United States Environmental Protection Agency

Reference Concentrations for the Fourth Unregulated Contaminant Monitoring Rule (UCMR 4)

Background

EPA uses the Unregulated Contaminant Monitoring Rule (UCMR) program to collect nationally representative data for contaminants suspected to be present in drinking water, but that do not have regulatory standards. UCMR 4 requires monitoring for 30 chemicals between 2018 and 2020. This monitoring is used by EPA to understand the frequency and level of occurrence of unregulated contaminants in the nation's public water systems (PWSs). Every five years EPA develops a new list of UCMR contaminants, largely based on the Contaminant Candidate List (CCL). The Safe Drinking Water Act (SDWA) requires EPA to:

- Manage monitoring for no more than 30 contaminants per 5-year cycle
- Collect data from large PWSs (i.e., those that serve more than 10,000 people)
- Collect data from a representative sample of small PWSs (i.e., those serving less than or equal to 10,000 people)
- Store analytical results in a National Contaminant Occurrence Database (NCOD)

State and local officials may also use UCMR data to assess the need for actions to protect public health. When evaluating UCMR data, State and local officials should consider the following limitations:

- UCMR monitoring generates a robust national data set that is representative of occurrence at a national level; it is not designed to be representative of occurrence at a State or local level.
- UCMR results are not available immediately after sample collection. EPA's regulations allow PWSs and the laboratories that support their monitoring up to six months to report results to EPA.
- There is limited information about health effects and treatment techniques to address a number of these unregulated contaminants.

Reference Concentrations

EPA has established UCMR 4 Minimum Reporting Levels (MRLs) based on the capability of the analytical method, not based on a level established as "significant" or "harmful." UCMR 4 results reported at or above those MRLs should be interpreted accordingly. The detection of a UCMR 4 contaminant does not represent cause for concern, in and of itself.

Reference concentrations are health-based and provide context for the detection of a UCMR contaminant. They do not represent regulatory values or action levels and should not be interpreted as an indication that the Agency intends to establish a future drinking water regulation. Decisions as to whether to regulate contaminants in drinking water will be made following the Agency's Regulatory Determination process. Visit EPA's Regulatory Determination website for more information.

Community water systems must inform their consumers of UCMR monitoring results (including the average and range of detections). See 40 CFR 141.153(d)(7) for Consumer Confidence Report (CCR) regulatory requirements and Section IV of EPA's guidance, *"Preparing Your Drinking Water Consumer Confidence Report"* for details on the contents of the report.

Non-transient, non-community water systems required to monitor for UCMR must inform their consumers of the availability of monitoring results. See 40 CFR 141.207 for Tier 3 Public Notice (PN) regulatory requirements and EPA's web page for PN guidance.

Some UCMR 4 contaminants have reference concentrations associated with short-term exposure. Therefore, large PWSs may want to request results for these contaminants early (i.e., before their laboratory posts the results to the UCMR web-based reporting system) so that these PWSs can inform their consumers in a timely manner. EPA manages the laboratory analysis for small PWSs and will work to communicate results in a timely manner.

States may establish requirements for drinking water contaminants not yet regulated by EPA, and those requirements may be based on State-established levels that differ from EPA's reference concentrations. PWSs are responsible for being aware of and complying with their State's requirements, if any.

UCMR 4 Reference Concentrations Table

The table below provides MRL and reference concentration information for each contaminant monitored under UCMR 4. When developing the table, EPA followed these principles:

(1) EPA based the reference concentrations on publicly-available health information found in the following EPA resources:
   a. 2018 Edition of Drinking Water Standards and Health Advisories Tables,
   b. CCL 4 Contaminant Information Sheets, and
   c. Human Health Benchmarks for Pesticides (HHBPs).

   The primary sources of the health information used to derive the reference concentrations in the resources referenced above are the products of peer reviewed assessments from EPA or other governmental agencies. 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 EPA resources listed above, the most recent health information was used for the reference concentrations.

(3) If both (chronic) cancer and non-cancer health endpoints were available from the most recent EPA source, 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 "EPA References" in the table below 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 EPA source, 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 "EPA References" in the table below for health effects information (e.g., additional short-term 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.

EPA will periodically update the following table as new information becomes available. For more health effects information visit: EPA's Drinking Water Contaminant Human Health Effects Information.

UCMR 4 Reference Concentrations

Contaminant	*MRL (µg/L)*	*Reference Concentration (µg/L)*	*Reference Concentration based on a Cancer Endpoint (Y/N)*	*EPA Reference(s)*
Germanium[1]	0.3	NA	-	-
Manganese[2]	0.4	300	N [chronic and short -term exposure (10-day infants)]	Health Advisory for Manganese
Alpha-hexachlorocyclohexane[3,4]	0.01	0.006 to 0.6	Y	CCL 4 Contaminant Information Sheets
Chlorpyrifos[5]	0.03	2	N (chronic exposure)	2018 Edition of the Drinking Water Standards and Health Advisories Tables
Dimethipin[6]	0.2	140	N (chronic exposure)	Human Health Benchmarks for Pesticides (HHBPs)
Ethoprop[4,7]	0.03	1.14 to 114	Y	Human Health Benchmarks for Pesticides (HHBPs)
Oxyfluorfen[8]	0.05	200	N (chronic exposure)	Human Health Benchmarks for Pesticides (HHBPs)

[1] The CCL 4 Contaminant Information Sheet provides a concentration for this contaminant, but it is based on a single study. Therefore, no reference concentration is provided for UCMR 4.
[2] Mn also has a non-mandatory secondary drinking water standard based on aesthetic factors (taste and color) and staining (plumbing fixtures and laundry).
[3] 10^{-6} cancer risk < MRL < 10^{-4} cancer risk. The MRL was established based on the capability of the analytical method.
[4] Reference concentration range based on cancer risk of 10^{-6} to 10^{-4}.
[5] The Office of Pesticide Programs (OPP) Reregistration Eligibility Decision, 2006 is the basis for the health advisory. Additional OPP health effects information and information on subsequent regulatory actions by the pesticides program is available for chlorpyrifos.
[6] Dimethipin does not currently have any actively registered pesticide products and is not scheduled for review under the registration review program, per the Agency's October 2015 Notice; dimethipin is no longer a registered pesticide under EPA's program.
[7] Additional OPP health effects information is available for ethoprop.
[8] 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.

Contaminant	*MRL (µg/L)*	*Reference Concentration (µg/L)*	*Reference Concentration based on a Cancer Endpoint (Y/N)*	*EPA Reference(s)*
Profenofos[9]	0.3	0.3	N (chronic exposure)	Human Health Benchmarks for Pesticides (HHBPs)
Tebuconazole	0.2	190	N [chronic and short-term exposure (1-day children)]	Human Health Benchmarks for Pesticides (HHBPs)
Total permethrin[4, 10]	0.04	3.344 to 334.4	Y	Human Health Benchmarks for Pesticides (HHBPs)
Tribufos[11]	0.07	0.6	N (chronic exposure)	Human Health Benchmarks for Pesticides (HHBPs)
Butylated hydroxyanisole[1]	0.03	NA	-	-
o-toluidine[1,12]	0.007	NA	-	-
Quinoline[3,4]	0.02	0.01 to 1	Y	CCL 4 Contaminant Information Sheets
1-butanol	2.0	700	N (chronic exposure)	CCL 4 Contaminant Information Sheets
2-methoxyethanol[1,12]	0.4	NA	-	-
2-propen-1-ol[12] (allyl alcohol)	0.5	35	N (chronic exposure)	CCL 4 Contaminant Information Sheets
"Total microcystins" [13,14]	0.3	0.3 (bottle-fed infants and young children); 1.6 (school-age children and adults)	N [Short-term exposure (10-day)]	Health Advisory and Supporting Documentation for Microcystins
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)]	Health Advisory and Supporting Documentation for Microcystins

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

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

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

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

[13] The term "Total microcystins" is used in UCMR 4 to represent the results of EPA Method 546. The method uses ELISA to detect the Adda amino acid side chain, which is common to microcystin and nodularin congeners.

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

Contaminant	*MRL (µg/L)*	*Reference Concentration (µg/L)*	*Reference Concentration based on a Cancer Endpoint (Y/N)*	*EPA Reference(s)*
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)]	Health Advisory and Supporting Documentation for Microcystins
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)]	Health Advisory and Supporting Documentation for Microcystins
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)]	Health Advisory and Supporting Documentation for Microcystins
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)]	Health Advisory and Supporting Documentation for Microcystins
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)]	Health Advisory and Supporting Documentation for Microcystins
Nodularin-R[14]	0.005	NA	-	-
Anatoxin-a[14,15]	0.03	NA	-	-
Cylindrospermopsin[14]	0.09	0.7 (bottle-fed infants and young children); 3 (school-age children and adults)	N [Short-term exposure (10-day)]	Health Advisory and Supporting Documentation for Cylindrospermopsin
HAA5[16]	-	60	Y/N (chronic exposure)	The MCL for the National Primary Drinking Water Regulation
HAA6Br[17]	-	NA	-	-
HAA9[18]	-	NA	-	-

[15] The Health Effects Support Document for 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 (RfD).

[16] Since HAA5 is regulated, 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.

[17] HAA6Br = Bromochloroacetic Acid, Bromodichloroacetic Acid, Dibromoacetic Acid, Dibromochloroacetic Acid, Monobromoacetic Acid, and Tribromoacetic Acid.

[18] HAA9 = Bromochloroacetic Acid, Bromodichloroacetic Acid, Chlorodibromoacetic Acid, Dibromoacetic Acid, Dichloroacetic Acid, Monobromoacetic Acid, Monochloroacetic Acid, Tribromoacetic Acid, and Trichloroacetic Acid.

Terms

a) UCMR Reference Concentration = The reference concentrations are 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 Human Health Benchmark for Pesticides (i.e., HHBPs). The primary sources of the health information used to derive the guideline values in the resources referenced above are peer reviewed assessments from EPA or other governmental agencies. The reference concentrations are subject to change as new health assessments are completed. Reference Concentrations are not legally enforceable federal standards.

b) MRL = UCMR Minimum Reporting Level. The minimum concentration that may be reported by a laboratory as a quantified value for a method analyte following analysis. The MRLs were established based on the capability of the analytical method, not based on a level established as "significant" or "harmful." ***[Note that the Agency for Toxic Substances & Disease Registry (ATSDR) uses the term "MRL" for a different purpose (i.e., to describe "Minimal Risk Levels"). The UCMR term and the ATSDR term have no relationship to each other.]***

c) HRL = Health Reference Levels. The CCL process derives HRLs for screening purposes using available data. The CCL HRLs derived from health assessments can be used in the Regulatory Determination process as risk-derived concentrations against which to evaluate the occurrence data to determine if contaminants may 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.

d) HA = Health Advisories. HAs provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. EPA's health advisories are non-enforceable and non-regulatory and provide technical information to State agencies and other public health officials on health effects, analytical methodologies, and treatment technologies to assist with risk management decisions.

e) HHBP = Human Health Benchmarks for Pesticides. EPA has developed HHBPs for informational purposes for use by States, water systems 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 allowed in drinking water. 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 ($1x\ 10^{-6}$) 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 $1x\ 10^{-6}$. 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 dose, "an 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 non-cancer 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 communicating 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 (RfD), "an 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 non-cancer effects following 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.

j) PPRTV = Provisional Peer-Reviewed Toxicity Value. A toxicity value (expressed as mg/kg-day) derived for use in the Superfund Program when a value is not available in EPA's Integrated Risk Information System (IRIS, the first tier in the Superfund hierarchy of human health toxicity values). PPRTVs are derived after a review of the relevant scientific literature using the methods, sources of data and guidance for value derivation used by the EPA IRIS Program. All provisional peer-reviewed toxicity values receive internal review by EPA scientists and external peer review by independent scientific experts.

k) NA = Not Available

References

EPA's Drinking Water Contaminant Human Health Effects Information (https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information)

2018 Edition of the Drinking Water Standards and Health Advisories Tables (https://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf)

CCL 4 Contaminant Information Sheets (https://www.epa.gov/sites/production/files/2016-11/documents/815r16003.pdf)

Human Health Benchmarks for Pesticides (HHBPs) (https://ofmpub.epa.gov/apex/pesticides/f?p=109:3)