DRAFT Drinking-Water Standards for New Zealand 202X

The Standards

Water suppliers are required to provide their consumers with safe water, i.e. water that is unlikely to cause harm either immediately or over a period of time (Section 21 of the *Water Services Bill*). To assist in determining when a drinking water is safe to consume, the standards set limits on the concentration of determinands in the water, the maximum acceptable values (MAV), and specify expected outcomes from the treatment of the water. Compliance with these standards is necessary, but not sufficient, for establishing that drinking-water is safe.

The standards apply to all supplies, regardless of the nature of the source water in use, and number of people served by the supply. All consumers on a supply should receive water that meets these standards and therefore the standards must be met at all points in a distribution system.

While the standards establish limits on the composition of the water all consumers should receive, they do not specify the monitoring required to show, to an acceptable level of confidence, that they are being met. Monitoring requirements and other compliance criteria are contained in operational compliance rules produced by Taumata Arowai.

The standards do not promote drinking-water as a means of addressing dietary deficiencies. Consequently, they do not specify minimum determinand concentrations required to achieve beneficial health effects. In particular, they do not specify the concentration of fluoride required for benefiting dental health, nor do they state a requirement for water fluoridation.

Maximum Acceptable Values

The MAV of a microorganism is its concentration in drinking-water above which there is a significant risk of contracting a waterborne (enteric) disease. MAVs are not given for all microorganisms of health significance (pathogens). Instead, MAVs are provided for representative organisms: *Escherichia coli (E. coli)*, representative of bacteria, and *Cryptosporidium* plus *Giardia*, representative of protozoa. *E. coli* is used as indicator of bacterial risk. Its presence is evidence of recent faecal contamination and therefore of the possible presence of pathogens.

The MAV of a chemical determinand is the highest concentration of the determinand expected, on the basis of present knowledge, not to cause any significant risk to the health of the consumer over 70 years of consumption of 2 litres per day of that water. MAVs for carcinogenic determinands are conservatively set, where possible, as the concentration in drinking water associated with an estimated excess lifetime cancer risk of 10^{-5} (or one additional case of cancer per 100,000 of the population ingesting drinking-water containing the substance at the guideline value for 70 years).

Wherever possible, the MAVs are derived from World Health Organization (WHO) guideline values adjusted for a 70 kg bodyweight, where bodyweight is required in the calculation.

Some MAVs have been set in the absence of a WHO guideline value, for one of two reasons:

a. The WHO has derived a health-based value, but not established a formal guideline value, often because the determinand occurs at concentrations well below those of health concern. Where there is evidence of the determinand being detected at concentrations near the health based value in New Zealand waters, the MAV has been set at the WHO's health-based value (bodyweight corrected).
b. A determined is, or has been, registered or approved for use in New Zealand but the WHO provides neither a guideline value nor a health-based value. In these cases, the MAV calculation is based on toxicological data considered appropriate by another international body or the *Australian Drinking Water Guidelines*.

MAVs are not provided for contaminants of emerging concern for which there is no WHO guideline or health-based value.

Advances in scientific knowledge may lead to changes in the MAVs. When evidence for these changes becomes available, revised MAVs will be included in later editions of the Standards.

Table 1: MAVs for Microbiological Determinands

Determinand	MAV[1]
Escherichia coli[2]	Less than 1 in 100 ml of sample
Total pathogenic protozoa	Less than one infectious (oo)cyst per 100 L of sample[3]

1. These are maximum acceptable values for regulatory purposes. They do not represent a dose/response relationship that can be used as the basis for determining acceptable concentrations of pathogens in drinking water.
2. Indicator organism.
3. The methods available for enumerating pathogenic protozoa are becoming less expensive and more reliable, but they are not yet suitable for routine monitoring of treated water quality. Although new methods of assessing the infectiousness of protozoa by using human cell cultures have been developed, they are not yet suitable for routine monitoring of *Cryptosporidium* contamination of drinking-water. The referee method cannot identify the species of *Giardia* or *Cryptosporidium*; nor can it determine the viability or infectivity of detected cysts or oocysts (ie, (oo)cysts). Until the methodology improves, results are to be reported as verified (oo)cysts.

Table 2: MAVs for Inorganic Determinands

Determinand	MAV	Units	Notes
Aluminium	1	mg/L	Health-based value derived by WHO, but no guideline value established. Concentrations near the MAV in some NZ supplies.
Antimony	0.02	mg/L	
Arsenic	0.01	mg/L	For excess lifetime skin cancer risk of 6×10^{-4}. Limited by analytical and treatment difficulties.
Barium	1.5	mg/L	
Boron	2.4	mg/L	
Bromate	0.01	mg/L	For excess lifetime cancer risk of 7×10^{-5}.
Cadmium	0.003	mg/L	
Chlorate	0.7	mg/L	Disinfection must never be compromised.
Chlorine	5	mg as Cl_2/L	Disinfection must never be compromised.
Chlorite	0.8	mg/L	Disinfection must never be compromised. DBP
Chromium	0.05	mg/L	Total chromium
Copper	2	mg/L	
Fluoride	1.5	mg/L	
Lead	0.01	mg/L	
Manganese	0.4	mg/L	Health-based value derived by WHO, but no guideline value established. Concentrations near the MAV in some NZ supplies.
Mercury	0.006	mg/L	Inorganic mercury.
Monochloramine	3	mg as Cl_2/L	

Determinand	MAV	Units	Notes
Nickel	0.08	mg/L	
Nitrate, short term	50	mg/L	
Nitrite, short term	3	mg/L	
Nitrate and nitrite	The sum of the ratio should not exceed 1		The sum of the ratio of the concentration of each to its respective MAV should not exceed 1
Perchlorate	0.08	mg/L	Disinfection must never be compromised.
Selenium	0.04	mg/L	
Uranium	0.03	mg/L	

Table 3: MAVs for Organic Determinands (Cyanotoxin MAVs are provided in a separate table).

Determinand	MAV	Units	Notes
Acrylamide	0.0005	mg/L	For excess lifetime cancer risk of 10^{-5}.
Alachlor	0.02	mg/L	Pesticide. For excess lifetime cancer risk of 10^{-5}.
Aldicarb	0.01	mg/L	Pesticide
Aldrin + dieldrin	0.00004	mg/L	Pesticide. Sum of, not each.
Atrazine	0.1	mg/L	Pesticide. Sum of atrazine and its metabolites
Azinphos methyl	0.1	mg/L	Pesticide.
Benzene	0.01	mg/L	For excess lifetime cancer risk of 10^{-5}.
Benzo(a)pyrene	0.0007	mg/L	For excess lifetime cancer risk of 10^{-5}.
Bromacil	0.4	mg/L	Pesticide.
Bromodichloromethane	0.06	mg/L	DBP. For excess lifetime cancer risk of 10^{-5}.
Bromoform	0.1	mg/L	DBP
Carbofuran	0.008	mg/L	Pesticide
Carbon tetrachloride	0.005	mg/L	
Chlordane	0.0002	mg/L	Pesticide
Chloroform	0.4	mg/L	DBP
Chlorotoluron	0.04	mg/L	Pesticide
Chlorpyriphos	0.04	mg/L	Pesticide
Cyanazine	0.0007	mg/L	Pesticide
2,4-D	0.04	mg/L	Pesticide
2,4-DB	0.1	mg/L	Pesticide
DDT + isomers	0.001	mg/L	Pesticide. Sum of all isomers
Di(2-ethylhexyl) phthalate	0.009	mg/L	
1,2-Dibromo-3-chloropropane	0.001	mg/L	For excess lifetime cancer risk of 10^{-5}.

Determinand	MAV	Units	Notes
Dibromoacetonitrile	0.08	mg/L	DBP
Dibromochloromethane	0.15	mg/L	DBP
1,2-Dibromoethane	0.0004	mg/L	For excess lifetime cancer risk of 10^{-5}.
Dichloroacetic acid	0.05	mg/L	DBP
Dichloroacetonitrile	0.02	mg/L	DBP
1,2-Dichlorobenzene	1.5	mg/L	
1,4-Dichlorobenzene	0.4	mg/L	
1,2-Dichloroethane	0.03	mg/L	For excess lifetime cancer risk of 10^{-5}.
1,2-Dichloroethene	0.06	mg/L	Total of cis and trans isomers
Dichloromethane	0.02	mg/L	
1,2-Dichloropropane	0.05	mg/L	
1,3-Dichloropropene	0.02	mg/L	Total of cis and trans isomers. For excess lifetime cancer risk of 10^{-5}.
Dichlorprop	0.1	mg/L	Pesticide
Dimethoate	0.008	mg/L	Pesticide
1,4-Dioxane	0.06	mg/L	For excess lifetime cancer risk of 10^{-5}.
Diuron	0.02	mg/L	Pesticide
EDTA (editic acid)	0.7	mg/L	
Endrin	0.001	mg/L	Pesticide
Epichlorohydrin	0.0005	mg/L	
Ethylbenzene	0.3	mg/L	
Fenoprop	0.01	mg/L	Pesticide
Hexachlorobutadiene	0.0007	mg/L	
Hexazinone	0.4	mg/L	Pesticide
Hydroxyatrazine	0.3	mg/L	Atrazine metabolite
Isoproturon	0.01	mg/L	Pesticide
Lindane	0.002	mg/L	Pesticide
MCPA	0.8	mg/L	Pesticide. Health-based value derived by WHO, but no guideline value established. Occasionally found in NZ bores, at concentrations an order of magnitude below the MAV.
Mecoprop	0.01	mg/L	Pesticide
Metalaxyl	0.3	mg/L	Pesticide
Methoxychlor	0.02	mg/L	Pesticide
Metolachlor	0.01	mg/L	Pesticide
Metribuzin	0.07	mg/L	Pesticide
Molinate	0.007	mg/L	Pesticide

Determinand	MAV	Units	Notes
Monochloroacetic acid	0.02	mg/L	DBP
Nitrilotriacetic acid (NTA)	0.2	mg/L	
N-nitrosodimethylamine (NDMA)	0.0001	mg/L	
Oryzalin	0.4	mg/L	Pesticide
Oxadiazon	0.2	mg/L	Pesticide
Pendimethalin	0.02	mg/L	Pesticide
Pentachlorophenol	0.009	mg/L	Pesticide. For excess lifetime cancer risk of approximately $10^{-5.}$
PFHxS[2] + PFOS[3]	0.00007	mg/L	Sum of
PFOA[4]	0.00056	mg/L	
Picloram	0.2	mg/L	Pesticide
Pirimiphos methyl	0.1	mg/L	Pesticide
Primisulfuron methyl	0.9	mg/L	Pesticide
Procymidone	0.4	mg/L	Pesticide
Propazine	0.07	mg/L	Pesticide
Pyriproxifen	0.4	mg/L	Pesticide
Simazine	0.002	mg/L	Pesticide
Sodium dichloroisocyanurate (as cyanuric acid)	40	mg /L	
Styrene	0.03	mg/L	
2,4,5-T	0.01	mg/L	Pesticide
Terbacil	0.04	mg/L	Pesticide
Terbuthylazine	0.008	mg/L	Pesticide
Tetrachoroethene	0.05	mg/L	
Thiabendazole	0.4	mg/L	Pesticide
Toluene	0.8	mg/L	
Trichloroacetic acid	0.2	mg/L	DBP
Trichloroethene	0.03	mg/L	
2,4,6-Trichlorophenol	0.2	mg/L	For excess lifetime cancer risk of $10^{-5.}$
Triclopyr	0.1	mg/L	Pesticide
Trifluralin	0.03	mg/L	Pesticide
Trihalomethanes(THMs)	The sum of the should not exceed 1		DBP. The sum of the ratio of the concentration of each to its respective MAV should not exceed 1
Vinyl chloride	0.0003	mg/L	For excess lifetime cancer risk of $10^{-5.}$
Xylenes (total)	0.6	mg/L	

Determinand	MAV	Units	Notes
1080	0.035	mg/L	Pesticide. Short-term exposure.

1 Aminomethylphosphonic acid.

2 PHFxS – perfluorohexane sulfonate

3 PFOS - perfluorooctane sulfonate

4 PFOA - perfluorooctanoic acid

Table 4: MAVs for Cyanotoxin Determinands

Determinand	MAV	Units	Notes
Anatoxins	6	(µg/L)	Cyanotoxin. PMAV. Expressed as anatoxin-a toxicity equivalents.
Cylindrospermopsins	0.7	(µg/L)	Cyanotoxin. PMAV. Expressed as cylindrospermopsin toxicity equivalents.
Microcystins / Nodularins	1	(µg/L)	Cyanotoxin. PMAV. Expressed as microcystin-LR toxicity equivalents.
Saxitoxins	3	(µg/L)	Cyanotoxin. PMAV. Expressed as saxitoxin-equivalents.

Table 5: MAVs for Radiological Determinands

Determinand	MAV	Unit
Total alpha activity	0.5	Bq/L excluding radon
Total beta activity	1	Bq/L excluding potassium-40
Radon	100	Bq/L

Aesthetic Values

The aesthetic properties of a water concern its taste, odour, appearance and in some instances its feel (at higher pH values). Consumers will generally be more aware of these properties of their drinking water than the presence of health-significant determinands that influence the water's safety. A water is considered *acceptable* when its aesthetic properties are not objectionable to the majority of its consumers and the values of specific determinands lie within the acceptable range set out in the table below.

Most aesthetic properties do not *directly* influence the safety of the water. However, in extreme cases, water that consumers consider aesthetically unacceptable can cause them to seek water from other, possibly unsafe, sources. To guard against this possibility, water suppliers have a legal duty (*Section 24, Water Services Bill*) to take all reasonably practicable steps to ensure that they provide their consumers with aesthetically acceptable water.

The table below lists some determinands that can adversely affect the aesthetic properties of drinking water and the approximate range within which the determinand should be aesthetically acceptable. The acceptable ranges are those that scientific studies and experience indicate should ensure a water that is acceptable to most consumers. Where the World Health Organization (WHO) has set acceptability values for a determinand, this value has been adopted. Sensitivity to determinands varies between individuals; some are more sensitive to some determinands than the majority of the population. Therefore, it is not possible to say that meeting these values will ensure acceptability of the water for everybody.

The table's most important component is the general requirement that taste, and odour, should be acceptable to most consumers. This is not necessarily achieved by all numerical values in the table being met, because of the wide range of determinands that can adversely affect the aesthetic properties of a water.

In addition to testing to determine that the values in Table 1 have been met, water suppliers must be aware of their consumers' perception of the acceptability of their water supply. Complaints about water quality can provide valuable information about the quality of the reticulated water, and in some instances may alert the water supplier to the presence of determinands of health significance.

Table 1: Acceptable ranges for determinands that may affect the aesthetic properties of a drinking water

Determinand	Acceptable Range	Unit	Comments
Aluminium	≤ 0.1	mg/L	Above this value, complaints of depositions or discoloration may arise.
Ammonia	≤ 1.5	mg/L	Odour threshold (alkaline conditions).
Calcium			See 'Hardness'.
Chloride	≤ 250	mg/L	Taste threshold (depends on the counter ion: sodium, calcium or potassium).
Chlorine	0.3 – 0.6	mg/L as Cl_2	Taste and odour threshold (pH-dependant). *(Disinfection must not be compromised in trying to avoid taste and odour complaints).*
2-Chlorophenol	≤ 0.0001	mg/L	Taste threshold.
	≤ 0.01		Odour threshold.
Colour	≤ 15	TCU	Appearance.
Copper	≤ 1	mg/L	Staining of laundry and sanitary ware.
1,2-Dichlorobenzene	≤ 0.001	mg/L	Taste threshold.
	≤ 0.002		Odour threshold.
1,4-Dichlorobenzene	≤ 0.0003	mg/L	Odour threshold.
	≤ 0.006		Taste threshold.
2,4-Dichlorophenol	≤ 0.0003	mg/L	Taste threshold.
	≤ 0.04		Odour threshold.
Ethylbenzene	≤ 0.002	mg/L	Odour threshold.
	≤ 0.08		Taste threshold.
Hardness (total) (Ca + Mg) as $CaCO_3$	≤ 200	mg/L	Scale deposition, scum formation, depending on pH and alkalinity. Low hardness (<100) may be more corrosive.
	≤ 100–300		Taste threshold (Ca; depends on counter ion).
Hydrogen sulphide	≤ 0.05	mg/L	Taste and odour threshold.
Iron	≤ 0.3	mg/L	Staining of laundry and sanitary ware.
Magnesium			See hardness.
Manganese	≤ 0.04	mg/L	Staining of laundry.
	≤ 0.10		Taste threshold.
Monochlorobenzene	≤ 0.01	mg/L	Taste and odour threshold.
pH	7.0–8.5		Ideally 7.4 – 8.0. Most waters with a low pH have a high plumbosolvency. Waters with a high pH have a soapy taste and feel. A pH less than 8 is preferable for effective disinfection with chlorine.
Sodium	≤ 200	mg/L	Taste threshold (depends on counter ion).

Determinand	Acceptable Range	Unit	Comments
Styrene	≤ 0.004	mg/L	Odour threshold.
Sulphate	≤ 250	mg/L	Taste threshold.
Taste and odour	Acceptable to most consumers		
Temperature	Preferably not more than 15°C		
Toluene	≤ 0.03	mg/L	Odour threshold.
	≤0.04		Taste threshold.
Total dissolved solids	≤ 1000	mg/L	Taste may become unacceptable from 600–1200 mg/L.
Trichlorobenzenes (total)	see below		
1,2,3-Trichlorobenzene	≤ 0.01	mg/L	Odour threshold.
1,2,4-Trichlorobenzene	≤ 0.005	mg/L	Odour threshold.
1,3,5-Trichlorobenzene	≤ 0.05	mg/L	Odour threshold.
2,4,6-Trichlorophenol	≤ 0.002	mg/L	Taste threshold.
	0.3	mg/L	Odour threshold.
Turbidity	≤ 4	NTU	Appearance. See compliance criteria for effects on disinfection.
Xylene	≤ 0.02	mg/L	Odour threshold.
Zinc	≤ 1.5	mg/L	Taste threshold.