AWQC

DISINFECTION BY-PRODUCTS

The Australian Water Quality Centre (AWQC) is dedicated to ensuring and responding to the public health requirements relating to the provision of water and wastewater services for communities in Australia and across the world.

Specialist water services

Ensuring public health

Trihalomethanes, Halogenated acetic acids, MX, Cyanogen chloride, DBP_551, Halogenated phenols and Formaldehyde

Disinfection by-products (DPBs) form when bromide and/or natural organic matter found in source water reacts with chemical treating agents during the disinfection process. The treatment process may include chlorination, chloramination or ozonation and along with the water being treated may influence the type and amount of DBPs that are formed. The AWQC offers a wide range of NATA accredited tests for the determination of the various DBPs.

Trihalomethanes: are the most common disinfection by-products tested for and include the compounds listed below. These are analysed by headspace gas chromatography with an electron capture detector (GC/ECD).

Also offered is trihalomethane formation potential (THM-FP), where the amount of THMs formed during chlorination of source water can be determined under controlled conditions. Do not add ascorbic acid or ammonium chloride for THM-FP analysis.

NATA WORLD RECOGNISED ACCREDITATION

bsi. ISO 9001:2015 Quality Management

Halogenated Acetic Acids are another group of DBPs that are also formed during the disinfection process. The AWQC has NATA accreditation for these compounds (as listed below) analysed by gas chromatography coupled to an electron capture detector (GC/ECD).

HAA Components and Limits of Reporting			
Compound	LOR(µg/L)	Compound	LOR(µg/L)
Monochloroacetic acid	3	Dibromoacetic acid	1
Dichloroacetic acid	1	Bromodichloroacetic acid	1
Trichloroacetic acid	1	Chlorodibromoacetic acid	1
Bromoacetic acid	1	Tribromoacetic acid	1
Bromochloroacetic acid	1		

MX: (3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone) is a member of the halogenated hydroxyfuranone class and is classified as a mutagenic by-product in chlorinated water. Because of its complexity, it is often associated with the chlorine treatment of effluent/sewage. It is analysed by gas chromoatography attached to a MS/MS detector (GC/MS/MS).

MX Component and Limit of Reporting	LOR(µg/L)
3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone	1

Cyanogen Chloride (CNCl): is an inorganic compound produced when source water containing cyanide compounds are chlorinated. It may also form during the chloramination treatment process along with other by-products of which there is little known about. Cyanogen chloride is a volatile gas, slightly soluble in water, but highly toxic even at low concentrations. It is analysed by headspace gas chromatography with an electron capture detector (GC/ECD).

CNCl Component and Limit of Reporting	LOR(µg/L)
Cyanogen Chloride	1

DBP_551: is a name given to an analysis performed by the AWQC based on the USEPA Method 551 "Determination of Chlorination Disinfection By-products and Chlorinated Solvents in Drinking Water". It includes haloaldehydes, haloacetonitriles, haloketones and halopicrins. One other DBP that is also tested as part of this analysis is dibromonitromethane. The analysis is conducted using gas chromatography with an electron capture detector.

Haloaldehydes are formed by the reaction of chlorine with natural organic matter and bromide ions found in raw water supplies. Chloral Hydrate is the most significant of the haloaldehydes.

Haloacetonitriles are formed from natural organic matter, in particular amino acids, during chlorination. Lower concentrations of haloacteonitriles are formed during the chloramination process.

Haloketones form during the water treatment process of source water with chlorine.

Halopicrins are often associated with waters that are nitrite-rich. Chloropicrin is considered the most significant in the group for treated waters.

Dibromonitromethane is formed during the ozonation treatment process and its concentration increases in waters that are bromide-rich.

DBP_551 Components and Limits of Reporting			
Compound	LOR(µg/L)	Compound	LOR(µg/L)
Chloral Hyrdrate	1	1,1,1-Trichloroacetone	1
Dichloroacetonitrile	1	1,3-Dichloroacetone	1
Trichloroacetonitrile	1	1,1,3-Trichloroacetone	1
Bromochloroacetonitrile	1	Chloropicrin	1
Dibromoacetonitrile	1	Dibromonitromethane	
1,1-Dichloroacetone	1		

Halogenated Phenols: identified in drinking water are formed when chlorine reacts with phenolic compounds, such as biocides, or from the degradation of phenoxy herbicides. There are fourteen phenol by-products tested for at the AWQC by gas chromoatography attached to a MS/MS detector (GC/MS/MS).

Halogenated Phenols components and Limits of Reporting			
Compound	LOR(µg/L)	Compound	LOR(µg/L)
2-chlorophenol	0.1	Pentachlorophenol	0.1
4-chlorophenol	0.1	2-bromophenol	0.1
2,4-dichlorophenol	0.1	3-bromophenol	0.1
2,6-dichlorophenol	0.1	4-bromophenol	0.1
3,5-dichlorophenol	0.1	2,4-dibromophenol	0.1
2,4,5-trichlorophenol	0.1	2,6-dibromophenol	0.1
2,4,6-trichlorophenol	0.1	2,4,6-tribromophenol	0.1

Formaldehyde: is considered to be the most problematic compound formed during ozonation by the water industry due to its potential health effects. It, along with other compounds of low molecular weight, are produced when natural organic matter undergoes partial oxidation. The analysis is conducted using gas chromatography with an electron capture detector.

Method: Formaldehyde	LOR(µg/L)
Cyanogen Chloride	3

CNCl Sample Requirements:

- *355ml PET or glass bottle*
- *Preserve with 250mg/400mL ascorbic acid*
- *No air gap essential*
- *Transport & store at 4°C*

THM, HAA, DBP_551 Halogenated Phenols and Formaldehyde Sample Requirements:

- *355ml PET or glass bottle*
- *Preserve with 0.1g/L ammonium chloride*
- *No air gap essential*
- *Transport & store at 4°C*

MX Sample Requirements:

- *10 L PET or Glass bottle*
- *Preserve with 0.5g/L ascorbic acid, acidified to pH2 with HCl*
- *No air gap essential*
- *Transport & store at 4°C*

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