecting the number of results and the number of PWSs with results. For more information, refer to the EPA's UCMR 4 website.

[5] The first number is the reference concentration for 10^{-6} cancer risk; the second number is the reference concentration for 10^{-4} cancer risk.

[6] The first number is associated with the first reference concentration; the second number is associated with the second reference concentration.

[7] The first number is the reference concentration for bottle-fed infants and young children; the second number is the reference concentration for school-age children and adults.

[8] Samples for the microcystin congeners (*e.g.*, microcystin-LA) and nodularin-R are only analyzed if the total microcystins result is ≥0.3 µg/L; thus, there are very few results for the individual congeners and nodularin-R. See FAQ for more information.

Contaminant	UCMR MRL[2] (µg/L)	Ref Conc[3] (µg/L)	Total number of results[4]	Number of results ≥MRL	Number of results >Ref Conc	% of total results >Ref Conc	Total number of PWSs with results[4]	Number of PWSs with results ≥MRL	Number of PWSs with results >Ref Conc	% of PWSs with results >Ref Conc
nodularin-R	0.005	-	5[8]	0	-	-	5[8]	0	-	-
anatoxin-a	0.03	-	35,405	132	-	-	3,484	50	-	-
cylindrospermopsin	0.09	0.7 / 3[7]	35,425	13	1 / 0[6]	0.003% / 0%[6]	3,484	12	1 / 0[6]	0.03% / 0%[6]
total microcystins	0.3	0.3 / 1.6[7]	35,000	8	8 / 0[6]	0.02% / 0%[6]	3,485	7	7 / 0[6]	0.2% / 0%[6]
HAA5	NA	60	63,484	61,419[9]	1,330[10]	2.1%	4,924	4,834[9]	447[10]	9.1%
HAA6Br	NA	-	63,443	59,947[9]	-	-	4,924	4,771[9]	-	-
HAA9	NA	-	63,432	61,520[9]	-	-	4,924	4,840[9]	-	-

[9] The number of results or PWSs with at least one HAA in the group at or above its individual MRL.

[10] The HAA5 results for UCMR 4 are not reflective of the compliance status for a PWS per the Disinfectants and Disinfection Byproducts Rule (D/DBPR). HAA5 compliance for D/DBPR is based on an LRAA calculated at each monitoring location.

Data Considerations

The UCMR 4 analytical results are publicly available through the UCMR Archival Data Finder and as text files.

The UCMR Archival Data Finder allows people to easily search for, summarize, and download the UCMR 4 analytical results. Results can be filtered using multiple data fields, including public water system (PWS), PWS size, state, EPA Region, contaminant, source water type, and results at or above UCMR minimum reporting levels (MRLs) (data definitions provided in Table 4). Selected results can be viewed online or downloaded as a Microsoft Excel file (.xlsx). Additional resources for the UCMR Archival Data Finder are available here.

For those interested in large-scale data processing using statistical or data analysis software, the EPA recommends using the occurrence data text files containing the UCMR 4 analytical results as well as additional information reported during monitoring. Data are provided in tab delimited text files (.txt) (see below for descriptions), with field names included in the first row of each file and no text qualifier. The EPA recommends importing all ID fields into your choice of software (*e.g.*, Microsoft Excel, Microsoft Access) as text since some of the IDs can otherwise be misinterpreted as long integer field types when they contain alpha characters.

- To download the occurrence data text files (data definitions provided in Table 5), select one of the following zip (.zip) files from UCMR 4 (2018-2020) Occurrence Data:
    - **UCMR 4 Occurrence Data Text Files** to view all the analytical results (*i.e.*, results for all contaminants reported by all PWSs). The **UCMR4_All.txt** file may be too large to be imported into Excel, in which case you can try other applications (*e.g.*, Microsoft Access) or import a subset of the data as described below.
    - **UCMR 4 Occurrence Data Text Files by State** to view all the analytical results, organized by Tribes and states. Within that zip file, one text file (**UCMR4_All_Tribes_AK_LA.txt**) will have all results for Tribal PWSs and for the states starting alphabetically with A through L; another file (**UCMR4_All_MA_WY.txt**) will have all results for the states starting alphabetically with M through W. The results are organized this way to address file size limitations and streamline data management.
    - **UCMR 4 Occurrence Data Text Files by Method Classification** to view all the analytical results, organized by analytical method. Within that zip file, you will find individual text files with results organized by method (*e.g.*, a Method 200.8 file with results for germanium and manganese).
- The following text files for **additional data elements** and **indicators** (*i.e.*, information beyond analytical results for the 30 UCMR 4 contaminants) are also contained in each of the above zip files:
    - **UCMR4_ZIPCodes.txt** – U.S. Postal Service ZIP Code(s) for all areas served by a PWS (data definitions provided in Table 6)
    - **UCMR4_HAA_Indicators.txt** – Analytical results for total organic carbon and bromide (data definitions provided in Table 5)
    - **UCMR4_HAA_AddtlDataElem.txt** – Disinfectant Type, Disinfectant Residual, Treatment Information (data definitions provided in Table 7)
    - **UCMR4_Cyanotoxins_AddtlDataElem.txt** – Disinfectant Type, Treatment Information, Cyanotoxin Bloom Occurrence, Cyanotoxin Occurrence, Cyanotoxin Possible Bloom Treatment, Cyanotoxin Possible Bloom Source Water (data definitions provided in Table 8)

For step-by-step details on using the UCMR Archival Data Finder and occurrence data text files, please refer to the document Instructions for Accessing UCMR Results. Additional reference material is available on the EPA's UCMR 4 website.

Table 4. UCMR 4 Data Definitions for the UCMR Archival Data Finder

The data definitions below are specific to the UCMR 4 data. The UCMR Archival Data Finder also contains data from additional UCMR cycles, which may have different definitions for the provided fields. Please refer to the document Instructions for Accessing UCMR Results for data definitions specific to each cycle.

Field Name	Definition
UCMR Cycle	UCMR cycle and monitoring years. Results may have sample collection dates outside the designated UCMR sample collection timeframe (*e.g.*, resample collection): **UCMR 4 (2018–2020)**
PWS ID	Public Water System (PWS) Identification Code. The code used to identify each PWS. The code begins with the standard 2-character postal state abbreviation or Region code for Tribes; the remaining 7 numbers are unique to each PWS in the state. Utah PWS IDs begin with 4 letters (UTAH) followed by 5 numbers
PWS Name	Name of the PWS
Contaminant	The UCMR 4 contaminant analyzed
Result	Numeric value of the analytical result in µg/L for the contaminant. Results less than the UCMR MRL are indicated by **<MRL**
Units	Units of the UCMR MRL and analytical results: **µg/L** (micrograms per liter)
Collection Date	Date of sample collection (month, day, year)
Facility ID	Identification code (5-digit number) for each applicable facility associated with water treatment or delivery at the PWS
Facility Name	Name of the facility at the PWS
Sample Point ID	Identification code for each sample point location at the PWS
Sample Point Name	Name of the sample point at the PWS
Sample Event Code	Identification code for each sample event**:** **SE1**, **SE2**, **SE3**, **SE4** for all contaminants, where "SE1" and "SE2" represent the first and second sample event for all water types and "SE3" and "SE4" represent the third and fourth sample event for SW and GU sources only; **SE5**, **SE6**, **SE7**, **SE8** for cyanotoxins (SW and GU sources only)
Sample ID	Identification code for each sample
Method ID	Identification code of the analytical method
PWS Size	Size category of the PWS for UCMR 4, based on retail population as indicated by the Safe Drinking Water Information System (Federal) (SDWIS/FED) as of December 31, 2015: **S** (≤ 10,000), **L** (> 10,000)
Facility Water Type	Source of water at the facility: **SW** (surface water), **GW** (ground water), **GU** (ground water under the direct influence of surface water), **MX** (any combination of SW, GW, and GU)
Sample Point Type	Sampling Point Type Code: **EP** (entry point to the distribution system), **DS** (distribution system)
EPA Region	EPA Region (states): **Region 1** (CT, ME, MA, NH, RI, VT), **Region 2** (NJ, NY, PR [Puerto Rico], VI [Virgin Islands]), **Region 3** (DE, DC, MD, PA, VA, WV), **Region 4** (AL, FL, GA, KY, MS, NC, SC, TN), **Region 5** (IL, IN, MI, MN, OH, WI), **Region 6** (AR, LA, NM, OK, TX), **Region 7** (IA, KS, MO, NE), **Region 8** (CO, MT, ND, SD, UT, WY), **Region 9** (AZ, CA, HI, NV, AS [American Samoa], GU [Guam], MP [Northern Marianas Islands], NN [Navajo Nation]), **Region 10** (AK, ID, OR, WA)
State	State abbreviation. Tribal PWSs without primacy are attributed to an EPA Region (01, 02, 04, 05, 06, 08, 09, 10)
Associated Facility ID	Null for UCMR 4
Associated Sample Point ID	Null for UCMR 4
Monitoring Requirement	**AM** (Assessment Monitoring)
Minimum Reporting Level (MRL)	Minimum Reporting Level defined by UCMR 4 in µg/L for the contaminant. Based on laboratory capability; not related to contaminant health effects information (see Terms and Definitions). UCMR MRLs are not provided for the three HAA groups
UCMR1 Sample Type	Null for UCMR 4
CASRN	Chemical Abstracts Service Registry Number (CASRN) is a unique identifier assigned by the Chemical Abstracts Service (a division of the American Chemical Society) to every chemical substance (organic and inorganic compounds, polymers elements, nuclear particles, etc.) in the open scientific literature. It contains up to 10 digits, separated by hyphens into three parts

Field Name	Definition
DTXSID	Distributed Structure-Searchable Toxicity Substance Identifier (DTXSID) is a unique substance identifier used in the EPA's CompTox Chemicals database, where a substance can be any single chemical, mixture, or polymer

Table 5. Data Definitions for Text Files: UCMR4_All, UCMR4_All_Tribes_AK_LA, UCMR4_All_MA_WY, UCMR4_*MethodNumber*, and UCMR4_HAA_Indicators

Field Name	Definition
PWSID	Public Water System (PWS) Identification Code. The code used to identify each PWS. The code begins with the standard 2-character postal state abbreviation or Region code for Tribes; the remaining 7 numbers are unique to each PWS in the state. Utah PWS IDs begin with 4 letters (UTAH) followed by 5 numbers
PWSName	Name of the PWS
Size	Size category of the PWS for UCMR 4, based on retail population as indicated by the Safe Drinking Water Information System (Federal) (SDWIS/FED) as of December 31, 2015: **S** (≤ 10,000), **L** (> 10,000)
FacilityID	Identification code (5-digit number) for each applicable facility associated with water treatment or delivery at the PWS
FacilityName	Name of the facility at the PWS
FacilityWaterType	Source of water at the facility: **SW** (surface water), **GW** (ground water), **GU** (ground water under the direct influence of surface water), **MX** (any combination of SW, GW, and GU)
SamplePointID	Identification code for each sample point location at the PWS
SamplePointName	Name of the sample point at the PWS
SamplePointType	Sampling Point Type Code: **EP** (entry point to the distribution system), **DS** (distribution system); *for HAA_Indicators.txt only*: **SR** (source water – untreated water)
AssociatedFacilityID	Null for UCMR 4
AssociatedSamplePointID	Null for UCMR 4
CollectionDate	Date of sample collection (month, day, year)
SampleID	Identification code for each sample
Contaminant	The UCMR 4 contaminant analyzed
MRL	Minimum Reporting Level (MRL) defined by UCMR 4 in µg/L for the contaminant. Based on laboratory capability; not related to contaminant health effects information (see Terms and Definitions). UCMR MRLs are not provided for the three HAA groups
Units	Units of the UCMR MRL and analytical results: **µg/L** (micrograms per liter)
MethodID	Identification code of the analytical method
AnalyticalResultsSign	Sign indicating whether the analytical result is less than (**<**) the UCMR MRL or equal to (**=**) a numeric value at or above the UCMR MRL
AnalyticalResultValue	Numeric value of the analytical result in µg/L for the contaminant. Null (or blank) values represent results less than the UCMR MRL
SampleEventCode	Identification code for each sample event: **SE1**, **SE2**, **SE3**, **SE4** for all contaminants, where "SE1" and "SE2" represent the first and second sample event for all water types and "SE3" and "SE4" represent the third and fourth sample event for SW and GU sources only; **SE5**, **SE6**, **SE7**, **SE8** for cyanotoxins (SW and GU sources only)
MonitoringRequirement	**AM** (Assessment Monitoring)
Region	EPA Region (states): **1** (CT, ME, MA, NH, RI, VT), **2** (NJ, NY, PR [Puerto Rico], VI [Virgin Islands]), **3** (DE, DC, MD, PA, VA, WV), **4** (AL, FL, GA, KY, MS, NC, SC, TN), **5** (IL, IN, MI, MN, OH, WI), **6** (AR, LA, NM, OK, TX), **7** (IA, KS, MO, NE), **8** (CO, MT, ND, SD, UT, WY), **9** (AZ, CA, HI, NV, AS [American Samoa], GU [Guam], MP [Northern Marianas Islands], NN [Navajo Nation]), **10** (AK, ID, OR, WA)
State	State abbreviation. Tribal PWSs without primacy are attributed to an EPA Region (01, 02, 04, 05, 06, 08, 09, 10)
UCMR1SampleType	Null for UCMR 4

Table 6. Data Definitions for Text File: UCMR4_ZIPCodes

Field Name	Definition
ZIPCODE	U.S. Postal Service ZIP Code(s) for all areas served by a PWS. This is entered by the PWS

Table 7. Data Definitions for Text File: UCMR4_HAA_AddtlDataElem

Additional Data Element	Definition and Response Options
DisinfectantType	All of the disinfectants/oxidants that have been added prior to the entry point to the distribution system. Please select ALL that apply. **PEMB** = permanganate, **HPXB** = hydrogen peroxide, **CLGA** = gaseous chlorine, **CLOF** = offsite generated hypochlorite (stored as a liquid form), **CLON** = onsite generated hypochlorite, **CAGC** = chloramine (formed with gaseous chlorine), **CAOF** = chloramine (formed with offsite hypochlorite), **CAON** = chloramine (formed with onsite hypochlorite), **CLDB** = chlorine dioxide, **OZON** = ozone, **ULVL** = ultraviolet light, **OTHD** = other types of disinfectant/oxidant, **NODU** = no disinfectant/oxidant used
DisinfectantResidual	Disinfectant residual type in the distribution system for each HAA sample. **CL2** = chlorine (*i.e.*, originating from addition of free chlorine only), **CLO2** = chlorine dioxide, **CLM** = chloramines (originating from the addition of chlorine and ammonia or pre-formed chloramines), **CAC** = chlorine and chloramines (if being mixed from chlorinated and chloraminated water), **NOD** = no disinfectant residual
TreatmentInformation	Treatment information associated with the sample point. Please select ALL that apply. **CON** = conventional (non-softening, consisting of at least coagulation/sedimentation basins and filtration), **INF** = in-line filtration, **DFL** = direct filtration, **SFN** = softening, **SSF** = slow sand filtration, **GAC** = granular activated carbon adsorption (not part of filters in CON, SFN, INF, DFL, or SSF), **POB** = pre-oxidation with chlorine (applied before coagulation for CON or SFN plants or before filtration for other filtration plants), **RBF** = river bank filtration, **PSD** = pre-sedimentation, **BIO** = biological filtration (operated with an intention of maintaining biological activity within filter), **UTR** = unfiltered treatment for surface water source, **GWD** = ground water system with disinfection only, **PAC** = application of powder activated carbon, **AIR** = air stripping (packed towers, diffused gas contactors), **MFL** = membrane filtration, **IEX** = ionic exchange, **DAF** = dissolved air floatation, **CWL** = clear well/finished water storage without aeration, **CWA** = clear well/finished water storage with aeration, **ADS** = aeration in distribution system (localized treatment), **OTH** = other types of treatment, **NTU** = no treatment used, **DKN** = do not know

Table 8. Data Definitions for Text File: UCMR4_Cyanotoxins_AddtlDataElem

Additional Data Element	Definition and Response Options
CyanotoxinBloomOccurrence	A yes or no answer provided by the PWS for each cyanotoxin sample event. Question: Preceding the finished water sample collection, did you observe an algal bloom in your source waters near the intake? **YES** = if yes, select ALL that apply (see **CyanotoxinBloomOccurrenceDetail**); **NO** = have never seen a bloom; **DK** = do not know; **NA** = purchased consecutive connection (no source water)
CyanotoxinBloomOccurrenceDetail	If yes, select ALL that apply: **YD** = yes, on the day the UCMR cyanotoxin sample was collected, **YW** = yes, between the day the sample was taken and the past week, **YM** = yes, between the past week and past month, **YY** = yes, between the past month and past 12 months, **YP** = yes, more than a year ago
CyanotoxinOccurrence	A yes or no answer provided by the PWS for each cyanotoxin sample event. Question: Preceding the finished water sample collection, were cyanotoxins ever detected in your source waters near the intake and prior to any treatment (based on sampling by you or another party)? **YES** = if yes, select ALL that apply (see **CyanotoxinOccurrenceDetail**); **NO** = have never detected cyanotoxins in source water; **NS** = unaware of any source water cyanotoxin sampling

Additional Data Element	Definition and Response Options
CyanotoxinOccurrenceDetail	If yes, select ALL that apply: **YD** = yes, on the day the UCMR cyanotoxin sample was collected, **YW** = yes, between the day the sample was taken and the past week, **YM** = yes, between the past week and past month, **YY** = yes, between the past month and past 12 months, **YP** = yes, more than a year ago Select ALL that apply (*i.e.*, all that were detected) if you answered YES to detecting cyanotoxins in source water: **MIC** = microcystins, **CYL** = cylindrospermopsin, **ANA** = anatoxin-a, **SAX** = saxitoxins, **OTH** = other (see field name "IfOtherText" for details), **DK** = do not know
CyanotoxinPossibleBloomTreatment	A yes or no answer provided by the PWS for each cyanotoxin sample event. Question: Preceding the finished water sample collection, did you notice any changes in your treatment system operation and/or treated water quality that may indicate a bloom in the source water? **YES =** if yes, select ALL that apply (see **CyanotoxinPossibleBloomTreatmentDetail**); **NO** = no changes observed; **DK** = do not know
CyanotoxinPossibleBloomTreatmentDetail	If yes, select ALL that apply: **DFR** = decrease in filter runtimes, **ITF** = increase in turbidity in filtered water, **ICD** = need for increased coagulant dose, **TOI** = increase in taste and odor issues in finished water, **IOD** = need for increase in oxidant/disinfectant dose, **IDB** = increase in TTHM/HAA5 in finished water, **OTH** = describe other changes (see field name "IfOtherText" for details)
CyanotoxinPossibleBloomSourceWater	A yes or no answer provided by the PWS for each cyanotoxin sample event. Question: Preceding the finished water sample collection, did you observe any notable changes in source water quality parameters (if measured)? **YES =** if yes, select ALL that apply to the source water (see **CyanotoxinPossibleBloomSourceWaterDetail**); **NO** = no changes observed; **DK** = do not know
CyanotoxinPossibleBloomSourceWaterDetail	If yes, select ALL that apply to the source water: **ITP** = increase in water temperature, **ITU** = increase in turbidity, **IAL** = increase in alkalinity, **ITO** = increase in total organic carbon, **ICD** = increase in chlorine demand, **IPH** = increase in pH and/or **DPH =** decrease in pH, **ICA** = increase in chlorophyll a, **IPY** = increase in phycocyanin, **INU** = increase in nutrients (example: nitrogen or phosphorus), **OTH** = describe other changes (see field name "IfOtherText" for details)