

A global overview of national regulations and standards for drinking-water quality

Second edition

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Abbreviations and acronyms

Bq/l	Becquerel per litre
BSS	Basic Safety Standards
cfu	colony forming units
EU	European Union
Euratom	European Atomic Energy Community
GDWQ	Guidelines for Drinking-water Quality
GL	Guidance level
GV	Guideline value
HBV	health-based value
ICRP	International Commission on Radiological Protection
µg/l	micrograms per litre
mg/l	milligrams per litre
mSv/year	milli Sieverts per year
NTU	Nephelometric turbidity unit
PAHO	Pan American Health Organization
pCi/l	pico Curie per litre
RegNet	WHO International Network of Drinking-water Regulators
TCU	true colour unit
WHO	World Health Organization
WHOPES	WHO Pesticide Evaluation Scheme

Role of the WHO Guidelines for Drinking-water Quality

The Guidelines for Drinking-water Quality (GDWQ) are one of the longest-standing normative publications of the World Health Organization (WHO), with the first edition published in 1958. The GDWQ are an international reference point for the establishment of national or regional regulations and standards for water safety. They are addressed to water and health regulators, policy-makers and their advisors, mainly to assist them in the development of national standards. The GDWQ are also used by many others as a source of information on water quality and health and on effective management approaches.

The GDWQ include an assessment of the health risks presented by the various microbial, chemical, radiological and physical contaminants that may be present in drinking-water. Where applicable, they derive maximum concentration guideline values for these hazardous constituents. Through a Framework for Safe Drinking Water, the GDWQ support the development of health-based targets, implementation of preventive risk management strategies (through water safety planning), and independent surveillance. Health-based water quality targets define drinking-water that does not represent any significant risk to health, generally over a lifetime of consumption. These numeric targets include 'guidance levels' (GL), 'guideline values' (GV) and 'health-based values' (HBV) for constituents in drinking-water or indicators of water quality (Box 1).

Box 1. Guidance levels, guideline values, and health-based values

The term 'guidance levels' is used for radiological parameters, while 'guideline values' or 'health-based values' is used for all other parameters. Generally, health-based values have been established for some chemicals in the GDWQ, rather than a formal guideline value, in order to provide guidance to Member States when there is reason for local concern. Establishing a formal guideline value for such substances may encourage Member States to incorporate a value into their national standards when this may be unnecessary.

In the case of manganese, a health-based value was established rather than a guideline value as manganese is not of health concern at levels normally causing acceptability problems in drinking-water (e.g. staining of laundry). However, there are circumstances in which manganese can remain in solution at concentrations of health concern in some acidic or anaerobic waters, particularly groundwater. It may therefore be appropriate to incorporate manganese in national standards under these circumstances and to consider both aesthetic as well as health aspects when confirming the acceptability of drinking-water.

In addition, a number of provisional guideline values have been established based on the practical level of treatment performance or analytical achievability (Box 2). In these cases, the guideline value is higher than the calculated health-based value.

Recognizing the benefits of a risk management approach, the GDWQ are not promoted as mandatory international standards, but as guidance that should be adapted to the specific circumstances, needs and resources of countries. Therefore, national or regional drinking-water quality regulations should only include a subset of the values included in the GDWQ and may have different parameter limits than what is specified in the GDWQ.

Many countries use the GDWQ directly or indirectly in setting national drinking-water quality standards. To better understand the extent to which the GDWQ are used and reflected in these standards, a global review of various country regulations and policies was

conducted. This report summarizes information from 125 countries and territories on values specified in national drinking-water quality standards for aesthetic, chemical, microbiological and radiological parameters. The aim of the report is to enable regulators and other key stakeholders to access and compare data when setting or revising national drinking-water quality standards, although comparison should be approached with caution. The report is not intended to provide guidance on selecting appropriate parameters and parameter limits for drinking-water quality standards. The separate publication, *Developing Drinking-water Quality Regulations and Standards* (WHO, 2018) should be consulted for such guidance.

Box 2. Provisional guideline values

For several chemical parameters, the GDWQ suggest guideline values which may be provisional for the following reasons:

- A: provisional guideline value set at the achievable quantification level;
- P: provisional guideline value because of uncertainties in the health database;
- T: provisional guideline value set at the practical treatment level); and
- D: provisional guideline value set considering possible health effects and the need to maintain adequate disinfection. Adequate disinfection of drinking-water remains paramount.

For some chemicals, GV's are designated with a "C". This indicates that the concentration of the substance at or below the guideline value may affect the appearance, taste or odour of the water, which may lead to consumer complaints.

Data sources and methods

The data reviewed in the report were obtained from members of the WHO International Network of Drinking-water Regulators (RegNet)¹, WHO regional and country office contacts, through internet searches or purchased from the relevant standards organizations. Data were collected for 125 countries and territories (Figure 1) up to 2019, and were reviewed and validated. The data validation entailed an online public review, as well as review by WHO regional and country office contacts, and RegNet members, who were asked to clarify inconsistencies and provide data updates wherever relevant.

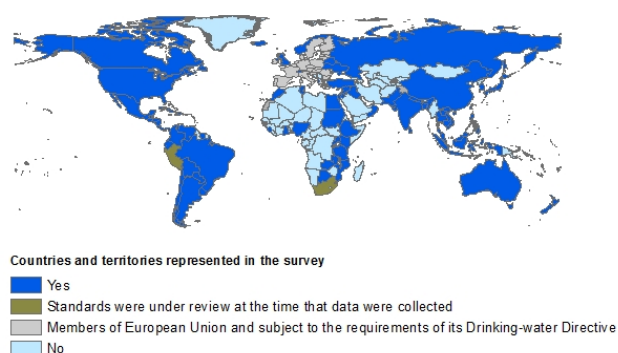


Figure 1: Countries and territories represented in the survey

These countries and territories have a total population of approximately 6.5 billion people, representing approximately 89 % of the world population². Countries that are members of the European Union (EU) are subject to the requirements of its Drinking-water Directive and European Atomic Energy Community (Euratom) which specifies radionuclide requirements. However, all these countries have their own regulations, some of which differ from the

¹ Information about RegNet can be found at the following link:
http://www.who.int/water_sanitation_health/water-quality/regulation/regnet/en/

² Based on mid-year population estimates for 2017: United Nations, Department of Economic and Social Affairs, Population Division (2017). *World Population Prospects: The 2017 Revision. Wallchart*

Directive with more stringent requirements or include additional parameters. In addition, it is understood that the following countries and territories use the standards specified in the GDWQ without currently publishing separate documentation listing regulatory parameters and values at the time that data for this report were collected: Kiribati, Kuwait, Mali, Nauru, Senegal, Solomon Islands, Tonga and Tuvalu.

Countries and territories specify parameter values for drinking-water quality in a variety of formats; regulations, standards, specifications, laws, decrees, requirements and norms. For the purposes of this report these are all referred to as standards. The drinking-water quality standards specified by countries and territories for inorganic chemicals, organic chemicals, aesthetic and microbiological parameters were compared to the GV or HBV; and radiological parameters were compared to the GL of the fourth edition of the GDWQ (WHO, 2011)³.

This report does not include detailed background information on the parameters, including derivation and adaptation of guideline values and appropriate risk management strategies; the report should be read in conjunction with the GDWQ to provide this information. The report also does not include the extent and effectiveness of compliance monitoring by national regulatory authorities against national standards, including information on how many samples are required or taken for each parameter; or whether drinking-water quality in each country and territory meets the values specified.

Documentation and the report

According to the documentation reviewed, the oldest specifications of values for drinking-water in current use date back to 1956. Fourteen countries and territories' values, (42 including the members of the European Union (EU) through the European Drinking-water Directive), date to the 1990s. However, many EU Member States have implemented the Directive through more recent documentation but these have not been included in the survey because they differ little in requirements from the original Directive. The other 89 countries and territories have produced documentation in the year 2000 and later. As countries and territories often review their legislation and values, these findings are constantly subject to change.

³ The most recent edition of the GDWQ is the fourth edition, first addendum published in 2017. For the first addendum, risk assessments for the following parameters have been revised, resulting in updated guideline or health-based values: barium, bentazone, diquat and MCPA. As the first addendum was published after the cut-off date for the review and further, as countries have had little time to consider the first addendum in their national standards, an analysis against these updated values has not been included in this document. Information on the changes made in the first addendum to the fourth edition of the GDWQ can be found at the following link: http://www.who.int/water_sanitation_health/publications/gdwq4-1st-addendum/en/

Thirty-seven countries and territories directly reference the GDWQ in their standards, although this number is likely to be higher because the full documentation was not available in all cases. Botswana and Pakistan list the WHO GV alongside their values.

Although the GDWQ encourage countries and territories to set their own water-quality standards to ensure they are locally relevant in terms of parameters included, limits, etc., none of the documentation received includes a full explanation on why parameters are included and how countries and territories derived their values, including where they differ from the WHO GV. However, this is now becoming more readily available in separate documentation such as that produced by Health Canada. Others more generally reference WHO and other countries and territories' values, such as those of the European Union, the United States of America, Nigeria and South Africa. Some countries and territories' standards also reference the analytical method required. In some cases the names of the members of expert committees who drew up the values are listed.

Some countries and territories include in their standards details of the likely origin of parameters and their associated risk. This may help the understanding of those who have to analyze and manage drinking-water quality. Examples are: Australia, the Dominican Republic, Fiji, India, New Zealand, Nigeria, Pakistan, the Philippines, South Africa, Uruguay and the USA. Other countries and territories may provide similar information in separate documentation or consider the information included in the GDWQ sufficient.

In addition to setting values for specific parameters, many countries and territories' documentation includes a general statement along the lines of: "water intended for human consumption should: not contain concentrations of compounds which could, either alone or in combination with other compounds, be harmful to human health; and not contain any micro-organisms and parasites in such a number that could be harmful to human health".

For the purposes of this report, all values for chemical parameters have been converted to mg/l. The values used in this report are the highest listed by countries and territories in their standards for normal (non-emergency or severe weather-affected) water supplies. Not all the values countries and territories have listed are mandatory; some are advisory, for guidance or occasionally described as operational. This applies particularly to the aesthetic and other parameters. The GDWQ suggest values with a wide margin of safety, and countries and territories are advised to adapt their drinking-water quality standards to local conditions and circumstances.

For clarity and convenience this report has adopted the terms “higher” or “above” for values greater than those specified in the GDWQ and “lower” or “below” for values less than those specified in the GDWQ. Countries and territories may have good reasons to specify a value more, or less stringent than WHO based on an overall risk-benefit strategy to protect public health, whereby scarce resources directed to provide greatest public health benefits. In addition, differences in the number of parameters specified by countries and territories are to be expected, according to the relevance of the parameters to the countries and territories concerned. A list of source documentation used in this survey is provided at the end of the report.

Inorganic parameters

The 4th edition of the GDWQ includes GVs or HBVs for 24 inorganic parameters. All but one of the 125 countries and territories specify a value for nitrate, and all but two specify a value for arsenic. The least specified inorganic parameters were: beryllium (13 out 125 countries); chlorate (15) and glyphosate (15). All the median values equalled or were below the GV except for cadmium (GV 0.003 mg/l, median 0.005 mg/l).

Antimony

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	83 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	17
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	65
Maximum value set	0.05 mg/l
Minimum value set	0.003 mg/l
Median value	0.005 mg/l

The majority of countries and territories (65/83) set a value for antimony below the GV, with 53 countries and territories setting 0.005 mg/l.

Arsenic

WHO Guideline value	0.01 mg/l (provisional A, T)
Number of countries and territories setting a regulatory / guideline value	123 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	28
Number of countries and territories setting the WHO Guideline	94
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.5 mg/l
Minimum value set	0.007 mg/l
Median value	0.01 mg/l

Arsenic is one of the parameters with a value set by most countries and territories (123/125). The majority of countries (94/125) specified the provisional GV; only one country set a value below the provisional GV.

Barium

WHO Guideline value	0.7 mg/l ⁴
Number of countries and territories setting a regulatory / guideline value	63 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	14
Number of countries and territories setting the WHO Guideline	41
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	8
Maximum value set	2.0 mg/l
Minimum value set	0.1 mg/l
Median value	0.7 mg/l

The majority (41/63) of those countries and territories setting a value for barium specified the GV.

Beryllium

WHO Guideline value	None specified
WHO Health-based value	0.012 mg/l
Number of countries and territories setting a regulatory / guideline value	13 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Health-based value	1
Number of countries and territories setting the WHO Health-based value	0
Number of countries and territories setting a regulatory / guideline value less than WHO Health-based value	12
Maximum value set	0.06 mg/l
Minimum value set	0.0002 mg/l
Median value	0.002 mg/l

Beryllium is one of the least specified parameters; with only 13 out of the 125 countries and territories surveyed setting a value.

⁴ The GV has been increased to 1.3 mg/l in the first addendum to the 4th edition of GDWQ (WHO, 2017), which is available here: <http://apps.who.int/iris/bitstream/10665/254637/1/9789241549950-eng.pdf?ua=1>

Boron

WHO Guideline value	2.4 mg/l
Number of countries and territories setting a regulatory / guideline value	85 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	6
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	76
Maximum value set	5 mg/l
Minimum value set	0.1 mg/l
Median value	1 mg/l

6 countries set the revised GV for boron in the 4th edition of the GDWQ (WHO, 2011); most countries and territories had based their value on the previous provisional GV of 0.5 mg/l.

Bromate

WHO Guideline value	0.01 mg/l (provisional A,T)
Number of countries and territories setting a regulatory / guideline value	63 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	10
Number of countries and territories setting the WHO Guideline	52
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.025 mg/l
Minimum value set	0.001 mg/l
Median value	0.01 mg/l

Most countries and territories specified a value for bromate at or close to the provisional GV.

Cadmium

WHO Guideline value	0.003 mg/l
Number of countries and territories setting a regulatory / guideline value	117 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	66
Number of countries and territories setting the WHO Guideline	46
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	5
Maximum value set	0.15 mg/l
Minimum value set	0.0000005 mg/l
Median value	0.005 mg/l

Cadmium is the inorganic parameter for which the most countries and territories specified a higher value than the GV, as demonstrated by the median value. Only four countries and territories specified a value below the GV.

Chlorate

WHO Guideline value	0.7 mg/l (provisional D)
Number of countries and territories setting a regulatory / guideline value	15 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	9
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	3
Maximum value set	20 mg/l
Minimum value set	0.2 mg/l
Median value	0.7 mg/l

Only 15 countries and territories set a value for chlorate. Of these, 9 set the provisional GV of 0.7 mg/L.

Chlorine

WHO Guideline value*(C)	5.0 mg/l (as free chlorine)
Number of countries and territories setting a regulatory / guideline value	59
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	11
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	48
Maximum value set	5.0 mg/l
Minimum value set	0.1 mg/l
Median value	1.0 mg/l

*It is possible to reduce the concentration of chlorine effectively to zero (<0.1 mg/l) by reduction; however, it is normal practice to supply water with a chlorine dioxide residual of a few tenths of a milligram per litre to provide some protection against microbial regrowth during distribution.

Chlorine is the inorganic parameter with the largest range between minimum and maximum. No country had a value above the GV. Twenty four countries and territories specified a level below 1 mg/l. Eleven countries and territories specified the GV. Some countries and territories set a range, specifying minimum and maximum levels. It was not always clear if the set value referred to free or total chlorine.

Chlorite

WHO Guideline value	0.7 mg/l (provisional D)
Number of countries and territories setting a regulatory / guideline value	29 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	6
Number of countries and territories setting the WHO Guideline	11
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	12
Maximum value set	1.0 mg/l
Minimum value set	0.05 mg/l
Median value	0.7 mg/l

Twenty eight countries and territories set a value for chlorite, and of these, 11 specified the GV.

Chromium (total)

WHO Guideline value	0.05 mg/l (provisional P)
Number of countries and territories setting a regulatory / guideline value	114 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	107
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.5 mg/l
Minimum value set	0.001 mg/l
Median value	0.05 mg/l

Most countries and territories set a value for total chromium, and the great majority set the provisional GV.

Copper

WHO Guideline value*	2.0 mg/l
Number of countries and territories setting a regulatory / guideline value	119 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	58
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	59
Maximum value set	3.0 mg/l
Minimum value set	0.001 mg/l
Median value	2.0 mg/l

*The GDWQ also notes that copper causes aesthetic issues including staining of laundry at concentrations above 1 mg/l

The majority of countries and territories specified the GV or specified lower values. Only two countries set values above the GV.

Cyanide

WHO Guideline value	No value established in fourth edition, previously 0.07 mg/l*
WHO Health-based value	0.5 mg/l (rounded value, for short-term exposure)
Number of countries and territories setting a regulatory / guideline value	115 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than the WHO health-based value	13
Number of countries and territories setting the previous WHO health-based value	32
Number of countries and territories setting a regulatory / guideline value less than the previous WHO health-based value	70
Maximum value set	0.6 mg/l
Minimum value set	0.01 mg/l
Median value	0.05 mg/l

*The GV was changed to a HBV, for short term exposure, in the 4th edition of the GDWQ.

The majority of countries and territories (115/125) set a value for this parameter, and over half specified values below the GV.

Fluoride

WHO Guideline value	1.5 mg/l
Number of countries and territories setting a regulatory / guideline value	122 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	8
Number of countries and territories setting the WHO Guideline	77
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	17
Maximum value set	5.0 mg/l
Minimum value set	0.6 mg/l
Median value	1.5 mg/l

All but three countries specified a value for this parameter, and the majority set the GV. Many specified a lower value for higher water temperatures. In some cases where a low value was set, a higher value was allowed under certain circumstances.

Glyphosate

WHO Guideline value	None specified
WHO health-based value	0.9 mg/l
Number of countries and territories setting a regulatory / guideline value	15 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Health-based value	2
Number of countries and territories setting the WHO Health-based value	1
Number of countries and territories setting a regulatory / guideline value less than WHO Health-based value	12
Maximum value set	1 mg/l
Minimum value set	0.01 mg/l
Median value	0.7 mg/l

The GDWQ link together glyphosate and its major metabolite aminomethylphosphonic acid (AMPA). Because of their low toxicity, the health-based value derived for AMPA alone or in combination with glyphosate is orders of magnitude higher than concentrations of glyphosate or AMPA normally found in drinking-water. Under usual conditions, therefore, the presence of glyphosate and AMPA in drinking-water does not represent a hazard to human health. For this reason, the establishment of a formal guideline value for glyphosate and AMPA is not deemed necessary. Glyphosate is one of the least specified parameters; with only 15 out of the 125 countries and territories setting a value. No country or territory specified a value for AMPA.

Lead

WHO Guideline value	0.01 mg/l (provisional; A, T)
Number of countries and territories setting a regulatory / guideline value	122 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	26
Number of countries and territories setting the WHO Guideline	95
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.005 mg/l
Median value	0.01 mg/l

Lead is specified by all but 3 countries and territories in this survey. The majority set the GV, while some countries and territories allowed time for the 0.01 mg/l standard to apply. Of the countries and territories that set a value above the GDWQ, most specified 0.05 mg/l.

Manganese

WHO Guideline value	No value established in the fourth edition, previously 0.4 mg/l
WHO Health-based value (4 th edition)*	0.4 mg/l
Number of countries and territories setting a regulatory / guideline value	117 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than the previous WHO Guideline	19
Number of countries and territories setting the previous WHO Guideline	12
Number of countries and territories setting a regulatory / guideline value less than the previous WHO Guideline	86
Maximum value set	0.5 mg/l
Minimum value set	0.01 mg/l
Median value	0.1 mg/l

*The GV was changed to a HBV in the 4th edition of the GDWQ, recognizing that manganese is not of health concern at levels normally causing acceptability problems in drinking-water. Manganese can cause aesthetic issues, including taste impacts and staining of laundry at concentrations above 0.1 mg/l. However, there are circumstances in which manganese can remain in solution at concentrations of health concern in some acidic or anaerobic waters, particularly groundwaters. Therefore, aesthetic as well as health aspects should be considered in the establishment of standards and confirming the acceptability of drinking-water.

The majority of countries and territories in the survey set a value for manganese. Most set a value below the previous GV. Some countries and territories listed the parameter as aesthetic, some as inorganic, and some as both.

Mercury

WHO Guideline value	0.006 mg/l
Number of countries and territories setting a regulatory / guideline value	116 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	8
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	106
Maximum value set	0.007 mg/l
Minimum value set	0.0005 mg/l
Median value	0.001 mg/l

The majority of countries and territories (116/125) set a value for this parameter. Only eight countries specified the GV; most specified values below the GV.

Molybdenum

WHO Guideline value	0.07 mg/l
Number of countries and territories setting a regulatory / guideline value	32 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	26
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	3
Maximum value set	0.25 mg/l
Minimum value set	0.05 mg/l
Median value	0.07 mg/l

The majority (26/32) of the countries and territories setting a value for molybdenum specified the GV.

Nickel

WHO Guideline value	0.07 mg/l
Number of countries and territories setting a regulatory / guideline value	97 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	4
Number of countries and territories setting the WHO Guideline	11
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	82
Maximum value set	0.25 mg/l
Minimum value set	0.01 mg/l
Median value	0.02 mg/l

Most countries and territories specifying a value for nickel set it below the GV, at 0.02 mg/l.

Nitrate

WHO Guideline value	50 mg/l* (as NO ₃ ⁻)
Number of countries and territories setting a regulatory / guideline value	124 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	69
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	33
Maximum value set	75 mg/l (as NO ₃ ⁻)
Minimum value set	40 mg/l (as NO ₃ ⁻)
Median value	50 mg/l (as NO ₃ ⁻)

*The GDWQ also include a value for combined nitrate plus nitrite as: The sum of the ratios of the concentrations as reported or detected in the sample of each to its guideline value should not exceed 1.

Nitrate is one of only three inorganic parameters with a value set by all countries and territories in the survey. Many quoted their value as 10 mg/l (as N) which has been converted to 45 mg/l (as NO₃⁻) for the purposes of this report but counted as being at the GV. Several countries and territories including the European Union countries included a formula that reduces the nitrate value as the nitrite level increases.

Nitrite

WHO Guideline value	3 mg/l* (as NO ₂ ⁻)
Number of countries and territories setting a regulatory / guideline value	96 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	39
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	55
Maximum value set	3.3 mg/l (as NO ₂ ⁻)
Minimum value set	0.003 mg/l (as NO ₂ ⁻)
Median value	0.5 mg/l (as NO ₂ ⁻)
Median value	50 mg/l (as NO ₃ ⁻)

*The GDWQ also include a value for combined nitrate plus nitrite as: The sum of the ratios of the concentrations as reported or detected in the sample of each to its guideline value should not exceed 1.

Many countries and territories' values for nitrite have been based on older WHO guidance. Only two countries had values above the revised GV. Thirty-nine countries and territories specified the revised GV (or its equivalent as mg N/l). Several countries and territories including the European Union countries included a formula that reduces the nitrate value as the nitrite level increases.

Selenium

WHO Guideline value	0.04 mg/l (provisional, P)
Number of countries and territories setting a regulatory / guideline value	110 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	4
Number of countries and territories setting the WHO Guideline	7
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	99
Maximum value set	0.05 mg/l
Minimum value set	0.007 mg/l
Median value	0.01 mg/l

Only seven country and territories specified the new provisional GV of 0.04 mg/l; almost all others specified the previous value of 0.01 mg/l.

Uranium

WHO Guideline value	0.03 mg/l (provisional P)
Number of countries and territories setting a regulatory / guideline value	21 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	1
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	19
Maximum value set	1.0 mg/l
Minimum value set	0.002 mg/l
Median value	0.02 mg/l

Uranium is one of the least specified parameters; with only 21 out of the 125 countries and territories setting a value. The majority specified a value based on the previous GV, with only one country specifying the latest.

Organic parameters

The 4th edition of the GDWQ includes GVs or HBVs for 89 organic parameters. The most specified organic parameters are: aldrin and dieldrin (75 out of 125 countries and territories); benzene (86); benzo[a]pyrene(70); tetrachloroethene (75); and 1,2 dichloroethane (70). Among the least specified values are: 2-phenylphenol (1); cyanuric acid(1); sodium dichloroisocyanurate(1) and hydroxyatrazine(2).

Fifteen countries and territories did not specify values for any inorganic parameters, while some included notes with general requirements for low levels of pesticides. For the organic parameters that had specifications, all but four had median values equal to or below the GV. The exceptions were: cyanazine (GV 0.0006 mg/l, median 0.0007 mg/l), but only specified by five countries and territories; dibromoacetonitrile (GV 0.07 mg/l, median 0.0775), specified by 16 countries and territories; dichloroacetonitrile (GV 0.02 mg/l, median 0.06 mg/l), specified by 17 countries and territories; and vinyl chloride (GV 0.0003 mg/l, median 0.0005 mg/l), specified by 60 countries and territories.

Forty-six countries and territories do not specify values for most individual pesticides other than aldrin and dieldrin, heptachlor and heptachlor epoxide. Instead, they include a blanket statement that the value for all individual pesticides is 0.0001 mg/l, and for total pesticides 0.0005 mg/l (where “total pesticides” is defined as the sum of all individual pesticides detected and quantified in the monitoring procedure), or similar requirement. Where a country or territory does not specify a value for an individual parameter in its standards, it is not included in the tables below.

Acrylamide

WHO Guideline value	0.0005 mg/l
Number of countries and territories setting a regulatory / guideline value	59 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	22
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	37
Maximum value set	0.0005 mg/l
Minimum value set	0.0001 mg/l
Median value	0.0001 mg/l

Almost half of the countries and territories (59/125) set a value for acrylamide. No country set a value greater than the GV; the majority set 0.0001 mg/l.

Alachlor

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	27 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	20
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	5
Maximum value set	0.15 mg/l
Minimum value set	0.002 mg/l
Median value	0.02 mg/l

Most countries and territories (20/27) set the GV; and only two set a higher value.

Aldicarb

WHO Guideline value	0.01 mg/l
Number of countries and territories setting a regulatory / guideline value	21 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	17
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	4
Maximum value set	0.01 mg/l
Minimum value set	0.003 mg/l
Median value	0.01 mg/l

Only four out of 21 countries and territories set values that differed from the GV.

Aldrin and Dieldrin

WHO Guideline value	0.00003 mg/l
Number of countries and territories setting a regulatory / guideline value	75 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	8
Number of countries and territories setting the WHO Guideline	64
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	3
Maximum value set	0.001 mg/l
Minimum value set	0.00001 mg/l (0)
Median value	0.00003 mg/l

Most countries and territories (64/75) specified the GV, and only three set values that were lower.

Atrazine and its chloro-s-triazine metabolites

WHO Guideline value	0.1 mg/l
Number of countries and territories setting a regulatory / guideline value	32 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	4
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	27
Maximum value set	0.5 mg/l
Minimum value set	0.0015 mg/l
Median value	0.002 mg/l

There was wide deviation from the GV in the values set for this parameter. Only one country set a value above the GV, most countries and territories were well below.

Bentazone

WHO Guideline value	None specified
WHO health-based value	0.3 mg/l ⁵
Number of countries and territories setting a regulatory / guideline value	13 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Health-based value	2
Number of countries and territories setting the WHO Health-based value	5
Number of countries and territories setting a regulatory / guideline value less than WHO Health-based value	6
Maximum value set	0.5 mg/l
Minimum value set	0.03 mg/l
Median value	0.3 mg/l

Only 13 countries and territories set a value for bentazone, and the majority set below the HBV of 0.3 mg/L specified in the 4th edition of the GDWQ (WHO, 2011).

Benzene

WHO Guideline value	0.01 mg/l
Number of countries and territories setting a regulatory / guideline value	86 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	35
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	50
Maximum value set	0.03 mg/l
Minimum value set	0.0005 mg/l
Median value	0.005 mg/l

Benzene is the most specified organic parameter among the 125 countries and territories surveyed. The majority specified values below the GV of 0.01 mg/L, and only one country specified a higher value.

⁵ The HBV has been increased to 0.5 mg/l in the first addendum to the 4th edition of GDWQ (WHO, 2017), which is available here: <http://apps.who.int/iris/bitstream/10665/254637/1/9789241549950-eng.pdf?ua=1>

Benzo[a]pyrene

WHO Guideline value	0.0007 mg/l
Number of countries and territories setting a regulatory / guideline value	70 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	17
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	53
Maximum value set	0.0007 mg/l
Minimum value set	0.000005 mg/l
Median value	0.00001 mg/l

Where countries and territories also had a value for polynuclear aromatic hydrocarbons (PAH; see additional parameters), this parameter was usually quoted separately. The majority of countries and territories set a value below the GV, and no country set a value higher than the GV.

Bromodichloromethane

WHO Guideline value	0.06 mg/l*
Number of countries and territories setting a regulatory / guideline value	30 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	23
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	7
Maximum value set	0.06 mg/l
Minimum value set	0.015 mg/l
Median value	0.06 mg/l

* See [total trihalomethanes \(THMs\)](#) for information on how to account for additive toxicity with other individual THM compounds

Of the 30 countries and territories specifying a value for this parameter, the majority (23) specified the GV. Some countries and territories which did not specify a value for this parameter included it in their value for total trihalomethanes.

Bromoform

WHO Guideline value	0.1 mg/l*
Number of countries and territories setting a regulatory / guideline value	24 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	22
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.1 mg/l
Minimum value set	0.075mg/l
Median value	0.1 mg/l

*See [total trihalomethanes \(THMs\)](#) for information on how to account for additive toxicity with other individual THM compounds

All but two of the countries and territories specifying a value for this parameter used the GV. Some countries and territories which did not specify a value for this parameter included it in their value for total trihalomethanes.

Carbofuran

WHO Guideline value	0.007 mg/l
Number of countries and territories setting a regulatory / guideline value	29 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	9
Number of countries and territories setting the WHO Guideline	10
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	10
Maximum value set	0.1 mg/l
Minimum value set	0.0035 mg/l
Median value	0.007 mg/l

Twenty-nine countries and territories specified a value for carbofuran, with the majority (19) setting values greater or less than the GV.

Carbon tetrachloride

WHO Guideline value	0.004 mg/l
Number of countries and territories setting a regulatory / guideline value	38 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	9
Number of countries and territories setting the WHO Guideline	9
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	20
Maximum value set	0.005 mg/l
Minimum value set	0.0013 mg/l
Median value	0.003 mg/l

Twenty-nine of the 38 countries and territories specifying a value for this parameter differed from the GV. Nine countries and territories specified 0.005 mg/l.

Chloral hydrate (trichloroacetaldehyde)

WHO Health-based value	0.1 mg/l (rounded figure)
Number of countries and territories setting a regulatory / guideline value	12 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO health-based value	0
Number of countries and territories setting the WHO health-based value	2
Number of countries and territories setting a regulatory / guideline value less than WHO health-based value	10
Maximum value set	0.1 mg/l
Minimum value set	0.01 mg/l
Median value	0.01 mg/l

Only 12 countries and territories specified a value for chloral hydrate, and ten of these set values below the HBV.

Chlordane

WHO Guideline value	0.0002 mg/l
Number of countries and territories setting a regulatory / guideline value	37 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	12
Number of countries and territories setting the WHO Guideline	24
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.003 mg/l
Minimum value set	0.00015 mg/l
Median value	0.0002 mg/l

The majority of countries and territories specifying a value for chlordane set the GV (24/37), and only one specified a lower value.

Chloroform

WHO Guideline value	0.3 mg/l*
Number of countries and territories setting a regulatory / guideline value	40 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	8
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	31
Maximum value set	0.4 mg/l
Minimum value set	0.03 mg/l
Median value	0.2 mg/l

* See [total trihalomethanes \(THMs\)](#) for information on how to account for additive toxicity with other individual THM compounds

The majority of countries and territories specifying a value for this parameter set a value below the GV, most specifying 0.2 mg/l. Some countries and territories did not specify a value for this parameter but included it in their value for total trihalomethanes.

Chlorotoluron

WHO Guideline value	0.03 mg/l
Number of countries and territories setting a regulatory / guideline value	13 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	10
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.02 mg/l
Median value	0.03 mg/l

The majority of countries and territories specifying a value for chlorotoluron set the GV (10/13).

Chlorpyrifos

WHO Guideline value	0.03 mg/l
Number of countries and territories setting a regulatory / guideline value	16 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	12
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.09 mg/l
Minimum value set	0.01 mg/l
Median value	0.03 mg/l

The majority of countries and territories specifying a value for this parameter set the GV (12/16).

Cyanazine

WHO Guideline value	0.0006 mg/l
Number of countries and territories setting a regulatory / guideline value	5 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	2
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.01 mg/l
Minimum value set	0.0006 mg/l
Median value	0.0007 mg/l

Only five countries and territories specified a value for cyanazine, and none set a value below the GV.

Cyanogen Chloride

WHO Guideline value	No value specified in fourth edition, previously 0.07 mg/l
WHO Health-based value	0.6 mg/l (rounded value)
Number of countries and territories setting a regulatory / guideline value	14 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than previous WHO Guideline	0
Number of countries and territories setting the previous WHO Guideline	0
Number of countries and territories setting a regulatory / guideline value less than previous WHO Guideline	14
Maximum value set	0.4 mg/l
Minimum value set	0.05 mg/l
Median value	0.07 mg/l

The 4th edition of the GDWQ specifies a HBV of 0.6 mg/l for cyanogen chloride, a change from the GV of 0.07 mg/l previously specified in the 3rd edition. All the fourteen countries and territories setting values for this parameter set values lower than the HBV. All two countries and territories specified the former GV (0.07 mg/l).

Cyanuric Acid

WHO Guideline value	40 mg/l
Number of countries and territories setting a regulatory / guideline value	1 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	1
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0

Only one country in the survey set a value for this parameter.

2,4-D (2,4-Dichlorophenoxyacetic Acid)

WHO Guideline value	0.03 mg/l
Number of countries and territories setting a regulatory / guideline value	47 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	11
Number of countries and territories setting the WHO Guideline	34
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.1 mg/l
Minimum value set	0.01 mg/l
Median value	0.03 mg/l

The majority of countries and territories setting a value for this parameter designated the GV; only two set values less than the GV.

2,4-DB (2,4-Dichlorophenoxybutyric Acid)

WHO Guideline value	0.09 mg/l
Number of countries and territories setting a regulatory / guideline value	16 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	4
Number of countries and territories setting the WHO Guideline	11
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.067 mg/l
Median value	0.09 mg/l

Only 16 countries and territories designated a value for this parameter, with most setting the GV.

Dichlorodiphenyltrichloroethane (DDT) and metabolites

WHO Guideline value	0.001 mg/l
Number of countries and territories setting a regulatory / guideline value	48 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	23
Number of countries and territories setting the WHO Guideline	25
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	2.0 mg/l
Minimum value set	0.001 mg/l
Median value	0.001 mg/l

Forty-eight countries and territories specified a value for DDT, with over half (25/42) setting the GV.

Di(2-ethylhexyl)phthalate

WHO Guideline value	0.008 mg/l
Number of countries and territories setting a regulatory / guideline value	13 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	10
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.009 mg/l
Minimum value set	0.0054 mg/l
Median value	0.008 mg/l

Thirteen countries and territories designated a value for this parameter, and only one set a value greater than the GV.

Dibromoacetylnitrile

WHO Guideline value	0.07 mg/l
Number of countries and territories setting a regulatory / guideline value	15 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	9
Number of countries and territories setting the WHO Guideline	5
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.01 mg/l
Median value	0.08 mg/l

Only 15 countries and territories designated a value for this parameter, and only one set a value less than the GV.

Dibromochloromethane

WHO Guideline value	0.1 mg/l*
Number of countries and territories setting a regulatory / guideline value	30 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	24
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	5
Maximum value set	0.15 mg/l
Minimum value set	0.01 mg/l
Median value	0.1 mg/l

* See [total trihalomethanes \(THMs\)](#) for information on how to account for additive toxicity with other individual THM compounds

Among the thirty countries and territories designating a value for dibromochloromethane, the majority specified the GV, and only one set a greater value.

1,2-Dibromo-3-chloropropane

WHO Guideline value	0.001 mg/l
Number of countries and territories setting a regulatory / guideline value	23 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	17
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	4
Maximum value set	0.007 mg/l
Minimum value set	0.0002 mg/l
Median value	0.001 mg/l

Only six out of 23 countries and territories set values that differed from the GV for 1,2-Dibromo-3-chloropropane.

1,2-Dibromoethane

WHO Guideline value	0.0004 mg/l
Number of countries and territories setting a regulatory / guideline value	8 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	7
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.0004 mg/l
Minimum value set	0.00001 mg/l
Median value	0.0004 mg/l

Only eight countries and territories specified a value for this parameter, and the majority set the GV.

Dichloroacetic acid

WHO Guideline value	0.05 mg/l (provisional, D)
Number of countries and territories setting a regulatory / guideline value	15 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	13
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.05 mg/l
Minimum value set	0.02 mg/l
Median value	0.05 mg/l

Of the 15 countries and territories specifying a value for dichloroacetic acid, only two did not specify the provisional GV.

Dichloroacetonitrile

WHO Guideline value	0.02 mg/l (provisional, P)
Number of countries and territories setting a regulatory / guideline value	17 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	9
Number of countries and territories setting the WHO Guideline	7
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.09 mg/l
Minimum value set	0.01 mg/l
Median value	0.06 mg/l

Seventeen countries and territories specified a value for dichloroacetonitrile, and of these, almost half (9/17) set values above the provisional GV.

1,2-Dichlorobenzene

WHO Guideline value	1 mg/l (C)*
Number of countries and territories setting a regulatory / guideline value	27 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	15
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	10
Maximum value set	1.5 mg/l
Minimum value set	0.0005 mg/l
Median value	1 mg/l

* Concentrations at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints

There was wide variation in values specified for this parameter according to whether countries and territories followed the WHO health-based GV or a value based on taste and odour thresholds. Some specified values for both.

1,4-Dichlorobenzene

WHO Guideline value	0.3 mg/l (C)*
Number of countries and territories setting a regulatory / guideline value	25 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	15
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	9
Maximum value set	0.4 mg/l
Minimum value set	0.0003 mg/l
Median value	0.3 mg/l

* Concentrations at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints

As with 1,2- Dichlorobenzene, countries and territories also specified health-based GVs or values based on taste and odour thresholds, and some specified values for both.

1,2-Dichloroethane

WHO Guideline value	0.03 mg/l
Number of countries and territories setting a regulatory / guideline value	70 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	19
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	49
Maximum value set	0.05 mg/l
Minimum value set	0.003 mg/l
Median value	0.003 mg/l

Of the 70 countries and territories specifying a value for this parameter, 36 specified the lowest value of 0.003 mg/l, and only 2 specified values greater than the GV.

1,1-Dichloroethene (Vinylidene chloride)

WHO Guideline value	No value established in the 4 th edition, previously 0.03 mg/l
WHO Health-based value	0.140 mg/l
Number of countries and territories setting a regulatory / guideline value	29 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than the previous WHO Guideline	0
Number of countries and territories setting the previous WHO Guideline	0
Number of countries and territories setting a regulatory / guideline value less than the previous WHO Guideline	29
Maximum value set	0.1 mg/l
Minimum value set	0.0003 mg/l
Median value	0.03 mg/l

The 4th edition of the GDWQ specify a HBV of 140 µg/l (0.140 mg/l) for 1,1-dichloroethene, a change from the GV of 0.03 mg/l previously specified in the 3rd edition. All the twenty-nine countries and territories setting values for this parameter set values less than the HBV.

1,2-Dichloroethene

WHO Guideline value	0.05 mg/l
Number of countries and territories setting a regulatory / guideline value	28 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	18
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	5
Maximum value set	30.0 mg/l
Minimum value set	0.005 mg/l
Median value	0.05 mg/l

Of the 28 countries and territories setting a value for this parameter, the majority (18/23) did not differ from the GV.

Dichloromethane

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	29 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	23
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	5
Maximum value set	0.05 mg/l
Minimum value set	0.003 mg/l
Median value	0.02 mg/l

Of the 29 countries and territories setting a value for this parameter, the majority (23/29) did not differ from the GV.

1,2-Dichloropropane

WHO Guideline value	0.04 mg/l (provisional P)
Number of countries and territories setting a regulatory / guideline value	22 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	6
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	15
Maximum value set	0.05 mg/l
Minimum value set	0.005 mg/l
Median value	0.02 mg/l

Twenty-two countries and territories set a value for this parameter, and the majority (15/22) specified values less than the GV.

1,3-Dichloropropene

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	17 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	15
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.015 mg/l
Median value	0.02 mg/l

The majority of countries and territories (15/17) setting a value for 1,3-Dichloropropene specified the GV.

Dichlorprop

WHO Guideline value	0.1 mg/l
Number of countries and territories setting a regulatory / guideline value	20 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	19
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.075 mg/l
Median value	0.1 mg/l

None of the 20 countries and territories specifying a value for dichlorprop set a value above the GV.

Di(2-ethylhexyl)phthalate

WHO Guideline value	0.008 mg/l
Number of countries and territories setting a regulatory / guideline value	17 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	10
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	4
Maximum value set	0.08 mg/l
Minimum value set	0.001 mg/l
Median value	0.008 mg/l

The majority of countries and territories (10/17) specified the GV for di(2-ethylhexyl)phthalate.

Dimethoate

WHO Guideline value	0.006 mg/l
Number of countries and territories setting a regulatory / guideline value	12 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	4
Number of countries and territories setting the WHO Guideline	8
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.08 mg/l
Minimum value set	0.006 mg/l
Median value	0.006 mg/l

Only four countries out of 12 specified values above the GV for dimethoate, and none specified values below.

1,4-Dioxane

WHO Guideline value	0.05 mg/l
Number of countries and territories setting a regulatory / guideline value	4 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	4
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.05 mg/l
Minimum value set	0.05 mg/l
Median value	0.05 mg/l

All four countries specifying a value for this parameter set the GV.

Diquat

WHO Guideline value	None
WHO Health-based value	0.006 mg/l ⁶
Number of countries and territories setting a regulatory / guideline value	7 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	7
Number of countries and territories setting the WHO Guideline	0
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.07 mg/l
Minimum value set	0.007 mg/l
Median value	0.02 mg/l

All seven countries and territories that specified a value for diquat set values above the HBV of 0.006 mg/L.

Edetec Acid (EDTA)

WHO Guideline value	0.6 mg/l
Number of countries and territories setting a regulatory / guideline value	17 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	7
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	9
Maximum value set	0.7 mg/l
Minimum value set	0.15 mg/l
Median value	0.25 mg/l

Of the seventeen countries and territories specifying a value for EDTA, only one set a value above the GV.

⁶ The HBV has been increased to 0.03 mg/l in the first addendum to the 4th edition of GDWQ (WHO, 2017), which is available here: <http://apps.who.int/iris/bitstream/10665/254637/1/9789241549950-eng.pdf?ua=1>

Endrin

WHO Guideline value	0.0006 mg/l
Number of countries and territories setting a regulatory / guideline value	18 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	4
Number of countries and territories setting the WHO Guideline	10
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	4
Maximum value set	0.002 mg/l
Minimum value set	0.00005 mg/l
Median value	0.0006 mg/l

The majority (10/18) of countries and territories setting a value for endrin specified the GV.

Endosulfan

WHO Guideline value	None
WHO Health-based value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	9 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	3
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	4
Maximum value set	0.03 mg/l
Minimum value set	0.00035 mg/l
Median value	0.02 mg/l

Nine countries and territories set a value for endosulfan.

Epichlorohydrin

WHO Guideline value	0.0004 mg/l
Number of countries and territories setting a regulatory / guideline value	56 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	18
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	35
Maximum value set	0.0005 mg/l
Minimum value set	0.0001 mg/l
Median value	0.0001 mg/l

Fifty-six of the countries and territories in the survey specified a value for this parameter, with the majority (35/56) setting a value below the GV of 0.0004 mg/L. Thirty-three countries and territories specified 0.0001 mg/l; and one country specified 0.0002 mg/l as a treatment standard only where epichlorohydrin is used in treatment.

Ethylbenzene

WHO Guideline value	0.3 mg/l (C)*
Number of countries and territories setting a regulatory / guideline value	31 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	4
Number of countries and territories setting the WHO Guideline	23
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	4
Maximum value set	0.7 mg/l
Minimum value set	0.002 mg/l
Median value	0.3 mg/l

*Concentrations at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints

The majority (23/31) of countries and territories specified the GV for ethylbenzene.

Fenitrothion

WHO Guideline value	None
WHO Health-based value	0.008 mg/l
Number of countries and territories setting a regulatory / guideline value	3 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	0
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.04 mg/l
Minimum value set	0.007 mg/l
Median value	0.007 mg/l

Fenitrothion is one of the least specified organic parameters, with only three countries specifying a value.

Fenoprop

WHO Guideline value	0.009 mg/l
Number of countries and territories setting a regulatory / guideline value	15 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	12
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.01 mg/l
Minimum value set	0.006 mg/l
Median value	0.009 mg/l

Of the 15 countries and territories specifying a value for fenoprop, there is little variation from the GV of 0.009 mg/L

Heptachlor and Heptachlor Epoxide

WHO Guideline value	None specified
WHO Health-based value	0.00003 mg/l
Number of countries and territories setting a regulatory / guideline value	30 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO health-based value	8
Number of countries and territories setting the WHO health-based value	22
Number of countries and territories setting a regulatory / guideline value less than WHO health-based value	0
Maximum value set	0.03 mg/l
Minimum value set	0.00003 mg/l
Median value	0.00003 mg/l

Of the 30 countries and territories specifying a value for heptachlor and heptachlor epoxide, none set a value less than the HBV.

Hexachlorobenzene

WHO Guideline value	None specified
WHO Health-based value	0.001 mg/l
Number of countries and territories setting a regulatory / guideline value	24 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO health-based value	2
Number of countries and territories setting the WHO health-based value	17
Number of countries and territories setting a regulatory / guideline value less than WHO health-based value	5
Maximum value set	1 mg/l
Minimum value set	0.00001 mg/l
Median value	0.001 mg/l

The majority of countries and territories (17/24) specifying a value for hexachlorobenzene set the HBV, and two set values greater.

Hexachlorobutadiene

WHO Guideline value	0.0006 mg/l
Number of countries and territories setting a regulatory / guideline value	20 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	12
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	5
Maximum value set	0.6 mg/l
Minimum value set	0.0004 mg/l
Median value	0.0006 mg/l

The majority of countries and territories (12/20) specifying a value for hexachlorobutadiene set the GV.

Hydroxyatrazine

WHO Guideline value	0.2 mg/l
Number of countries and territories setting a regulatory / guideline value	2 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	2
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.2 mg/l
Minimum value set	0.2 mg/l
Median value	0.2 mg/l

Two of countries and territories in the survey specified a value for this parameter.

Isoproturon

WHO Guideline value	0.009 mg/l
Number of countries and territories setting a regulatory / guideline value	20 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	17
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.007 mg/l
Median value	0.009 mg/l

There was little variation from the GV in the values specified for isoproturon, with only 3/19 countries and territories not specifying the GV.

Lindane

WHO Guideline value	0.002 mg/l
Number of countries and territories setting a regulatory / guideline value	51 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	9
Number of countries and territories setting the WHO Guideline	36
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	6
Maximum value set	2.0 mg/l
Minimum value set GV	0.0002 mg/l
Median value	0.002 mg/l

Of the 51 countries and territories specifying a value for lindane, the majority set the GV.

MCPA (4-(2-Methyl-4-chlorophenoxy) acetic acid)

WHO Guideline value	0.002 mg/l ⁷
Number of countries and territories setting a regulatory / guideline value	2. (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	18
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.7 mg/l
Minimum value set	0.002 mg/l
Median value	0.002 mg/l

All countries and territories specifying a value for MCPA set the GV, with the exception of five that set values greater values.

Mecoprop

WHO Guideline value	0.01 mg/l
Number of countries and territories setting a regulatory / guideline value	16 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	14
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.01 mg/l
Minimum value set	0.001 mg/l
Median value	0.01 mg/l

Mecoprop was specified by 16 countries and territories, and only two did not specify the GV.

⁷ The guideline value has changed to 0.7 mg/l in the first addendum to the 4th edition of GDWQ, which can be found here: http://www.who.int/water_sanitation_health/publications/drinking-water-quality-guidelines-4-including-1st-addendum/en/

Methoxychlor

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	40 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	9
Number of countries and territories setting the WHO Guideline	30
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	20.0 mg/l
Minimum value set	0.015 mg/l
Median value	0.02 mg/l

Most countries and territories (30/40) specified the GV but there was considerable variation in the ten other values for this parameter.

Methyl parathion

WHO Guideline value	None
WHO Health-based value	0.009 mg/l
Number of countries and territories setting a regulatory / guideline value	8 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	1
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	4
Maximum value set	0.1 mg/l
Minimum value set	0.0003 mg/l
Median value	0.008 mg/l

Eight countries and territories set a value for methyl parathion, and only one of them specified the GV.

Metolachlor

WHO Guideline value	0.01 mg/l
Number of countries and territories setting a regulatory / guideline value	23 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	4
Number of countries and territories setting the WHO Guideline	18
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.3 mg/l
Minimum value set	0.007 mg/l
Median value	0.01 mg/l

All 23 of the countries and territories specifying a value for metolachlor specified the GV, with the exception of five countries.

Microcystin-LR

WHO Guideline value	0.001 mg/l (provisional, P)
Number of countries and territories setting a regulatory / guideline value	16 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	13
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.0015 mg/l
Minimum value set	0.0001 mg/l
Median value	0.001 mg/l

Microcystin-LR was specified by 16 countries and territories, and of these, only three did not specify the provisional GV of 0.001 mg/L.

Molinate

WHO Guideline value	0.006 mg/l
Number of countries and territories setting a regulatory / guideline value	21 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	17
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.1 mg/l
Minimum value set	0.004 mg/l
Median value	0.006 mg/l

Of the 21 countries and territories specifying a value for molinate, only four did not specify the GV.

Monochloramine

WHO Guideline value	3 mg/l
Number of countries and territories setting a regulatory / guideline value	18 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	13
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.003 mg/l
Minimum value set	2.0 mg/l
Median value	3.0 mg/l

Of the 18 countries and territories specifying a value for this parameter only five did not specify the GV. One country specified 3 mg/l post-treatment, but 0.05 mg/l in distribution.

Monochloroacetic Acid (Monochloroacetate)

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	6 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	5
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.2 mg/l
Minimum value set	0.02 mg/l
Median value	0.02 mg/l

Only six countries and territories specified a value for monochloroacetate, and almost all specified the GV.

Nitrilotriacetic Acid

WHO Guideline value	0.2 mg/l
Number of countries and territories setting a regulatory / guideline value	17 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	15
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.4 mg/l
Minimum value set	0.15 mg/l
Median value	0.2 mg/l

Of the 17 countries and territories specifying a value for this parameter only two did not specify the GV.

Nitrobenzene

WHO Guideline value	None
WHO Health-based value	0.03 mg/l (short term) 0.008-0.063 mg/l (long term exposure, depending on end-point and approach used)
Number of countries and territories setting a regulatory / guideline value	3
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	0
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.2 mg/l
Minimum value set	0.004 mg/l
Median value	0.2 mg/l

The GDWQ derive two HBVs for nitrobenzene; one for short- and the other for long-term exposure, based on the limited available information. Only three countries specified a value for this parameter.

N-Nitrosodimethylamine (NDMA)

WHO Guideline value	0.0001 mg/l
Number of countries and territories setting a regulatory / guideline value	5 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	3
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.0001 mg/l
Minimum value set	0.000012 mg/l
Median value	0.0001 mg/l

NDMA is among the least specified organic parameters, with only five countries and territories specifying a value.

Parathion

WHO Guideline value	None
WHO Health-based value	0.01 mg/l
Number of countries and territories setting a regulatory / guideline value	7 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	1
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.05 mg/l
Minimum value set	0.003 mg/l
Median value	0.02 mg/l

The majority of countries and territories setting values for this parameter (5/7) specified values above the HBV of 0.01 mg/L.

Pendimethalin

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	22 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	19
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.4 mg/l
Minimum value set	0.015 mg/l
Median value	0.02 mg/l

Of the 22 countries and territories specifying a value for pendimethalin, only three did not specify the GV.

Pentachlorophenol (PCP)

WHO Guideline value	0.009 mg/l
Number of countries and territories setting a regulatory / guideline value	36 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	23
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	7
Maximum value set	0.1 mg/l
Minimum value set	0.00001 mg/l
Median value	0.009 mg/l

The majority of countries and territories specifying values for PCP specified the GV.

Permethrin

WHO Guideline value	No value established in fourth edition, previously 0.3 mg/l
WHO Health-based value*	0.3mg/l
Number of countries and territories setting a regulatory / guideline value	19 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than the previous WHO Guideline	0
Number of countries and territories setting the previous WHO Guideline	2
Number of countries and territories setting a regulatory / guideline value less than the previous WHO Guideline	17
Maximum value set	0.3 mg/l
Minimum value set	0.02 mg/l
Median value	0.02 mg/l

*The GV was changed to a HBV in the 4th edition of the GDWQ, recognizing that it is not recommended for direct addition to drinking-water as part of WHO's policy to exclude the use of any pyrethroids for larviciding of mosquito vectors of human disease

Permethrin was specified by 19 countries and territories. The majority specified values less than the HBV of 0.3 mg/L, with 15 countries and territories specifying 0.02 mg/l.

2-Phenylphenol and its sodium salt

WHO Guideline value	None
WHO Health-based value	1 mg/l
Number of countries and territories setting a regulatory / guideline value	1
Number of countries and territories setting a regulatory / guideline value greater than the previous WHO Guideline	1
Number of countries and territories setting the previous WHO Guideline	0
Number of countries and territories setting a regulatory / guideline value less than the previous WHO Guideline	0
Maximum value set	1.4 mg/l
Minimum value set	1.4 mg/l
Median value	1.4 mg/l

2-Phenylphenol is among the least specified organic parameters; only one country set a value for this parameter.

Pyriproxyfen

WHO Guideline value*	No value established in 4 th edition, previously 0.3 mg/l
Number of countries and territories setting a regulatory / guideline value	4 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than previous WHO Guideline	1
Number of countries and territories setting the previous WHO Guideline	3
Number of countries and territories setting a regulatory / guideline value less than previous WHO Guideline	0
Maximum value set	0.4 mg/l
Minimum value set	0.3 mg/l
Median value	0.3 mg/l

*Under the WHO Pesticides Evaluation Scheme (WHOPES) the recommended dosage of pyriproxyfen in potable water in containers should not exceed 0.01mg/l.

Pyriproxyfen is a pesticide used for vector control in drinking-water sources and containers. While the 3rd edition of the GDWQ included a GV of 0.3 mg/l, the 4th edition of the GDWQ does not specify a value for pyriproxyfen as it is not considered appropriate to establish guideline values for vector control pesticides. However, it has been included here because a

GV was set in the 3rd edition, and five of the countries and territories retain a value for this parameter.

Simazine

WHO Guideline value	0.002 mg/l
Number of countries and territories setting a regulatory / guideline value	26 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	6
Number of countries and territories setting the WHO Guideline	19
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.1 mg/l
Minimum value set	0.0015 mg/l
Median value	0.002 mg/l

Simazine was specified by 26 countries and territories, with the majority specifying the GV.

Sodium Dichloroisocyanurate

WHO Guideline value	50 mg/l
Number of countries and territories setting a regulatory / guideline value	1 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	1
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	50 mg/l
Minimum value set	50 mg/l
Median value	50 mg/l

Only one country set a value for this parameter.

Styrene

WHO Guideline value	0.02 mg/l (C)*
Number of countries and territories setting a regulatory / guideline value	27 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	18
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	1
Maximum value set	0.2 mg/l
Minimum value set	0.015 mg/l
Median value	0.02 mg/l

*Concentrations at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints

Twenty-seven of the 125 countries and territories surveyed specified a value for styrene, with the majority specifying the GV.

Terbuthylazine

WHO Guideline value	0.007 mg/l
Number of countries and territories setting a regulatory / guideline value	6 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	4
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.01 mg/l
Minimum value set	0.007 mg/l
Median value	0.007 mg/l

Six countries and territories specified a value for terbuthylazine, and of these, four specified the GV.

Tetrachloroethene

WHO Guideline value	0.04 mg/l
Number of countries and territories setting a regulatory / guideline value	75 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	2
Number of countries and territories setting the WHO Guideline	22
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	46
Maximum value set	0.2 mg/l
Minimum value set	0.001 mg/l
Median value	0.01 mg/l

Tetrachloroethene is among the most specified organic parameters, and one of few parameters where the majority of countries and territories specifying a value set it below the GV.

Trichloroacetic acid

WHO Guideline value	0.2 mg/l
Number of countries and territories setting a regulatory / guideline value	16 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting the WHO Guideline	7
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	9
Maximum value set	0.2 mg/l
Minimum value set	0.02 mg/l
Median value	0.1 mg/l

Seven out of 16 countries and territories specifying a value for trichloroacetic acid specified the GV.

1,1,1-Trichloroethane

WHO Guideline value	None specified
WHO Health-based value	2 mg/l
Number of countries and territories setting a regulatory / guideline value	18 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO health-based value	2
Number of countries and territories setting the WHO health-based value	9
Number of countries and territories setting a regulatory / guideline value less than WHO health-based value	7
Maximum value set	2001 mg/l
Minimum value set	0.03 mg/l
Median value	2.0 mg/l

Of the 18 countries and territories specifying a value for 1,1,1-trichloroethane, seven specified the GV.

Trichloroethene

WHO Guideline value	0.02 mg/l (provisional P)
Number of countries and territories setting a regulatory / guideline value	69 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	21
Number of countries and territories setting the WHO Guideline	7
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	41
Maximum value set	70 mg/l
Minimum value set	0.001 mg/l
Median value	0.01 mg/l

Almost three fifths of the 125 countries and territories surveyed specified a value for trichloroethene, with the majority (41/69) specifying values less than the provisional GV. Several countries and territories specified 0.01 mg/l jointly with tetrachloroethene.

2,4,6-Trichlorophenol

WHO Guideline value	0.2 mg/l (C)*
Number of countries and territories setting a regulatory / guideline value	32 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	1
Number of countries and territories setting the WHO Guideline	19
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	12
Maximum value set	0.3 mg/l
Minimum value set	0.002 mg/l
Median value	0.2 mg/l

*Concentrations at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints

The majority of countries and territories (19/32) specifying a value for this parameter specified the GV.

2,4,5-T (2,4,5-Trichlorophenoxy acetic acid)

WHO Guideline value	0.009 mg/l
Number of countries and territories setting a regulatory / guideline value	22 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	15
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.1 mg/l
Minimum value set	0.002 mg/l
Median value	0.009 mg/l

Twenty-two countries and territories specified a value for 2,4,5-Trichlorophenoxy acetic acid, and the majority of these parameter specified the GV.

Trifluralin

WHO Guideline value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	19 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	3
Number of countries and territories setting the WHO Guideline	16
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	0
Maximum value set	0.09 mg/l
Minimum value set	0.02 mg/l
Median value	0.02 mg/l

Of the 19 countries and territories that specified a value for trifluralin the majority specified the GV.

Trihalomethanes (Total)

WHO Guideline value (the sum of the ratios of the concentrations for Bromodichloromethane, Bromoform, Chloroform and Dibromochloromethane to their guideline values)	≤ 1
Number of countries and territories setting a regulatory / guideline value	67 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	0
Number of countries and territories setting a regulatory / guideline value at the WHO Guideline	9
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	58
Maximum value set	1
Minimum value set	0.001
Median value	0.1

The GDWQ set out a fractionation approach for total trihalomethanes (THMs), in which the sum of the ratios of concentrations for bromodichloromethane, bromoform, chloroform and dibromochloromethane to their GVs should not exceed 1. Information on these individual compounds is presented earlier in the section on organic parameters. The majority of the 66 countries and territories specifying a value for total THMs set a value below the GV, and only 10 specified a value for total THMs and a value for each of its constituent parameters.

Toluene

WHO Guideline value	0.7 mg/l (C)*
Number of countries and territories setting a regulatory / guideline value	39 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	5
Number of countries and territories setting the WHO Guideline	26
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	8
Maximum value set	1 mg/l
Minimum value set	0.01 mg/l
Median value	0.7 mg/l

*Concentrations at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints

Thirty-nine countries and territories specified a value for toluene, with the majority specifying the GV.

Vinyl Chloride

WHO Guideline value	0.0003 mg/l
Number of countries and territories setting a regulatory / guideline value	65 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	53
Number of countries and territories setting the WHO Guideline	10
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	2
Maximum value set	0.02 mg/l
Minimum value set	0.0001 mg/l
Median value	0.0005 mg/l

The majority of countries and territories specifying a value for vinyl chloride set 0.0005 mg/l, greater than the GV of 0.0003 mg/L.

Xylenes

WHO Guideline value	0.5 mg/l (C)*
Number of countries and territories setting a regulatory / guideline value	36 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline	7
Number of countries and territories setting the WHO Guideline	23
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline	6
Maximum value set	10 mg/l
Minimum value set	0.05 mg/l
Median value	0.5 mg/l

*Concentrations at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints

Thirty-six countries and territories specified a value for xylenes, and almost two thirds of these set the GV.

Parameters relating to acceptability, taste and odour and appearance

The GDWQ identify 26 chemically derived parameters and four biologically derived parameters relating to acceptability, taste, odour and appearance. The importance of these parameters is that if the water is unacceptable to consumers, it may lead to rejection of the water, and use of other aesthetically more acceptable but potentially less-safe waters. Generally the concentrations that cause rejection are significantly lower than those of concern for health. As such, with the exception of manganese, which is widely found in drinking-water sources, it may not be appropriate to directly regulate or monitor such parameters, as they may be addressed through a general requirement in the national standard or regulation that water be acceptable to the majority of consumers. For these parameters, the GDWQ may include a HBV, or a GV(C) in order to assist in determining a response when problems are encountered (and to provide reassurance with regard to possible health risks).

Some parameters have recommended values, mainly based on consumer acceptance. All the countries and territories in the survey specified values for some of the chemical and physical parameters. Three countries and territories included general statements that potable water should be free of algae. Most of the values that were set were guidance or indicator levels rather than mandatory standards.

The acceptability parameters most often specified were pH (hydrogen ion) (specified by 120 countries and territories), chloride (116), iron (116), aluminium (110) and sulfate (117). The least specified parameters were petroleum oils (3), and dissolved oxygen (5). In addition, 90 countries and territories had descriptive requirements for the taste parameter, and 88 for the odour parameter, such as: “acceptable to most consumers”, “not offensive”, “not objectionable”, “acceptable to consumers and no abnormal change”. Twenty-four countries and territories had numerical values for the odour parameter and thirteen for the taste parameter.

The details for copper, chlorine, 1,2- and 1,4-dichlorobenzene, ethylbenzene, manganese, styrene, toluene, 2,4,6-trichlorophenol and xylenes appear already in the sections on inorganic or organic parameters as appropriate.

Aluminium

WHO Guidance	A GV has not been established for aluminium although the GDWQ note that average residuals should not exceed levels needed to optimize coagulation in drinking-water plants that use aluminium-based coagulants (0.1-0.2 mg/l). It also notes that a health-based value of 0.9 mg/l could be derived, but this exceeds practicable levels based on coagulation in treatment plants.
Number of countries and territories setting a regulatory / guideline value	111 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline recommendation of 0.2 mg/l	7
Number of countries and territories setting a regulatory / guideline value at the WHO Guideline recommendation of 0.2 mg/l	88
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline recommendation of 0.2 mg/l	16
Maximum value set	0.5 mg/l
Minimum value set	0.03mg/l
Median value	0.2 mg/l

GDWQ also note that aluminium concentrations greater than 0.1-0.2 mg/l can lead to aesthetic issues

All but twenty-three of the 111 countries and territories specifying a value for aluminium set a value of 0.2 mg/l.

Ammonium

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	90 (out of 125)
Maximum value set	3 mg NH ₄ /l
Minimum value set	0.05 mg NH ₄ /l
Median value	0.5 mg NH ₄ /l

The threshold odour concentration of ammonia at alkaline pH is approximately 1.5 mg/l, and a taste threshold of 35 mg/l has been proposed for the ammonium cation. Ammonia is not of direct relevance to health at these levels, and no health-based guideline value has been

proposed. Ninety countries and territories specified a value for ammonium, with 51 specifying 0.5 mg NH₄/l; 22 specifying 1.5 mg NH₄/l, and many specifying values ≤ 1 mg NH₄/l.

Calcium

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	42 (out of 125)
Maximum value set	500 mg/l
Minimum value set	30 mg/l
Median value	150 mg/l

The GDWQ advise a taste threshold for calcium ion of 150 – 300 mg/l, depending on the associated anion. Forty-two countries and territories specified a value for this parameter, although it was not always clear if the value specified was quoted as calcium ion or as a calcium salt.

Chloramines

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	6 (out of 125)
Maximum value set	4 mg/l
Minimum value set	0.15 mg/l
Median value	3.5 mg/l

A GV of 3 mg/L is set for monochloramine, and the information is presented in the inorganic parameters section. No HBV or GV is set for di- and trichloramines, as the available data is inadequate to derive a health-based GV. For dichloramine, the organoleptic effects between 0.1 and 0.5 mg/l were found to be “slight” and “acceptable”. Odour and taste thresholds of 0.15 and 0.13 mg/l were reported, respectively. An odour threshold of 0.02 mg/l has been reported for trichloramine, and it has been described as “geranium”. Six countries and territories set a value for chloramines, ranging from 0.15 to 4 mg/l.

Chloride

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	117 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline recommendation of 250 mg/l	16
Number of countries and territories setting a regulatory / guideline value at the WHO Guideline recommendation of 250 mg/l	93
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline recommendation of 250 mg/l	8
Maximum value set	1000
Minimum value set	20
Median value	250

Chloride is one of the most specified aesthetic parameters, with 116 countries and territories specifying a value. The GDWQ mention that concentrations in excess of 250 mg/l are increasingly likely to be detected by taste, and most countries and territories specified this value.

Chlorobenzene

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	7 (out of 125)
Maximum value set	0.3 mg/l
Minimum value set	0.001 mg/l
Median value	0.1 mg/l

No GV has been set for chlorobenzene, however the GDWQ mention that odour thresholds of 0.002–0.01 and 0.0003–0.03 mg/l have been reported for 1,2- and 1,4-dichlorobenzene, respectively. Odour thresholds of 0.01, 0.005–0.03 and 0.05 mg/l have been reported for 1,2,3-, 1,2,4- and 1,3,5-trichlorobenzene, respectively. A taste and odour threshold concentration of 0.03 mg/l has been reported for 1,2,4-trichlorobenzene. Seven countries and territories specified a value for chlorobenzene, ranging from 0.001 to 0.3 mg/L.

Chlorophenols (other than 2,4,6-trichlorophenol)

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	10 (out of 125)
Maximum value set	0.3 mg/l
Minimum value set	0.0001 mg/l
Median value	0.001 mg/l

Chlorophenols generally have very low taste and odour thresholds. The taste thresholds in water for 2-chlorophenol, and 2,4-dichlorophenol are 0.0001, and 0.0003 mg/l, respectively. Odour thresholds are 0.01 and 0.04 mg/l, respectively. Ten countries and territories specified a value for this parameter, ranging from 0.0001 to 0.3 mg/L.

Colour

WHO Guideline value (true colour units)	None set
Number of countries and territories setting a regulatory / guideline value	94 with numerical values (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO Guideline recommendation of 15 TCU mg/l	20
Number of countries and territories setting a regulatory / guideline value at the WHO Guideline recommendation of 15 TCU mg/l	54
Number of countries and territories setting a regulatory / guideline value less than WHO Guideline recommendation of 15 TCU	20
Maximum value set	50 TCU
Minimum value set	0.5 TCU
Median value	15 TCU

The GDWQ suggest 15 TCU as the level for consumer acceptance. The majority (54/94) of countries and territories setting a value for the colour parameter set 15 TCU. Twenty-four countries and territories had only an advisory statement of “acceptable to consumers and no change”, and one country specified “colourless”.

Dissolved oxygen

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	5 (out of 125)
Maximum value set	8 mg/l
Minimum value set	4 mg/l
Median value	6 mg/l

Dissolved oxygen is one of the least specified parameters, with only four countries and territories specifying values ranging from 4 to 8 mg/L.

Hardness

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	65 (out of 125)
Maximum value set	1000 mg CaCO ₃ /l
Minimum value set	100 mg CaCO ₃ /l
Median value	425 mg CaCO ₃ /l

It was assumed that all quoted figures referred to mg CaCO₃/l although this was not always clear, especially when no method was specified. Sixty-five countries and territories set a value for this parameter, and several others also had target or desirable levels below their maximum value.

Hydrogen sulphide

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	26 (out of 125), with numerical values
Maximum value set	0.1 mg/l
Minimum value set	0.003 mg/l
Median value	0.05 mg/l

All 26 countries and territories set values within the taste threshold of 0.05 – 0.1 mg/l quoted in the GDWQ.

Iron

WHO Guideline value	None set*
Number of countries and territories setting a regulatory / guideline value	116 (out of 125)
Maximum value set	2 mg/l
Minimum value set	0.1 mg/l
Median value	0.3 mg/l

*However, the GDWQ indicates a precautionary level of 2 mg/l, which does not present a hazard to health

Almost all countries and territories set a value for this parameter. Fourteen countries and territories set a value above the GDWQ aesthetic limit of 0.3 mg/l at which staining of laundry and fixtures may occur. Thirty-eight countries and territories specified the lowest value of 0.2 mg/L.

Magnesium

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	46 (out of 125)
Maximum value set	1,000 mg/l
Minimum value set	0.1 mg/l
Median value	70 mg/l

The GDWQ advise that the taste threshold for magnesium is probably less than the 150 – 300 mg/l range for calcium. Forty-six countries and territories specified a value for this parameter, although it was not always clear whether the value specified was quoted as magnesium ion or as a magnesium salt.

Monochlorobenzene

WHO Guideline value	None specified
WHO Health-based value	0.3 mg/l
Number of countries and territories setting a regulatory / guideline value	14 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO health-based value	0
Number of countries and territories setting the WHO health-based value	4
Number of countries and territories setting a regulatory / guideline value less than WHO health-based value	10
Maximum value set	0.3 mg/l
Minimum value set	0.003 mg/l
Median value	0.1 mg/l

Taste and odour thresholds of 0.01–0.02 mg/l and odour thresholds ranging from 0.04 to 0.12 mg/l have been reported for monochlorobenzene. Of the 14 countries and territories setting a value for this parameter, the majority specified a value below the HBV.

Odour

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	24, with numerical values (out of 125)
Maximum value set	6 DN
Minimum value set	2 DN
Median value	3 DN

All countries and territories specifying a numerical value set dilution number (DN) as 3, except for four countries that specified 2 and one specifying 6. Eighty-eight countries and territories had an advisory statement such as “acceptable to consumers and no abnormal change”, “non-objectionable” or “not detectable”.

Petroleum Oils

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	3 (out of 125)
Maximum value set	0.3 mg/l
Minimum value set	0.1 mg/l
Median value	0.1 mg/l

Petroleum oils can give rise to the presence of a number of low molecular weight hydrocarbons that have low odour thresholds in drinking-water. Benzene, toluene, ethylbenzene and xylenes (BTEX) are considered in the organic parameters section. Only three countries and territories set values for this parameter.

pH Maximum

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	121 (out of 125)
Maximum value set	pH 10.5
Minimum value set	pH 8
Median value	pH 8.5

The GDWQ do not establish a GV for pH, as it usually has no direct impact on consumers at levels found in drinking-water. It is however an important operational parameter, and the GDWQ indicate an optimum pH range of 6.5-8.5. Only four country out of the 125 included in the survey did not specify a value for this parameter. Fifty-five countries and territories specified a value above the GDWQ suggested pH 8.5, but many included the note that chlorine disinfectant is only effective below pH 8. The highest value of pH 10.5 was set by one country.

pH Minimum

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	120 (out of 125)
Maximum value set	pH 7
Minimum value set	pH 5
Median value	pH 6.5

Only five countries did not specify a value for this parameter. Thirteen countries and territories specified a value below the optimum range discussed in the GDWQ of pH 6.5.

Sodium

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	93 (out of 125)
Maximum value set	400 mg/l
Minimum value set	100 mg/l
Median value	200 mg/l

The GDWQ notes that at room temperature, the average taste threshold for sodium is 200 mg/l. Eighty-three of the 93 countries and territories set this value, and only two set a higher value.

Sulfate

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	118 (out of 125)
Maximum value set	800 mg/l
Minimum value set	50 mg/l
Median value	250 mg/l

The GDWQ suggest taste impairment is minimal below 250 mg/l but can be up to 1,000 mg/l for calcium sulfate. One hundred and seventeen countries and territories set a value for this parameter, and the majority (82) specified 250 mg/l.

Synthetic Detergents (Anionic) (Surfactants)

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	32 (out of 125)
Maximum value set	2 mg/l
Minimum value set	0.01 mg/l
Median value	0.5 mg/l

The GDWQ advise that the concentration of detergents in drinking-water should not be allowed to reach levels giving rise to either foaming or taste problem. Thirty-two countries and territories specified a value for this parameter, of these, 13 set 0.5 mg/l.

Taste

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	13 (out of 125), with numerical values
Maximum value set	6 DN
Minimum value set	2DN
Median value	3 DN

Thirteen countries and territories specified numerical values for taste, and nine of these specified 3 DN. Ninety countries and territories had an advisory statement such as “acceptable to consumers and no abnormal change”, “non-objectionable” or “inoffensive”.

Temperature

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	18 (out of 125)
Maximum value set	34°C
Minimum value set	15°C
Median value	25°C

None of the values for temperature were mandatory, being guiding levels or operational goals. None of the countries and territories’ documents indicated what would happen if temperatures rose above the suggested value. In addition to those with numerical values, ten countries and territories had descriptive levels such as: 2.5 °C above normal; “not objectionable”; “air temperature plus 3 °C”; “acceptable”; and “ambient”.

Total dissolved solids

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	71 (out of 125)
Maximum value set	2500 mg/l
Minimum value set	200 mg/l
Median value	1000 mg/l

Seventy-one countries and territories set a value for this parameter. There was a wide range of values; from 200 mg/l to 2,500 mg/l. Thirty-nine countries and territories specified 1000 mg/l, eleven specified 500 mg/l.

Trichlorobenzenes (total)

WHO Guideline value	None specified
WHO Health-based value	0.02 mg/l
Number of countries and territories setting a regulatory / guideline value	11 (out of 125)
Number of countries and territories setting a regulatory / guideline value greater than WHO health-based value	3
Number of countries and territories setting the WHO health-based value	8
Number of countries and territories setting a regulatory / guideline value less than WHO health-based value	0
Maximum value set	0.03 mg/l
Minimum value set	0.02 mg/l
Median value	0.02 mg/l

Eleven countries and territories specified a value for trichlorobenzenes, and of these, eight set the HBV of 0.02 mg/l. Odour thresholds of 0.01, 0.005–0.03 and 0.05 mg/l have been reported for 1,2,3-, 1,2,4- and 1,3,5-trichlorobenzene, respectively. A taste and odour threshold concentration of 0.03 mg/l has been reported for 1,2,4-trichlorobenzene.

Turbidity

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	98 (out of 125), with numerical values
Maximum value set	25 NTU
Minimum value set	0.3 NTU
Median value	5 NTU

The GDWQ notes that turbidity should ideally be <1 NTU for water to be disinfected and that large well-run municipal supplies should be able to achieve turbidity levels of < 0.5 NTU at all times, with an average of <= 0.2 NTU. It also notes that turbidity levels of 4 NTU and above is visible to the naked eye. Sixteen countries and territories specified a value of 1 NTU or less. Many values were accompanied by comments, including one country that specified 20 NTU but stated that the monthly average of results must not exceed 2 NTU; and another that quoted 5 as an aesthetic limit but 1 NTU as an operational limit. seventeen countries and territories had descriptive statements only such as “acceptable to consumers and no abnormal change”.

Zinc

WHO Guideline value	None set
Number of countries and territories setting a regulatory / guideline value	90 (out of 125)
Maximum value set	15 mg/l
Minimum value set	1 mg/l
Median value	5 mg/l

The GDWQ note that zinc concentrations at around 4 mg/l may affect the taste of water. Forty-six out of 90 countries and territories reporting a value for this parameter specified 3 mg/l or less.

Radiological parameters

The GDWQ suggest screening levels for gross alpha and gross beta activity, as the process of identifying individual radionuclides is too cost-intensive for routine monitoring given their generally low concentration. If the screening levels for gross alpha and gross beta activity suggested by WHO are not being exceeded, the individual dose criterion (i.e. total dose) of 0.1 milliSieverts per year (mSv/year) will usually not be exceeded either. The idea of screening levels is that radioactivity should be assessed against these during routine monitoring. If the screening levels are being exceeded after having taken further samples to validate the findings, the contribution of K-40 (beta) should be subtracted from the gross beta activity following a separate determination of total potassium. If the screening values are still being exceeded, an analytical strategy for individual radionuclides should be determined.

In general, countries and territories that specified values for radiological parameters did not deviate significantly from the GDWQ. Forty-eight countries and territories specified screening values for gross alpha and gross beta activity, two in terms of a ratio or annual dose. Some expressed their values in terms of Picocurie per litre (pCi/l); these have been converted to their equivalents as Becquerel per litre (Bq/l) for this report. Thirty seven countries and territories specified a value for total dose in terms of mSv/yr. Only fourteen of these also specified values for gross alpha and beta activity.

The GDWQ list guidance levels for 191 radionuclides. However, most countries and territories specified values for only a few of these, including: radon (14); radium-226 (10); strontium-90 (13). Where countries and territories specified values for gross alpha and beta activity and total dose, most included advice on the steps that should be taken if any of these values were exceeded.

Total Dose / Individual Dose Criteria

WHO/IDC guidance	0.1 mSv/year*
Number of countries and territories setting a regulatory / guideline value	37 (out of 125)
Number of countries and territories setting a regulatory / guidance level greater than WHO/IDC guidance	2
Number of countries and territories setting the WHO IDC guidance	35
Number of countries and territories setting a regulatory / guidance level less than WHO/IDC guidance	0
Maximum value set	1 mSv/year
Minimum value set	0.1 mSv/year
Median value	0.1 mSv/year

*This value is translated into operational targets to be measured by water suppliers and regulators as the screening values (gross alpha and gross beta, which are listed in the tables below) and guidance levels (which are listed in Table 9.2 of Chapter 9 of the GDWQ). The GDWQ notes that the IDC represents a very low level of health risk and also refers to the International Radiation Basic Safety Standards (BSS), (IAEA, 2014) reference level. The BSS, which is co-sponsored by eight international organizations including WHO, has established a reference level for the radiation dose due to the consumption of drinking-water of 1 mSv/year. It is generally advisable for countries to establish a national standard between 0.1 and 1 mSv/year, where 0.1 mSv/year is achievable for most countries.

Almost all countries have established their IDC as 0.1 mSv/year, and the EC Council Directive 2013/51/EURATOM also adopted a total indicative dose of 0.1 mSv/year. Only two countries out of the 37 that specified a value for this parameter set a value above 0.1 mSv/year.

Gross alpha activity

WHO Screening level	0.5 Bq/l
Number of countries and territories setting a regulatory / guidance level	57 (out of 125)
Number of countries and territories setting a regulatory / guidance level greater than WHO Screening level	4
Number of countries and territories setting the WHO Screening level	16
Number of countries and territories setting a regulatory / guidance level less than WHO Screening level	37
Maximum value set	0.56 Bq/l
Minimum value set	0.037 Bq/l
Median value	0.1 Bq/l

Twelve countries and territories specified the WHO screening level (or its equivalent when their values are converted from pCi/l).

Gross beta activity

WHO Screening level	1 Bq/l
Number of countries and territories setting a regulatory / guidance level	57 (out of 125)
Number of countries and territories setting a regulatory / guidance level greater than WHO Screening level	6
Number of countries and territories setting the WHO Screening level	46
Number of countries and territories setting a regulatory / guidance level less than WHO Screening level	5
Maximum value set	2.0 Bq/l
Minimum value set	0.1 Bq/l
Median value	1 Bq/l

Forty-six countries and territories specified the WHO screening level (or its equivalent when their values are converted from pCi/l). Six countries specified values above the WHO screening level, and five specified values less than the WHO screening level.

Microbiological parameters

The GDWQ identify 43 microbial parameters, which include bacterial, viral, protozoan, and helminth pathogens, as well as toxic cyanobacteria. The verification of microbial water safety is normally based on testing of indicator organisms, and the GDWQ include a GV for *Escherichia coli* (*E. coli*) or thermotolerant coliforms). Countries and territories in the survey designated numerical standards for 24 microbiological parameters. However, four of these parameters were designated by only one country and a further sixteen by less than ten countries and territories.

Values for *E. coli* (or faecal coliforms or thermotolerant coliforms) were specified by 119 countries and territories, then total coliforms (110 countries and territories), enterococci (faecal streptococci) (53 countries and territories), sulphite-reducing Clostridia (*Clostridium perfringens*) (44 countries and territories), total heterotrophic bacteria at 22°C (29 countries and territories) and total heterotrophic bacteria at 37°C (26 countries and territories) and *Pseudomonas aeruginosa* (17 countries and territories);. The other parameters were: Enteric viruses (seven countries and territories); Cryptosporidium and Giardia (seven countries and territories); Salmonella (six countries and territories);, somatic coliphages and *Staphylococcus aureus* (five countries and territories); pathogenic protozoa and Shigella (three countries and territories); amoeba, free living organisms, helminths, Legionella (two countries and territories);, *Vibrio cholerae*, nematodes, parasites and plankton (one country).

The normal value for microbiological parameters, other than heterotrophic bacteria, was zero or absent per volume (usually 100 ml for bacterial parameters and 10 litres for protozoa) although many countries and territories' values accepted that coliform bacteria would be detected in samples on occasions.

In addition to setting values for some microbiological parameters, many countries and territories' documentation included a statement the same as or similar to that in the European Drinking-water Directive that drinking-water "shall be free from any micro-organisms and parasites which, in numbers or concentrations, constitute a potential danger to human health".

Clostridium perfringens (Sulphite-reducing anaerobes)

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	44 (out of 125)
Maximum value set	2 per 20 ml
Minimum value set	0 per 100 ml
Median value	0 per 100 ml

The GDWQ state that *Clostridium perfringens* has only limited value as a possible indicator of enteric viruses and protozoan (oo)cysts but may be useful as an indicator of the effectiveness of filtration processes. All countries and territories but one specifying a value for this parameter specified zero per 100 ml (or in some cases 20 ml or 50 ml) for this parameter.

Coliform bacteria (Total)

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	110 (out of 125)
Maximum value set	50 per 100 ml
Minimum value set	0 per 100 ml
Median value	0 per 100 ml

The GDWQ highlight that total coliform bacteria include organisms that can survive and grow in water so they are not useful as an indicator of faecal pathogens. It recommends that total coliforms should be absent immediately after treatment and presence of these organisms indicates inadequate treatment. Few countries and territories appeared to recognize this in their setting values. While six countries and territories did not specify a value for total coliforms, the others generally specified a value of zero for this parameter. Some specified <1.1 per 100 ml for analysis by most probable number technique. Where the value specified was greater than zero (e.g. 10 per 100 ml; 6 per 100 ml; or 3 per 100 ml), in most cases this was qualified by not detecting coliform bacteria in two consecutive samples or 95% of annual samples or both. One country specified 10 per 100ml as an operational value; another specified 100 coliform bacteria per 100 ml in a maximum of 1% of samples; 10 per 100 ml in a maximum of 4% of samples; and “not detected” in a minimum of 95% of samples. One country designated the highest value as a maximum allowable range of 50 – 150 per 100 ml, but a recommended maximum limit of 10 per 100 ml.

Enterococci (Faecal streptococci)

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	53 (out of 125)
Maximum value set	0 per 100 ml
Minimum value set	0 per 100 ml
Median value	0 per 100 ml

The GDWQ advise that intestinal enterococci can be used as an indicator of faecal pollution and may survive longer in water than *E coli*. All countries and territories specifying a value for this parameter specified zero per 100 ml, and one specified that the value should be zero per 100 ml in 95% of samples (where more than 20 are taken annually) and not be present in consecutive samples.

Escherichia coli (Faecal coliforms, Thermotolerant coliforms)

WHO Guideline value	Must not be detectable in any 100ml sample
Number of countries and territories setting a regulatory / guideline value	103 (out of 125)
Maximum value set	20 per 100 ml
Minimum value set	0
Median value	0

For the purposes of this survey, faecal coliforms and thermotolerant coliforms have not been counted separately where they have been specified by countries and territories in addition to *E coli* because the value has always been zero per 100 ml. The GDWQ advise that the presence of *E coli* (or thermotolerant coliforms) provides evidence of recent faecal contamination. All countries and territories specified a value of zero per 100 ml except one country, which specified 20 per 100 ml. One country did not specify a value for this parameter, just specifying zero per 100 ml for coliforms.

Total heterotrophic bacteria 22°C

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	29 (out of 125)
Maximum value set	2,000 cfu per ml
Minimum value set	5 cfu per ml
Median value	100 cfu per ml

The GDWQ advise that the test for this parameter has little value as an indicator of pathogen presence but can be useful in operational monitoring as a treatment and disinfectant indicator and for assessing the cleanliness of distribution systems. The objective is to keep numbers as low as possible. The EU countries specified “no abnormal change” for this parameter.

Total heterotrophic bacteria 37°C

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	26 (out of 125)
Maximum value set	500 cfu per ml
Minimum value set	0 cfu per ml
Median value	20 cfu per ml

The GDWQ advise that the test for this parameter has little value as an indicator of pathogen presence but can be useful in operational monitoring as a treatment and disinfectant indicator and for assessing the cleanliness of distribution systems. The objective is to keep numbers as low as possible.

Additional parameters

In the documentation used for this survey countries and territories specified 865 numerical values for 287 inorganic, organic, aesthetic and physical parameters that do not have a WHO GV, HBV or aesthetic limit. The additional parameters with numerical standard values most often specified, and reported in this section are: Conductivity (51 countries and territories); total polynuclear aromatic hydrocarbons (PAH) (44); oxidizability (permanganate value) (43); phenols (35); formaldehyde (19); silver (24); potassium (12); and propanil (11).

Conductivity

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	52 (out of 125)
Maximum value set	2700 $\mu\text{S}/\text{cm}$
Minimum value set	170 $\mu\text{S}/\text{cm}$
Median value	2500 $\mu\text{S}/\text{cm}$

Under half (52/125) of the countries and territories included in the survey specified a value for conductivity. A wide range of values were specified, from 170 to 2,700 $\mu\text{S}/\text{cm}$. Twenty-nine countries and territories specified 2500 $\mu\text{S}/\text{cm}$.

Formaldehyde

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	24 (out of 125)
Maximum value set	1 mg/l
Minimum value set	0.01 mg/l
Median value	0.9 mg/l

The GDWQ advise that this parameter occurs in drinking-water at concentrations well below those of health concern and specifies a tolerable concentration of 2.6 mg/l for ingested formaldehyde. Twenty-four countries and territories specified a value for formaldehyde, and of these, thirteen set 0.9 mg/l.

Oxidizability (permanganate value)

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	42 (out of 125)
Maximum value set	20 mg/l
Minimum value set	3 mg/l
Median value	5 mg/l

Forty-two countries and territories specified a value for this parameter, with the majority (35/42) setting 5 mg/l.

Total Polynuclear Aromatic Hydrocarbons (PAH)

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	45 (out of 125)
Maximum value set	0.01 mg/l
Minimum value set	0.0001 mg/l
Median value	0.0001 mg/l

The GDWQ do not advise a health-based guideline value for total PAH. Benzo(a)pyrene has a health-based value of 0.0007 mg/l (see organic parameters). For fluoranthene it advises that it occurs in drinking-water at concentrations well below those of health concern but a health-based value of 0.004 can be calculated on available data. Forty-five countries and territories specified a value for total PAHs, of these, 32 set 0.0001 mg/l.

Phenols

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	41 (out of 125)
Maximum value set	1 mg/l
Minimum value set	0.0003 mg/l
Median value	0.002 mg/l

The GDWQ do not advise a health-based guideline value for total phenols. 2,4,6-Trichlorophenol has a provisional GV (C) of 0.2 mg/l (see organic parameters), and summary information on chlorophenols other than 2,4,6-trichlorophenol is presented in the sections on acceptability parameters. Forty-one countries and territories specified a value for phenols. Over a third (15/41) set 0.002 mg/l.

Potassium

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	16 (out of 125)
Maximum value set	50 mg/l
Minimum value set	0.2 mg/l
Median value	12 mg/l

The GDWQ advise that currently, there is no evidence that potassium levels in municipally treated drinking-water, even water treated with potassium permanganate, are likely to pose any risk for the health of consumers. It is not considered necessary to establish a health-based guideline value for potassium in drinking-water. Sixteen countries and territories specified a value for potassium.

Propanil

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	12 (out of 125)
Maximum value set	0.7 mg/l
Minimum value set	0.02 mg/l
Median value	0.02 mg/l

The GDWQ advise that although a health-based value for propanil can be derived, this has not been done, because propanil is readily transformed into metabolites that are more toxic. Two of these metabolites, 3,4-dichloroaniline and 3,3',4,4'-tetrachloroazobenzene, are more toxic and more persistent than the parent compound.

Therefore, a guideline value for propanil is considered inappropriate and there are inadequate data on the metabolites to allow the derivation of guideline values for them. All of the twelve countries and territories setting a value for propanil specified 0.02 mg/l except one, which specified 0.7 mg/l. No country or territory specified a value for metabolites of propanil.

Silver

WHO Guideline value	None specified
Number of countries and territories setting a regulatory / guideline value	29 (out of 125)
Maximum value set	0.1 mg/l
Minimum value set	0.01 mg/l
Median value	0.05 mg/l

The GDWQ advise that the available data is inadequate to permit the derivation of a health-based guideline value; however, a concentration of 0.1mg/l could be tolerated without risk to health. Twenty-nine countries and territories specified a value for silver, and none set a value above 0.1 mg/l.

Conclusion

The GDWQ emphasize the importance of setting risk-based standards and adopting the specifications in the guidelines to local resources and needs. The GDWQ do not only provide guidance on standard-setting, but also on a holistic water safety framework that includes the establishment of national standards, as well as preventive risk management approaches (e.g. Water Safety Plans), and independent surveillance.

For the purpose of this report, only the standards that countries and territories are specifying for different water quality parameters were reviewed. In that context, it was found that the GDWQ play an overall significant role in countries and territories' setting of values that define drinking-water quality. More than half of the countries and territories in the survey reference the GDWQ directly (e.g. Iceland) or indirectly (e.g. Norway) by referencing other countries and territories which referenced the GDWQ. This figure is actually likely to be higher as the full value standard was not always available. Another limitation of this report is that direct comparison between countries and territories is difficult because standards in different countries and territories can be mandatory, recommended and/or risk-based. Direct comparison is further difficult and should be approached with caution, as national standards should be developed considering the local context. It must also be kept in mind that countries and territories review their specification for drinking-water quality with a different rhythm than to when updates to the GDWQ are published. However, the values included in the GDWQ and their role in providing orientation to countries and territories is underlined by the number of countries and territories making reference to the GDWQ in their specifications, and in a great many cases specifying GVs.

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