REPUBLIC OF VANUATU

WATER SUPPLY ACT [CAP 24]

National Drinking Water Quality Standards Order No.51 of 2019

In exercise of the powers conferred on me by subsection 10(1) of the Water Supply Act [CAP 24], I, the Honourable ALFRED MAOH, Minister of Lands and Natural Resources, make the following Order.

1 National Drinking Water Quality Standards

The National Drinking Water Quality Standards is set out in the Schedule.

2 Commencement

This Order commences on the day on which it is made.

Made at Port Vila this 13th day of May, 2019.

MINISTER OF LANDS AND NATURAL RESOURCES REPUBLIC OF VANUATU TERRES ET DES RESSOURCES NATURELLES MINISTRE DES

Honourable ALFRED MAOH
Minister of Lands and Natural Resources

SCHEDULE

NATIONAL DRINKING WATER QUALITY STANDARDS

VANUATU'S NATIONAL DRINKING WATER QUALITY STANDARDS

FOREWORD

Access to safe drinking water improves the health of communities, and promotes social and economic development.

"Ensure healthy lives and promote healthy lives for all ages" Where drinking water is unsafe to drink, serious illness can arise.

These National Drinking Water Quality Standards have been prepared to ensure that all Vanuatu communities can have confidence in the quality of drinking water that they are receiving. These standards have been prepared in consultation with the World Health Organization, and are consistent with the World Health Organization's *Guidelines for Drinking-Water Quality*. The Standards reflect the best current knowledge on drinking water quality, and the processes that can be used to make drinking water safe to drink.

There will be challenges in implementing these National Drinking Water Quality Standards, but their importance to Vanuatu should not be under-estimated. The provision of safe drinking water to all Vanuatu communities, and the implementation of these Standards, is based on Millennium Development Goals, Sustainable Development Goal 6 (SDG6) and Vanuatu's National Sustainable Development plan.

MINISTER OF LANDS AND NATURAL RESOURCES REPUBLIC OF VANUATU TERRES ET DES RESSOURCES NATURELLES

Honourable Ralph Regenvanu
Minister of Lands, Geology and Mine and Water Resource

ACRONYMS

C.*t*	Contact time
E. coli	*Escherichia coli*
DoW	Department of Water
DWQ	Drinking water quality
DWSSPs	Drinking Water Safety Security Plans
mg/L	milligrams per litre
mL	millilitre
MOH	Ministry of Health
NTU	Nephelometric Turbidity Unit
PWD	Public Works Department
SOPAC	Pacific Islands Applied Geoscience Commission
µS/cm	micro Siemens per centimetre
WHO	World Health Organization
DoPH	Department of Public Health

CONTENTS:

VISION

Consistent with the National Water Strategy for the Republic of Vanuatu, the aim of these drinking water quality standards is to provide sustainable and equitable access to safe drinking water for the people of Vanuatu, which will support improved public health, and promote social and economic development.

INTRODUCTION

Access to safe drinking water improves public health and promotes social and economic development. The disease burden created by a lack of access to safe drinking water is significant. The purpose of this document is to establish a water safety plan-based set of drinking water quality standards that will help ensure all people in Vanuatu can access safe drinking water.

Basing the drinking water quality standards on **water safety security plans** helps ensure that hazards that may cause deterioration in drinking water quality are identified and managed. By managing these hazards, it is more likely that the drinking water quality standards will be met. If hazards are not managed using the water safety plan approach, then too much emphasis is placed on monitoring the biological, physical and chemical quality of water against standards to make the water safe. The water is made safe by a well implemented water safety security plan; the standards, whilst important, and need to be met, are only there to verify that the water safety security plan has been effective in making the drinking water consistently safe.

The drinking water quality standards are divided into two parts. The first part sets drinking water quality standards for Institutional drinking water supply systems. The second part sets standards for Community drinking water supply systems. The reason behind setting different drinking water quality standards for Institutional drinking water supply systems and Community drinking water supply systems is the recognition that different approaches need to be taken when dealing with Institutional and Community supply systems.

Despite these differences, the underpinning principles for both Institutional and Community drinking water supply systems remain the same – ensuring that communities have access to safe drinking water, which in turn leads to improved public health and wellbeing.

PART A: DRINKING QUALITY WATER STANDARD FOR INSTITUTIONAL DRINKING WATER SUPPLY SYSTEMS

1. Context

Institutional (Commercial, private and Government) drinking water supply systems are in place Vanuatu. The Port Vila drinking water supply system is managed by UNELCO, a private company, under contract with the Government of Vanuatu. The urban water supply systems for Luganville, Isangel, Saratamata and Lakatoro are managed by Vanuatu's Public Works Department. There are other smaller drinking water supply systems that are managed by other private operators. There are also government and private schools and hospitals drinking water supply systems.

The drinking water quality standards described in Part A of this document is **Compulsory** and only apply to Institutions whether commercial, private or government that supply water.

2. Catchment Protection

The production of safe drinking water starts from where the water is collected; that is, the catchment area. If there are sources of contamination in the catchment area, then this contamination can end up in the institutional drinking water supply system.

The importance of catchment protection to safe drinking water is recognised by the ability to create Water Protection Zones, under section 26 of the *Water Resources Management Act 2002*, around drinking water sources.

As a general principle, and as an important public health measure, every effort should be made to avoid development or activities that may contaminate water in catchment areas that are used to collect water for urban drinking water supply systems.

In the specific case of the Port Vila Water Protection Zone, the Protection Zone is divided into three Protection Zones (Water Protection Zones 1, 2 and 3). In order to protect the Port Vila drinking water supply system, development or activities should not occur in Water Protection Zones 1 and 2. Development or activities may be allowed inWater Protection Zone 3 if adequate controls are in place to ensure that the development or activities do not contaminate the drinking water supply system. Some types of development or activities may not be allowed in Water Protection Zone 3, if they are highly likely to contaminate the drinking water supply system.

Where they do not exist, Water Protection Zones must be created to protect the quality of the raw water that will be treated and supplied to an urban drinking water supply system.

If development or activities must occur in drinking water catchment areas, or the development or activity is already present in the catchment area, then every effort should be made to minimise the possibility of the development or activity contaminating the institutional drinking water supply system.

Further advise on how to establish Water Protection Zones can be obtained from the Department of Water

3. Drinking Water Safety Security Plans

A drinking water safety and security plan (DWSSP) will be prepared for each Institutional drinking water supply system in Vanuatu, by the entity responsible for the water supply system. The purpose of the DWSSP is to identify hazards that may affect drinking water quality and quantity, and then identify how these hazards can be managed to ensure the ongoing safety and security of the drinking water that is being supplied.

The minimum content required in each DWSSP is:

- The names and contact details of the members of the drinking water safety and security plan team who are responsible for managing the drinking water safety and security plan for the drinking water supply system
- A description of the drinking water supply and sanitation system
- Identification of the hazards to the quality and quantity of drinking water in the drinking water supply system, including the completion of a sanitary inspection, which is done to examine the status of the drinking water supply system and the potential sources of contamination
- A description of how the major hazards to the quality of drinking water in the drinking water supply system will be managed
- Details of the procedures that will be used to ensure that the quality of drinking water in the drinking water supply system meets the agreed drinking water quality standards
- Details of the procedures that will be undertaken if the quality of drinking water in the drinking water supply system is found to be unsafe
- Details of the process that will be used to review and update the drinking water safety and security plan

Further advice on how to develop and implement a DWSSPcan be obtained from the Department of Public Health and the Department of Water

The Water supplier will seek approval of the drinking water safety and security plan from the Director of the Department of Water

Department of Water will carry out an annual audit of DWSSP implementation

4. Drinking Water Quality Standards for Institutional Drinking Water Supply Systems

4.1 Water treatment standards for Institutional drinking water supply systems

Where water treatment processes (for example, the addition of chlorine to the water) are used to make drinking water supply systems safe to drink, the following water treatment standards apply (Table 1).

Table 1: Water treatment standards for chlorinated Institutional drinking water supply systems

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Commercial Institution drinking water supply systems	Turbidity	≤ 1 Nephelometric Turbidity Units (NTU) at time of chlorination	1 sample per month per system	Laboratory test or field test
	Total Chlorine Residual*	0.2 – 0.7 mg/L^#	1 sample per month per system	Field test
	Free Chlorine Residual*	≥0.2 mg/L^	1 sample per week per system	Field test
	pH%	6.5-8.5	At same time as free residual chorine is measured	Field test

^ the total chlorine residual should never exceed 5 mg/L, based on health considerations. To ensure adequate disinfection, the free chlorine residual should be ≥0.2 mg/L. Ideally, in order to ensure adequate chlorination, the chlorine contact time should be no less than 15 mg/L.min (see Appendix A2 for more information on chlorine contact time).

the range 0.2 – 0.7 mg/L for total chlorine residual is based on current and best practice, not specifically the World Health Organization's *Guidelines for Drinking-Water Quality, 4th Edition* (2011).

* These standards apply at the first sample point downstream from the point of chlorination, and at points throughout the distribution system. The presence of ≥0.2 mg/L free residual chlorine across the entire drinking water supply system helps keep the water safe as water travels through the pipe network.

* The pH of the water has an impact on the disinfection effectiveness of the chlorination process. A pH <8 is preferable for effective disinfection with chlorine. Where a higher pH water is being chlorinated, an adjustment of chlorine dose can be

calculated to achieve the same disinfection effectiveness as 0.2 mg/L FAC at pH 8.0. [A graph or formula is available.]

4.2 Biological drinking water quality standards for Institutional drinking water supply systems

Water that is used for drinking, food preparation, cooking or other personal hygiene uses (for example, showering) must be free of waterborne microorganisms (bacteria, viruses and protozoa) that can cause illness. The presence in drinking water of waterborne microorganisms that can cause illness is the greatest threat to public health associated with drinking water supply systems.

The biological drinking water quality standards that apply to Institutional drinking water supply systems are detailed in Table 2.

Table 2: Biological drinking water quality standards for Institutional drinking water supply systems

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Institutional drinking water supply systems	*E. coli* (or Faecal coliforms)	<1 colony/100mL	If pop >5000 at least 1 sample per week per system. If pop <5000 at least 1 sample per month per system.	Laboratory Test^ Portable field test
	Total Coliforms	<1 colonies/100mL	If pop >5000 at least 1 sample per week per system. If pop <5000 at least 1 sample per month per system.	Laboratory Test^ Portable field test

* These standards apply at the first sample point downstream from the point of chlorination, and at points throughout the distribution system.

4.3 Physical drinking water quality standards for Institutional drinking water supply systems

As well as being safe to drink, drinking water should also be pleasant to taste, have no objectionable odours and should not have a negative impact on internal pipes and fittings. The physical water quality standards (Table 3) help ensure that the supplied drinking water is pleasant to drink.

Table 3: Physical drinking water quality standards for Institutional drinking water supply systems

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Institutional drinking water supply systems	pH*	6.5 - 8.5	1 sample per month per system	Laboratory test or field test
	Conductivity	<1200 µS/cm	1 sample per month system	Laboratory test or field test
	Taste & Odour	Acceptable Taste & Odour	1 assessment per month per system	Not applicable^
	Turbidity	≤1 Nephelometric Turbidity Units (NTU)	1 sample per month per system	Laboratory test or field test
	Hardness	200 mg/L (measured as calcium carbonate)	1 sample per month per system	Laboratory test

* pH as measured after treatment, in the pipe system. A different pH range may be appropriate for the treatment process in order to ensure adequate disinfection of the drinking water. A pH <8 is preferable for effective disinfection with chlorine.

^ taste and odour is a subjective test. A panel drawn from the Local Water Committee should be established, who can assess whether the taste and odour of the water is acceptable

* These standards apply at points or taps throughout the distribution system.

4.4 Chemical drinking water quality standards for Institutional drinking water supply systems

In most cases it requires long-term exposure to chemicals above a health-based guideline value before illness occurs. Whilst acute illness can occur from exposure to very high concentrations of a number of chemicals, in the vast majority of cases these chemicals make the water taste so unpleasant that individuals are unlikely to drink enough water to cause illness. Despite this, it is important that institutional drinking water supplies are free of chemicals that may lead to illness.

In drafting these chemical drinking water quality standards, consideration has been given to the current testing capability available in Vanuatu, and the need to monitor for chemicals that could be present in Institutional drinking water supply systems. Therefore, the list of chemical water quality standards in Table 4 is not extensive.

It is recommended that the identification of the hazards to the quality of drinking water in the water supply system, as is required as part of the water safety security plan detailed in Section 3, be used to determine whether additional chemical water quality standards should be applied to specific urban drinking water supply systems. Table A1 in the Appendix provides details of other chemical standards that could be applied, based on the water safety security plan assessment.

Table 4: Chemical drinking water quality standards for Institutional drinking water supply systems^

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Institutional drinking water supply systems	Arsenic	0.01 mg/L	1 sample per year per water supply system	Laboratory test
	Fluoride	1.5 mg/L	1 sample per year per water supply system	Laboratory test
	Copper	2 mg/L	1 sample per year per water supply system	Laboratory test
	Lead	0.01 mg/L	1 sample per year per water supply system	Laboratory test
	Iron	0.3 mg/L*	1 sample per year per water supply system	Laboratory test

^ if monitoring over time indicates that these chemicals are 50% of the standard in particular drinking water supply systems, then it may be appropriate to discontinue the monitoring program and exempt the water supply system from the water quality standard

* These standards apply at points or taps throughout the distribution system.

4.5 Monitoring Performance against the Drinking Water Quality Standards

To ensure that the drinking water quality standards are met, samples must be collected at the monitoring frequencies described in Tables 1 to 4.

All other drinking water quality standards apply at the point of supply to the community. Samples for analysis should be collected as close as possible to the point of supply.

To ensure the accuracy of the results used to determine whether drinking water quality standards are met, those involved in the collection, transport and analysis of drinking water samples must demonstrate appropriate training to deliver the tasks that they undertake, in order to ensure that Vanuatu communities receive safe drinking water.

The samples must be collected in appropriate sampling containers, submitted to a water testing laboratory, that has demonstrated appropriate quality assurance, in a timely manner.The laboratory must have well-maintained and calibrated testing equipment to ensure quality assurance and control. Appendix A3 provides advice on the sampling containers that should be used, and the transport and preservation procedures that should be followed, in order to ensure representative results are obtained.

4.6 Training of staff involved in managing Institutional water supply systems

The ongoing provision of safe drinking water relies on appropriately trained and experienced staff. It is a requirement of these standards that those who are involved in drinking water treatment, drinking water distribution, and the maintenance of drinking water assets, including the repair of pipes and pumps, must demonstrate training to a level that is appropriate for the tasks that they undertake, in order to ensure that Vanuatu communities receive safe drinking water.

4.7 Sharing Information

To ensure that the communities of Vanuatu are confident that their Institutional drinking water supply systems are a safe source of drinking water, the results of the monitoring programs undertaken under these standards should be made available to the community on an annual basis, by the Department of Water (DoW).

To enable all government departments and private companies with roles and responsibilities for the supply safe drinking water to the communities of Vanuatu to be able to meet their roles and responsibilities under these Standards, all results of the monitoring program are to be freely shared between all relevant government departments and private companies. The data must be shared and transmitted in an agreed format. A national drinking water quality database must be established where all water quality results are to be stored. The national drinking water quality database will be administered by DoW.

4.8 Review Period

To ensure that the drinking water quality standards for Institutional drinking water supply systems remain current, this document should be reviewed every five years. The review should be led by DGMWR, with input from MoH, PWD and other relevant stakeholders.

PART B: DRINKING WATER QUALITY STANDARDS FOR COMMUNITY WATER SUPPLY SYSTEMS

1. Context

Outside the major urban centres of Port Vila, Luganville, Isangel, Saratamata and Lakatoro, the water that is used as drinking water in Vanuatu is not treated and is consumed daily by communities. Community drinking water supply systems include community school water supply systems and community aidpost/clinic water supply systems

The drinking water quality standards described in Part B of this document is **Optional** and only apply to Community drinking water supply systems.

2. Catchment Protection

The production of safe drinking water starts from where the water is collected; that is, the catchment area. If there are sources of the contamination in the catchment area, then this contamination can end up in the drinking water supply system.

The importance of catchment protection to safe drinking water needs to be recognised. As a general principle, and as an important public health measure, every effort should be made to avoid development or activities that may contaminate water in areas that are used by communities to collect their drinking water.

The importance of catchment protection to safe drinking water is recognised by the ability to create Water Protection Zones, under section 26 of the *Water Resources Management Act 2002*, around drinking water sources.

Where they do not already exist, Water Protection Zones should be created to protect the quality of the raw water that will used for the Community drinking water supply system.

If development activities must occur in drinking water catchment areas, or the development or activity is already present in the catchment area, then every effort should be made to minimise the possibility of the development or activity contaminating the drinking water supply system.

3. Drinking Water Safety Security Plans

A drinking water safety and Security plan (DWSSP) will be prepared for each Community drinking water supply system in Vanuatu, by the Local Water Committee that is responsible for the water supply system. The purpose of the DWSSP is to identify hazards that may affect drinking water quality and quantity, and then identify how these hazards can be managed to ensure the ongoing safety and security of the drinking water that is being supplied.

The minimum content required in each DWSSP is:

- Details of the members of the Local Water Committee who will oversee the water safety and security plan process
- A description of the drinking water supply and Sanitation system
- Identification of the hazards to the quality and quantity of drinking water in community drinking water supply systems.
- Steps that will be taken to manage the identified hazards to the quality and quantity of drinking water in the Community drinking water supply system

Further advice on how to develop and implement a drinking water safety security plan can be obtained from the Department of Public Health and the Department of Water

The Community Water supplier will seek approval of the drinking water safety and security plan from the Director of the Department of Water

From time to time Department of Water may audit DWSSP implementation

4. Drinking Water Quality Standards for Community Drinking Water Supply Systems

4.1 Biological drinking water quality standards for Community water supply systems

Water that is used for drinking, food preparation, cooking or other personal hygiene uses (for example, showering) must be free of waterborne microorganisms (bacteria, viruses and protozoa) that can cause illness. The presence in drinking water of waterborne microorganisms that can cause illness is the greatest threat to public health associated with drinking water supply systems.

In most cases it will not be possible to submit a sample to a laboratory to have an *E. coli* (or Faecal coliform) test performed, so the alternative test methodology, the hydrogen sulphide (H_2S) paper strip test[1] is recommended.

In the case where samples from a Community drinking water supply system can be submitted to a laboratory to have *E. coli* (or Faecal coliform) testing performed, the biological drinking water quality standards that apply to the Community drinking water supply system, based on *E. coli* (or Faecal coliform) test results is given in Table 2.

Table 2: Biological drinking water quality standards for Community drinking water supply systems based on laboratory tests for *E. coli* (or Faecal coliforms)

Parameter	Standard	Monitoring Frequency	Test Method
E. coli (or Faecal coliforms)	<1 colony/100mL	1 sample per month per water supply system	Laboratory Test

^ consideration should also be given to advising people to boil their water if any sample exceed the standard

* These standards apply at the first sample point downstream from the point of chlorination, and at points throughout the distribution system.

4.2 Physical drinking water quality standards for Community drinking water supply systems

As well as being safe to drink, drinking water should also be pleasant to taste, have no objectionable odours and should not have a negative impact on internal pipes and fittings. The physical water quality standards (Table 2) help ensure that the supplied drinking water is pleasant to drink.

Table 2: Physical drinking water quality standards for Community drinking water supply systems

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Community drinking water supply systems	Conductivity	<2000 μS/cm	1 sample per month per system	Field Test

* These standards apply at points or taps throughout the distribution system.

4.3 Chemical drinking water quality standards for Community drinking water supply systems

The presence in drinking water of waterborne microorganisms that can cause illness is the greatest threat to public health associated with drinking water supply systems. Some chemicals can pose a risk to health. However, in most cases it requires long-term exposure to chemicals above a health-based guideline value before illness occurs. Whilst acute illness can occur from exposure to very high concentrations of a number of chemicals, in the vast majority of cases these chemicals make the water taste so unpleasant that individuals are unlikely to drink enough water to cause illness. Despite this, it is important that community drinking water supplies are free of chemicals that may lead to illness.

In drafting these chemical drinking water quality standards, consideration has been given to the current testing capability available in Vanuatu, and the need to monitor for chemicals that could be present in Community drinking water supply systems at concentrations that may cause illness. There is also a lack of water quality monitoring data upon which to base chemical water quality standards for community drinking water supplies.

Subject to further investigation, the only chemical drinking water quality standard that is recommended at this time for Community drinking water supply systems is fluoride, specifically in those Community drinking water supply systems that are affected by volcanic ash. Long-term consumption of water containing fluoride at concentrations above the standard of 1.5 mg/L may lead to illness.

Table 3: Chemical drinking water quality standards for Community drinking water supply systems that affected by volcanic ash

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Community drinking water supply systems	Fluoride^	1.5 mg/L	1 sample per year per water supply system affected by volcanic ash	Laboratory test

^ If any sample exceeds the standard, an investigation must be carried out. Contact Department of Water or Department of Public Health for advice.

* These standards apply at points or taps throughout the distribution system.

It is recommended that the identification of the hazards to the quality of drinking water in the water supply system, as is required as part of the water safety security plan detailed in Section 3, be used to determine whether additional chemical water quality standards should be applied to specific

Community drinking water supply systems. Table 4 in Part A and Table A1 in the Appendix provides details of other chemical, bacteriological and organic constituent standards that could be applied, based on the water safety security plan assessment.

4.4 Monitoring Performance against the Drinking Water Quality Standards

To ensure that the drinking water quality standards are met, samples must be collected at the monitoring frequencies described in Tables 1 to 3. The drinking water quality standards listed in Tables 2 and 3 apply at the point of supply to the community. Samples for analysis should be collected as close as possible to the point of supply.

To ensure the accuracy of the results used to determine whether drinking water quality standards are met, those involved in the collection, transport and analysis of drinking water samples must demonstrate appropriate training to deliver the tasks that they undertake, in order to ensure that Vanuatu communities receive safe drinking water.

The samples must be collected in appropriate sampling containers. If samples are to be submitted to a water testing laboratory for analysis, they must be submitted to the laboratory in a timely manner and the laboratory must have suitable testing equipment to ensure that the water analysis results are accurate. The laboratory must have well-maintained and calibrated testing equipment to ensure quality assurance and control.

Appendix A3 provides advice on the sampling containers that should be used, and the transport and preservation procedures that should be followed, in order to ensure representative results are obtained.

4.5 Review Period

To ensure that the drinking water quality standards for community drinking water supply systems remain current, this document should be reviewed every five years. The review should be led by DoW, with input from MoH, DoPH, PWD and other relevant stakeholders.

APPENDIX

A1. System-specific chemical, bacteriological and organic constituent water quality standards

There are a large number of chemicals which can potentially be present in drinking water, and if they are present in high enough concentrations they can lead to illness, but it is not possible to monitor all drinking water supply systems for all the chemicals that may be present.

Unless there is a source of the chemical somewhere in the drinking water supply system, it is highly unlikely that the chemical will be present in the drinking water supply system at concentrations that will cause illness. Therefore, it is not necessary to monitor a drinking water supply systems for chemicals that are unlikely to be present.

It is recommended that hazard identification and sanitary surveys be carried out as part of the water safety plan process, and if the hazard identification process identifies that a particular chemical may be present in a particular drinking water supply, then that chemical should be added to the water quality standards that apply to that supply.

Table A1 provides advice on chemical, bacteria and organic constituents drinking water quality standards that could be applied to either treated urban, or untreated rural, drinking water supply systems if particular chemicals are considered to be a hazard to the quality of the drinking water.

Table A1, i): Examples of chemical drinking water quality standards for Institutional or Community drinking water supply systems that may be applied, based on hazard identification and sanitary survey

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Treated urban or untreated rural drinking water supply systems	Antimony	0.02 mg/L	1 sample per year	Laboratory test
	Arsenic	0.01 mg/L	1 sample per year	Laboratory test
	Barium	0.7 mg/L	1 sample per year	Laboratory test
	Benzene	0.01 mg/L	1 sample per year	Laboratory test
	Cadmium	0.003 mg/L	1 sample per year	Laboratory test
	Chromium	0.05 mg/L	1 sample per year	Laboratory test
	Iron	0.3 mg/L^	1 sample per year	Laboratory test
	Manganese	0.4 mg/L	1 sample per year	Laboratory test
	Mercury	0.006 mg/L	1 sample per year	Laboratory test
	Molybdenum	0.07 mg/L	1 sample per year	Laboratory test
	Nickel	0.07 mg/L	1 sample per year	Laboratory test
	Nitrate	50 mg/L as nitrate	1 sample per month	Laboratory test
	Nitrite	3 mg/L as nitrite	1 sample per month	Laboratory test
	Selenium	0.01 mg/L	1 sample per year	Laboratory test
	Phosphate	0.015mg/L	1 sample per year	Laboratory test

For other chemical parameters, for example, disinfection by-products, pesticides, or herbicides, please seek advice from the World Health Organization's *Guidelines for Drinking-Water Quality, 4th Edition* (2011) for advice on appropriate guideline values.

^ aesthetic water quality standard. If the concentration of iron in the water is above 0.3 mg/L it may stain washing and bathroom fixtures.

Table A1, ii): Examples of bacteriological drinking water quality standards for Institutional or Community drinking water supply systems that may be applied, based on hazard identification and sanitary survey

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Institutional or Community drinking water supply systems	Faecal Streptococci	0 CFU/100ml	1 sample per year	Laboratory test
	Heterotrophic plate count	<100 CFU/100ml	1 sample per year	Laboratory test

Table A1, iii): Examples of organic constituents (Pesticides) drinking water quality standards for Institutional or Community drinking water supply systems that may be applied, based on hazard identification and sanitary survey

Supply type	Parameter	Standard	Monitoring Frequency	Test Method
Institutional or Community drinking water supply systems	2,4 D(2,4-Dichlorophenoxyacetic acid)	0.04 mg/l	1 sample per year	Laboratory test
	Glyphosate	0.5 mg/l	1 sample per year	Laboratory test
	Chorophyrifos	0.03 mg/l	1 sample per year	Laboratory test
	Malathion	0.2 mg/l	1 sample per year	Laboratory test

A2. Chlorine contact time

When chlorine is used as a disinfectant it takes time for the chlorine to inactivate or kill bacteria. The time taken to kill bacteria depends on the concentration of chlorine present in the water and the time that the chlorine is in contact with the bacteria. This is known as the contact time (or C.*t*) for chlorine, and it is determined by multiplying the concentration of the chlorine (in mg/L) by the contact time (in minutes). This is expressed as mg/L.min.

The recommended chlorine contact time to ensure safe drinking water is 15 mg/L.min. This can be achieved by having a concentration of chlorine of 0.5 mg/L in contact with the water for 30 minutes.

The turbidity (or cloudiness) of the water being chlorinated will have a significant impact on the effectiveness of the chlorination process. If the water to be chlorinated has a turbidity of greater than 1 NTU then a higher concentration of chlorine will be needed to achieve a C.*t* value of 15. Alternatively, if it is possible to do so, filter the water to lower the turbidity prior undertaking chlorination.

The pH of the water also has an impact on the disinfection effectiveness of the chlorination process. A pH <8 is preferable for effective disinfection with chlorine. Where a higher pH water is being chlorinated, an adjustment of chlorine dose can be calculated to achieve the same disinfection effectiveness as 0.2 mg/L FAC at pH 8.0. [A graph or formula is available.]

A3. Recommended sample containers, transport conditions and sample holding times for drinking water samples submitted to a laboratory for analysis

Accurate and reliable test results can only be obtained from drinking water samples that have been collected in appropriate sample containers, that have been transported correctly to the laboratory and that are analysed within an appropriate time period (that is, holding time). Table A2 below provides advice on the recommended sample containers, transport conditions and sample holding times for drinking water samples submitted to a laboratory for analysis in accordance with these standards.

Table A2: Recommended sample containers, transport conditions and sample holding times for drinking water samples submitted to a laboratory for analysis in accordance with drinking water quality standards

Parameter	Sample container	Minimum Sample Size	Maximum holding period	Preservation procedure
E. coli, Faecal Coliforms and Total Coliforms	Clean, sterile glass or Plastic bottle	250 mL	24 hours	For chlorinated supplies, sample containers should contain sodium thiosulphate to neutralise chlorine. Samples should be kept chilled (2-10°C) and in the dark until analysed. **Do not freeze samples**
Conductivity	Clean, dry glass or plastic bottle	500 mL^	24 hours	Samples should be kept chilled (2-10°C) and in the dark until analysed. **Do not freeze samples**
Fluoride	Clean, dry glass or plastic bottle	200 mL or 500 mL^	28 days	None required
Hardness	Clean, dry glass or plastic bottle	500 mL	7 days	None required. Fill sample container completely to exclude air
Metals (arsenic,	Clean, dry	100 mL	28 days	Upon receipt into

Parameter	Sample container	Minimum Sample Size	Maximum holding period	Preservation procedure
copper, lead)	glass or plastic bottle			laboratory add nitric acid (HNO_3) to preserve sample
pH	Clean, dry glass or plastic bottle	100 mL or 500 mL^	6 hours	Samples should be kept chilled (2-10°C) and in the dark until analysed. **Do not freeze samples**
Turbidity	Clean, dry glass or plastic bottle	100 mL or 500 mL^	24 hours	None required

^ To save on the number of bottles that need to be collected, it may be possible to collect a single 500mL bottle and perform conductivity, fluoride, pH and turbidity analyses from the one bottle. If this is going to be done, samples should be kept chilled (2-10°C) and in the dark until analysed. Do not freeze the sample.

Standardising Test Methods

To ensure that results are representative of drinking water quality, and can be compared across different urban and rural drinking water supply systems, and compared over time, recognised standard test methods should be used when analysing drinking water quality samples.

If the test is going to be undertaken in the laboratory, the test method that is used should be based on the standard test methods described in the current edition of the American Public Health Association (APHA) publication: *Standard Methods for the Examination of Water and Wastewater* (www.standardmethods.org), or be a recognised equivalent test method..

If portable testing kits are being used for testing drinking water quality in the field, or are being used to test samples in the laboratory, the kits should be sourced from reputable suppliers, and the test kit must have a detection limit that is equal to or less than the water quality standard that the result is being compared with.

For both laboratory equipment and field test kits the manufacturer's instructions with regard to calibration, servicing and maintenance should always be followed. Expired reagents or media should not be used to test drinking water quality samples.

Ideally, the same or equivalent test method should be used over time to allow for comparison of results over time. This helps identify trends in drinking water quality. If a new or different method is to be used, this should be recorded and noted.

A4. Sample collection

To ensure that representative samples are collected for testing and analysis, samples should be collected in the correct manner. Samples should be collected in sampling containers which comply with the requirements detailed in Table A2.

When collecting a drinking water sample for analysis from a tap connected to an urban or rural drinking water supply system, if it is possible to do so any plastic or rubber hoses, or other easily-removable fittings, should first be removed from the tap prior to the sample being collected, as hoses and fittings may contaminate the sample.

The tap should be turned on to close to its maximum flow and allowed to flow freely for between 1 and 2 minutes to flush the pipes. This is done to ensure that a representative sample is collected.

After the pipes are flushed, the tap should be turned back to a normal flow (about one third of its maximum flow) and then the sample bottles should be filled. The lid of the sample bottles should not be placed on the ground the bottle is being filled, as the lids may become contaminated and when the lid is put back on the bottle it may then contaminate the sample.

The sample bottle should be filled almost to the top, except where Table A2 states that the sample bottle should be completely filled.

The filled sample bottle should then be placed in a clean sample storage container (e.g. esky or plastic crate) and taken to the laboratory for analysis.

If samples need to be chilled for transport, care should be taken to ensure that samples are not left floating in melted ice water. If the ice melts, the melt water should be drained from the esky and more ice added. Alternatively, instead of ice, plastic freezer blocks can be used.