Water Services Authority
Taumata Arowai

NEW ZEALAND DRINKING WATER QUALITY ASSURANCE RULES

INTERPRETATION GUIDE FOR NETWORKED MEDIUM SUPPLIES

Contents Page

This is a guideline only and does not address every situation that may occur regarding a drinking water supply. It is not intended to be definitive and is not legal advice. Drinking water suppliers are responsible for understanding and complying with their legislative duties. The Authority may review and revise this guidance over time. If you are using a printed copy, please check the website to make sure it is up to date.

Introduction

If you supply drinking water to between 101 and 500 people you are a medium drinking water supplier and have a responsibility under the Water Services Act 2021 (the Act) to ensure the water is safe.

You need to follow the Drinking Water Quality Assurance Rules (the Rules) and notify the Water Services Authority–Taumata Arowai (the Authority) if monitoring results, like test results for *E. coli*, exceed a maximum acceptable value (MAV) set out in the Drinking Water Standards. The Act also requires you to notify the Authority if water is or may be unsafe.

The Rules are the minimum requirements for drinking water suppliers. By following the Rules, you will know more about the quality of the water you are supplying. You will also need to consider whether more frequent testing and/or treatment of the water is needed.

You need to report to the Authority to demonstrate compliance with monitoring rules each quarter and assurance rules for the year. The most accessible form available to report on medium supplies is the dedicated webform. Laboratories are required to notify you and us if drinking water testing exceeds these standards.

We have developed this guidance to help you understand the parts of the Rules that apply to your supply.

Is my supply a medium drinking water supply?

Under the Rules, a population is the number of people normally supplied with water, i.e. the number of people in the community who would receive water from the supply when there is not an unusually large number of people in the community.

If the normal number of people is between 101 and 500 people, even if this number is exceeded every year during special events or holiday periods, the supply is most likely a medium drinking water supply. Rules that apply to these types of supply are contained in the level 2 Rules modules, in addition to some applicable rules in the general Rules module. These are discussed in more detail in this guidance.

Medium supplies can be categorised as either networked or self-supplied buildings.

Is my supply networked?

The Rules define networked supplies as:

> *Drinking water supplies that provide drinking water via a distribution system at a pressure and volume to meet consumer demand, or at a restricted flow and volume.*
>
> *These supplies may include storage facilities within the network to manage demand*.

Below are some examples of networked medium drinking water supplies.

- A water supply for a town of 250 houses and small businesses is delivered through a network of pipes. Most of the houses are holiday homes and unoccupied outside of the school holidays. While the holiday population sometimes increases to 600 people, the base population for most of the year is only 120 people.

- A township has a steady resident population of 380 people across residents and businesses.

Is my supply a self-supplied building?

The Rules define self-supplied building supplies as:

> *water supplies (excluding domestic self-supplies) which provide drinking water to up to 10 buildings on one site (within the boundaries of one property, or within the boundaries of two or more properties with common ownership arrangements) and provide water to more than 25 people.*

Below are some examples of self-supplied medium drinking water supplies.

- A rural school has 200 students and staff and its own water supply from a bore. The supply is connected to four separate classroom buildings, a maintenance shed and administration building, which are all located on the same property.
- A marae consists of a wharenui (meeting house), wharekai (dining hall), wharemoe (sleeping house), ablutions block and a kitchen as well as a kōhanga reo and whare kaumātua (kaumātua flats), totalling nine buildings. The marae water supply is from both roof rainwater collection and a stream. It is treated and distributed to these buildings located on three neighbouring properties that are all owned by the same entity. The marae population on a regular day, including whare kaumātua residents, tamariki at the kōhanga reo, and regular visitors for weekly events and activities, is 110 people.
- A hotel in a remote location has capacity for 450 occupants, including guests and staff. The hotel takes water from a bore and has a maintenance building on the same site.

What happens if my supply's population exceeds 500 people?

As a water supplier, you need to monitor the number of people the water supply is servicing, because the more people drinking the water, the more people that could become sick if something goes wrong. If the population exceeds 500 people, you must do additional monitoring until the population returns to below 500 people. In this case, see the Varying Population module in the Rules, and the Varying Population rules section of this guidance..

What Rules modules do I need to follow?

Suppliers of medium drinking water supplies must demonstrate compliance against up to five Rules modules. They are:

- **G General Rules Module** – Requirements include compliance reporting, sampling and equipment verification.
- **S2 Source Water Rules Module** – Monitoring raw water quality and assessing risks to understand quality and characteristics of source water.
- **T2 Treatment Rules Module** – Treatment equipment requirements and monitoring of treated water quality.

- **D2 Distribution System Rules Module** – Monitoring water quality that is delivered to consumers and ensuring backflow prevention is in place (not required for self-supplied buildings).
- **VP Rules for Supplies with Varying Populations** – Additional monitoring requirements when the population exceeds the 500-person threshold.

The following section sets out the rules that medium drinking water supplies must comply with, explains the reason for the rule and recommends actions you can take to comply.

General rules – networked supplies and self-supplied buildings

The General Rules are a series of general requirements for water suppliers to report, test and manage their supplies. Medium supplies following level 2 rules need to comply with the requirements in G2.1, G2.2, G6, G7, G8, G9, G10, and G11. If you use continuous monitoring equipment for compliance with any rules, then you must also comply against G12, G13, G15, G16 and G17 as applicable.

What laboratories can I use to test drinking water? G8

The method of collecting, transporting, and analysing a sample is important to make sure the test results are accurate. For water samples that are require laboratory analysis, rule G8(a) requires suppliers to have them analysed by a laboratory accredited by IANZ for the specific test being ordered. This rule ensures the water supplier, consumers and the Authority have confidence that the result of the testing is accurate.

For example, laboratories that analyse water samples for *E. coli* and total coliforms must demonstrate to IANZ, that they have the capability and equipment to undertake these tests in a way that will provide an accurate result. If the results are not correct it could mean a water supplier is taking action to manage contaminated water when the water is actually safe, or that the supplier thinks the water they are supplying is safe when it is not.

Rule G8(b) requires you to follow the laboratory's instructions for collecting samples to avoid possible contamination. Instructions may include using a sterile container when sampling microbiological samples, using certain bottles containing preservatives, and sterilising and flushing sampling points.

What do I need to do when collecting samples? (G6 and G7)

Once the sample is collected, it needs to be traceable so that the supplier and the Authority can understand what the test results mean for the supply when the laboratory reports the results back to you. Rule G6 requires samples to be labelled with your supply's unique ID for the source abstraction point, treatment plant, or distribution the sample was taken from and

the time and the date the sample was collected. Suppliers should also assign a unique sample ID to each sample to distinguish between each of them.

When transporting samples, you will need to follow rule G7 to ensure the water samples don't heat up or become frozen before reaching the lab. This rule ensures the quality of microbiological samples by reducing the risk of bacterial die-off over time or, in some cases, bacterial growth.

If you are using IANZ accredited on-site laboratory equipment, delays getting the sample analysed should be minimised and the risk of the sample getting too hot are significantly reduced.

Can any monitoring be done without using an IANZ laboratory? G9.

Some monitoring, such as for turbidity and chlorine, can be done by a water supplier using handheld or desktop analysers. These instruments can become inaccurate over time and must be calibrated or verified as per manufacturer's instructions to maintain data quality as required by rule G9.

What is a suitably trained or experienced person? G10.

Suppliers must ensure that the people who work on the drinking water supply know what they are doing, and must determine if someone is suitably qualified, trained or experienced to meet rule G10. Water suppliers should ask people they engage to work on their supplies about their qualifications and experience. For example, if someone is engaged to test a backflow device, it would be useful to check that they have completed a course in backflow assessment and testing.

What is a hygiene code of practice? G11.

A hygiene code of practice outlines a water supplier's expectations about how people working on their supply will protect the supply from contamination, as this is a high-risk activity which, when done poorly, can lead to outbreaks of enteric disease. Drinking water should be thought of in the same way as a food establishment. Cleanliness is key. This document does not need to be long, but must include the following considerations as listed in Rule G11:

- How personal hygiene will be maintained, e.g. washing hands after using a toilet or use of sterile gloves.
- Preventing people with gastrointestinal (suspected or confirmed) from working on the water supply.
- How work sites, materials and tools will be protected from contamination, e.g. cleaning tools with 1% sodium hypochlorite before using them on the drinking water supply and not using tools that have been used on wastewater systems.

- How all reasonable steps will be taken to minimise exposure of the supply to contamination during any activity.

Source rules – networked supplies and self-supplied buildings

Source water rules help water suppliers to understand the quality of the water they are using, particularly in relation to microbiological contaminants, chemical contaminants and cyanobacteria.

What tests must be done on my source water? S2.1, S2.2, S2.3

You must test for *E. coli* and total coliforms in any source water at each source water abstraction point, along with specific chemicals according to the type of source.

Arsenic, boron, nitrate and manganese are commonly found in surface and groundwater sources. Cadmium, copper, and lead are metals which can leach out of roofing materials into a roof water supply. Testing for these chemicals in your source water help you understand whether these chemicals present a risk to your supply. The tests required in the S2 Rules module are standard tests that can be conducted by many accredited laboratories. Often laboratories will offer a suite of drinking water tests for a fixed fee or you can order individual tests. For more about accredited laboratories, go to the General Section 'What laboratories can I use to test drinking water? G8'.

Read here for more information on chemical contamination.

What are *E. coli* and total coliforms?

E. coli are bacteria that indicate faecal contamination. If they are found in a water sample, this indicates that the sample is contaminated with the faeces of a person, animal or bird, and therefore it is expected that bacteria and other pathogens that can cause serious illness will also be in the water. Some of these pathogens include bacteria like *Campylobacter* and *Salmonella*, viruses like norovirus, and protozoa like *Cryptosporidium* or *Giardia*. These pathogens along with *E. coli* can enter a water source, for example, through runoff or wastewater discharges near the surface or groundwater abstraction point, or from animal droppings on the roof collection area.

Total coliforms are a group of bacteria that live in the wider environment, e.g. on decaying vegetation. If total coliforms are found in a water sample, it indicates that bacteria are present in the water.

What do the *E. coli* and total coliforms test results mean?

You can use the results of both tests together to inform you of the quality of water being treated and provided. If a sample result is positive (e.g. 1 per 100 mL or more) for *E. coli,* it tells us that the water is contaminated with faeces and is not safe to drink without treatment. When a result is positive for total coliforms but negative for *E. coli*, it indicates the water is contaminated with bacteria, but they are not from the faeces of humans, animals or birds.

Total coliforms are normal in most source waters but should not be present in deep groundwater. If total coliforms are present in deep groundwater, then it may mean the aquifer has been compromised or your bore is abstracting water which is influenced by surface water, like a river or rainfall, or another close by bore which has been contaminated.

What do I do when I find *E. coli* and total coliforms in my source water?

If you find *E. coli* and total coliforms in source water, it's a good idea to keep track of these in a spreadsheet or logbook so you can know if something has changed with your source water. If you find very high amounts of *E. coli,* you may need to investigate the area around your source water for a source of contamination. Both live and dead animals can release large amounts of disease-causing bacteria into source water. If you find live or dead animals are regularly contaminating your source water, you will need to implement some risk mitigation strategies, like fencing off your bore, removing vegetation and branches overhanging your roof or removing a dead animal from near your source abstraction point.

How do I decide if a chemical determinand is a risk to the supply? S2.3

As a water supplier, you may be aware of other substances, including chemicals, that have the potential to present a risk to the supply. This risk assessment should be part of your drinking water safety plan and could be based on known land uses near the water source or information that a district or regional council has provided. For example, some water sources may be naturally high in iron due to geological factors, or the source may be near an agricultural area that uses particular pesticides.

Some chemicals are only a risk to certain sources and must be dealt with in a bespoke manner. For example, where fireplaces are present, soot can deposit on roofs where there are nearby chimneys, particularly in colder months. Rain can wash the soot into your roof water supply. Soot contains carcinogens like benzo(a)pyrene. If soot is deposited on your roof, that means benzo(a)pyrene presents a risk to your supply and you must test for it according to rule S1.3. If your water smells like smoke, or tastes like char,

you need to ensure you manage this risk. This may include measures like installing a first flush diverter, installing treatment which specifically removes this (e.g. activated carbon filters), or other measures to clean your roof regularly.

How often do I need to sample other chemical determinands? S2.3

Any chemicals determined to be a risk, or any chemicals detected at above 50% of the MAV, such as those required in S2.1 or S2.2, must be tested at least annually until 3 consecutive results are less than 50% of the MAV. There is flexibility in how these samples are taken. A supplier can take all the samples in a year or even in one month but must ensure that three consecutive samples are less than 50% of the MAV before they stop sampling. For example, if you take the first sample and it is less than 50% of the MAV, you may choose to take the remaining two samples quite soon after that to meet the requirement quickly.

However, once a determinand is known to have exceed 50% of the MAV, or is known to be present in the area, it becomes a known risk and should be included in your risk management plan. Continuing to sample the determinand alongside the required chemicals is recommended.

What do I do if a result for a chemical test (e.g. arsenic, nitrate, lead) is above the MAV? S2.3

If a chemical test of a source water sample exceeds the MAV, while it is not technically drinking water, it still indicates a risk of contamination in the water provided to consumers. The Rules require monitoring of elevated determinands to increase to at least annually until three consecutive results are below the MAV. At this point you can return to normal sampling frequency. However, once a determinand is known to have exceeded 50% of the MAV, it becomes a known risk and should be included in the risk management approach.

If a chemical is above the MAV in the water source, you must make sure it is not present in the drinking water after treatment. Unless the treatment plant has specific treatment processes to remove the chemical, it is likely that the MAV exceedance will be present in drinking water too. Any non-compliance with the Standards must be managed (see s 22 of the Act).

Where do I take a sample from if I have multiple sources e.g. a roof collection and a bore source? S2.4

If more than one source is used, samples need to be collected from each source separately. This is because you need to know the quality of each source in case only one source is being used at any particular time. If a supply uses roof water and a spring/stream or other source, all sources need to be sampled and tested separately.

What are benthic cyanobacteria mats and planktonic cyanobacterial growth? What do they look like and when do they occur? S2.5, S2.6 (a)

Benthic cyanobacteria grow on the bottom of riverbeds, appearing usually as thick dark brown or black mats with a slimy or velvety texture and musty smell.

When planktonic cyanobacteria bloom (floating algae), it can make water look cloudy, discoloured, or like it has small globules in it.

Benthic cyanobacteria mats can become detached from the riverbed and accumulate along the river edge.

Cyanobacteria, or blue-green algae, are a cross between bacteria and algae. Cyanobacteria can be a problem because some species can produce toxins called cyanotoxins which can make people ill. It is not clear what causes some cyanobacterial species to produce toxins. Cyanobacteria usually don't produce toxins all the time but when they do it can be very harmful.

Cyanobacteria can form as a colony that appears as a large cloud within a water column, and this is called planktonic cyanobacteria. Indications of planktonic cyanobacteria include water discolouration and a lack of clarity of the water.

Cyanobacteria can also form as mats on the floor of a river or lakebed and then are known as benthic cyanobacteria. Benthic cyanobacteria look like a brown slimy or furry layer on rocks in a river.

Cyanobacteria require light and nutrients such as nitrogen and phosphorous to grow. They tend to grow much faster in warmer water and when there is more sunlight, with summer being the time of highest risk. For example, a slow-moving surface source (e.g. a lake) surrounded by agricultural activity likely has a higher risk than a fast, spring-fed stream surrounded by native forest.

An algal bloom is a rapid growth of algae in a body of water. Algal blooms are often related to taste and odour issues in a water supply. If cyanobacteria are contributing to the algal bloom, the risk of cyanotoxins in the water supply increases. If the source water cannot easily be accessed to assess cyanobacteria risk, laboratory testing could also be used to determine cyanobacterial cell counts. Seek advice from an accredited laboratory if using this approach.

How do I know if cyanobacteria present a threat to my water supply? S2.5

Cyanobacteria risk assessment can be simple if there is no risk or low risk.

- Roof water is not at risk of cyanobacteria.
- Groundwater and springs are not typically at risk of cyanobacteria either unless there is a nearby lake or river which has been known to have cyanobacterial blooms.
- Surface waters can be more complex to assess whether cyanobacteria (and therefore cyanotoxins) present a risk. Surface waters can be low risk if you or others have tested for cyanobacteria in source water and found nothing, or where visual inspections have shown no evidence of cyanobacteria growth.

Where a surface water source, like a lake or river, has been known to have cyanobacteria present, risk can be more complex to assess, and you may need to consult local or regional professionals and experts to better understand your source.

Where cyanobacteria have been monitored for but not detected, this can change. You'll need to continue monitoring your source for signs of growth. Visual inspections can be done to check for algae growth but it takes specialised knowledge to be able to tell the difference between cyanobacteria and non-harmful algae. Often this requires expert advice and some level of monitoring.

Where cyanobacterial blooms occur and extensive benthic cyanobacterial mats have been confirmed, water taken from these sources is at high risk for cyanobacteria and cyanotoxins. You should record the risk of cyanobacteria to your source in your drinking water safety plan.

Are all signs of algae activity (like algal blooms and benthic mats) related to cyanobacteria? S2.5

Cyanobacteria are only one of many groups of algae but algal growth, particularly algal bloom, shows that conditions in the source promote levels of algal growth which can lead to a cyanobacterial bloom. Often different species of algae bloom at different periods of time adding even more complexity to determining the threat to the water supply. Monitoring can be undertaken to determine whether cyanobacteria are present and in what quantity.

What do I do if I find evidence of cyanobacterial growth? How do I assess the immediate risk to public health? S2.6(b)

Regional councils will generally undertake cyanobacteria testing for recreational purposes in certain lakes and streams that are at risk for cyanobacteria and cyanotoxins. Territorial authorities with drinking water supplies also test for cyanobacteria regularly and may hold information on your source water. This information can be useful if they monitor your source water. Regional and local authorities have responsibilities to ensure water supplies in their region are aware of these types of threats to source water.

For lakes and ponds generally, where cyanobacterial blooms and extensive benthic cyanobacterial mats have been confirmed, water taken from these sources is high risk for cyanobacteria and cyanotoxins. If cyanobacterial blooms in lakes and ponds have not been confirmed or where benthic cyanobacteria has not been confirmed, this can change. You'll need to continue monitoring your source for signs of growth according to rule 2.6. Visual inspections can be done to check for algae growth but it takes specialised knowledge to be able to tell the difference between cyanobacteria and non-harmful algae. Often this requires expert advice and some level of monitoring.

Where cyanobacterial blooms occur and extensive benthic cyanobacterial mats have been confirmed, water taken from these sources is at high risk for cyanobacteria and cyanotoxins. You should record the risk of cyanobacteria to your source in your drinking water safety plan.

How do I assess cyanotoxin risk? S2.6(b)

If a supplier finds evidence of cyanobacteria in their source water, they must determine if there is a risk to consumers from cyanotoxins. Assessing a supply for cyanotoxin risk is complex and will likely require assistance from an experienced professional advisor or laboratory that undertakes cyanobacteria/cyanotoxin analysis. It is important that the water supplier advises consumers if there is a risk of cyanobacteria/cyanotoxins contaminating the supply. Any complaints of skin irritation or gastrointestinal illness

should be taken very seriously, as this can also be a sign that there are cyanotoxins in the supply. There are treatment options available.

What do I do if I think my supply is at risk from cyanotoxins?

You must either stop supplying water from that source or issue a do not drink advisory if there is a risk of supplying water that contains cyanotoxins at a level that exceeds the MAV. The presence of cyanobacterial blooms or extensive benthic cyanobacterial mat coverage is the most obvious sign that you need to do something. You have options when you think your supply is at risk, as outlined in rule S2.6 (c).

If you think the supply is at risk from cyanotoxins, you need to arrange for laboratory testing, and expert advice will be required. Installing treatment is an option to remove cyanotoxins from drinking water. However, it is often a better option to find an alternative water source that doesn't have a cyanotoxin problem.

What treatment is available for cyanotoxins? S2.6(c)

Removing cyanotoxins can be challenging, as treatment can be expensive and there is a risk of breaking open the cyanobacteria cells and potentially releasing cyanotoxins. Treatment includes nanofiltration, reverse osmosis, or granular activated carbon filters. It's important that the treatment is specifically designed and validated to remove cyanotoxins. You can generally find out more from the manufacturer providing the treatment equipment. If an alternative source is available, switching to a source that has a lower risk of cyanotoxins may be more effective than installing treatment.

What taste or odour issues could be related to cyanobacteria? S2.7

Cyanobacteria can often be detected in drinking water by consumers due to distinctive taste and odours that they can generate. A musty or earthy smell and taste in the water and complaints about taste and odour are often the first indication of a cyanobacteria problem. It is therefore important to record and investigate any taste or odour complaints as they can help detect cyanobacteria issues.

Not all taste and odour problems are caused by cyanobacteria, and expert advice may need to be sought. The same treatment processes that treat for cyanotoxins are generally effective for taste and odour compounds too, that is nanofiltration, reverse osmosis, or granular activated carbon filters. The manufacturer of the treatment equipment will be able to give you more information on effectiveness for taste and odour treatment.

Treatment rules – networked supplies and self-supplied buildings

Treatment rules ensure that water suppliers provide safe drinking water to consumers by prescribing treatment processes and operational requirements of those processes to significantly reduce the risk of bacterial and protozoal contamination in drinking water and assess any other chemical risks.

What are *E. coli* and total coliforms?

E. coli are bacteria that indicate faecal contamination. If they are found in a water sample, this indicates that the sample is contaminated with the faeces of a person, animal or bird. It is expected that bacteria and other pathogens that can cause serious illness will also be in the water. Some of these pathogens include bacteria like *Campylobacter* and *Salmonella*, viruses like norovirus, and protozoa like *Cryptosporidium* or *Giardia*. These pathogens along with *E. coli* can enter a water source, for example, through runoff or wastewater discharges near the surface or groundwater abstraction point or from animal droppings on the roof collection area.

Total coliforms are a group of bacteria that live in the wider environment, e.g. on decaying vegetation. If total coliforms are found in a water sample, it indicates that bacteria are present in the water.

If treatment is ineffective then this contamination can carry through to consumers drinking water. This indicates there is a pathway for pathogens to enter the drinking water.

Where should I sample treated water? T2.1, T2.2

Treated water can be sampled as it leaves the treatment plant or in a treated water storage tank at the treatment plant. The sample needs to be representative of water leaving the treatment plant i.e. no further treatment steps between the sample location and the distribution network.

What do I do if water leaving the treatment plant contains *E coli* or total coliforms? T2.1

If a sample result is positive for *E. coli* then water containing animal or bird faeces could be provided to every person who drinks the water. You must take immediate steps to protect consumers and prevent them from becoming unwell from consuming the water. You can do this by advising all consumers to boil the water before they drink it.

You also must notify the Authority if a sample of treated water is positive for *E. coli* as this is in breach of the Standards and presents a public health risk. Laboratories will also notify the Authority separately of drinking water test results that are positive for *E. coli*.

Advising consumers to boil all drinking water is only a short-term measure. You must investigate to find the cause of the *E. coli* contamination and fix it (see ss 21(2) and 22(2) of the Act). You should take the following steps:

- if the supply has a treatment system, check it is working properly – you may need to shock dose chlorine in response to the *E. coli* detection
- if a suitable treatment system is not installed, find and install a suitable treatment system
- continue testing for *E. coli* and total coliforms as you investigate the contamination

If treated water stops testing positive for *E. coli* before a reason is found, it is important to still look for the cause so that you can remedy the issue and protect consumers from recurrence.

If a sample result is positive for total coliforms but does not contain *E. coli* then bacteria are entering the treated water. You don't have to advise consumers to boil the water but it is still important to check the treatment system is working. You should still look for the cause so that you can remedy the issue. If total coliforms are found, bacteria still entered the water and the water could be more seriously contaminated in the future.

How do I add chlorine to my supply and why is it important? T2.9

Chlorine is the world's most widely used tool for disinfecting drinking water. It is affordable and effective against most micro-organisms (like viruses and bacteria) found in water. In addition to providing disinfection at the treatment plant, chlorine provides a protective barrier to contamination in a distribution network. Chlorine is usually added using sodium hypochlorite or chlorine gas. Sodium hypochlorite can be generated on-site from salt or stored in a liquid form. Contact a chlorine dosing unit manufacturer to determine the best method for you and for advice on device operation and maintenance.

Chlorine is not required for medium self-supplied building supplies.

What monitoring requirements relate to chlorine addition? T2.2, T2.3 T2.4, T2.6

Chlorine is measured in drinking water as free available chlorine (FAC). FAC is measured in water leaving the treatment plant and must be at least 0.5 mg/L to ensure effective disinfection. FAC continues to disinfect as the water moves through the supply. This ongoing disinfection effect is called residual disinfection.

If you chlorinate using sodium hypochlorite or calcium hypochlorite which is not generated on-site from a salt brine, then chlorate must also be measured at least every three months. This is because these compounds can degrade due to poor storage or age, becoming less effective at treatment and resulting in elevated levels of chlorate.

The pH of drinking water must also be measured in chlorinated supplies and be between 6.5 and 8. pH correction may be required if water cannot be maintained in this range. Higher pH reduces the efficacy of chlorination. Changes in pH can also affect the aesthetics of the water. The addition of chlorine can cause pH changes in response to the source water chemistry.

Samples collected for T2.2 (e.g. FAC and pH) need to be taken on days spread over each month and be taken on different days of the week. This is because water supplies experience daily and weekly trends and suppliers need to understand how their supply operates in different situations. For instance, water usage on a weekday will be different to a weekend day, and this may cause changes in the treatment plant because of higher or lower usage putting pressure on the plant. Some systems can automatically adjust the amount of chlorine added if the flow of water changes and make chlorine dosing more reliable.

What do I do if FAC is too low? T2.2, T2.6

Low FAC can indicate there is a fault with the chlorine dosing system or that there is a large amount of organic matter consuming the chlorine. You must ensure the chlorine dosing system is working appropriately and increase the dose if required. If organic matter is present, this may indicate the source turbidity has increased (such as in response to heavy rainfall) or the filtration system is failing. Check that the filtration system is working. If the water is too turbid to meet T2.6, the water treatment plant might need to be stopped or a boil water notice issued. Consider contacting water treatment and operation professionals if the issue cannot be resolved quickly.

Some chemicals in the water can react with chlorine. Iron and manganese can use up chlorine, and chlorine can cause these chemicals to come out of the water. Iron and manganese can form black or brown grit in water pipes and will sometimes cause water to look discoloured.

What do my turbidity results mean? T2.2, T2.6

Turbidity is a measurement of water clarity. At high levels (more than 5 NTU) the water has a "muddy" or "milky" appearance. "Crystal-clear" water usually has a turbidity of less than 1 NTU. At low levels (less than 1-5 NTU), turbidity can only be detected by instruments.

Turbidity should be less than 5 NTU for UV disinfection to work well and to maintain high quality water for the consumer. Filtration typically can achieve turbidity well below 5 NTU. High turbidity (>1-5 NTU) in treated water indicate that something has changed in the system, such as a contamination of the source or an issue in the treatment process. It's important to regularly maintain your filters to ensure they can consistently reduce turbidity of source water.

What do I do if a result for a chemical test (e.g. arsenic, nitrate, lead) is above the MAV? T2.1, T2.2, T2.4, T2.5

If a chemical test exceeds the MAV, you must report it to the Authority with your proposed response. For notification guidance, refer to our website (Notify Taumata Arowai | Taumata Arowai and Hinekōrako guidance (Create and submit a supply notification). Laboratories must notify you if a treated water result from your supply is

above the MAV. The laboratory will also notify the Authority separately. Responses to chemical exceedances will vary depending on the chemical and could range from informational consumer advisory notices to a do not drink notice and providing an alternative supply (such as a water tanker). You could also provide bottled water so people have enough to drink.

What other determinands should I test for to meet rule T2.5?

Testing other determinands will depend on your supply. If you are aware of other substances that could present a risk to the supply, you need to identify them and address the risk in your drinking water safety plan. Substances may occur naturally in the source water (e.g. arsenic), be introduced to source water through human activities (e.g. via environmental discharges – permitted or accidental - or from typical land use activities) or they may be in a chemical that is used in a treatment process (e.g. such as pH correction).

If a contaminant in the source water exceeds 50% of the MAV, it is a risk to the supply that must be monitored in water leaving the treatment plant to make sure their levels do not exceed the MAV in drinking water.

You may choose to first test for a chemical in source water to identify whether it is a risk to your supply. It is good practice to take a sample in treated water at the same time you test your source water for a chemical determinand, so you know whether your treatment plant removed it. Chemical testing can be expensive, so it's important to weigh up the benefits versus cost of testing chemicals in medium water supplies.

How often should I sample for other determinands? T2.5

If a substance / determinand presents a risk to the supply, you must sample at least every three months until three consecutive samples have a result of less than 50% of the MAV (after this the Rules no longer require sampling to continue, unless the determinand becomes a risk again). If the first two samples are less than 50% of the MAV but the third is more than the MAV, sampling needs to begin again from the first sample.

Once a determinand is known to have exceeded 50% of the MAV, or is being added as part of a treatment process, it becomes a known risk and should be included in your risk management approach. Rule T2.5 is intended to provide flexibility around individual supply's circumstances. You might sample three days in a row or once per month over the next three months.

Remember that bacteria and nitrate MAV exceedances present an immediate public health risk, whereas other chemical determinands present a risk over time. Most chemicals are not commonly found in drinking water in excess of their MAV.

Why do I need filtration? T2.7

Filtration of a water supply removes particles of a certain size from water. This is important for downstream treatment like UV, to ensure that treatment is effective. Filtration can also make the drinking water more aesthetically pleasing to drink, reducing things like turbidity, grit, and iron from water.

Chemicals can be attached to particles or freely floating (i.e., dissolved) in the water. Most filters can remove chemicals attached to particles but only certain types of filters can remove chemicals dissolved in the water.

What is the difference between the filtration options? T2.7

There are four different types of filtration to meet treatment requirements for the medium drinking water supply rules. Each supply is unique, so you are advised to contact a filter manufacturer to determine the best system for your supply.

Cartridge filters are the most common for bore and roof water supplies and act as very fine sieves which are contained in a protective housing. The pore size of the filter is the size of the holes in the filtration cartridge. They are simple to maintain and replace when needed.

Back-washable media filters use a media, like sand, either in a big tub or in an enclosed vessel to remove dirt particles from water. Generally, these are used when a water source has elevated or intermittently elevated turbidity like surface water. Eventually the filter media gets clogged, at which point the water flow is reversed to wash the dirt particles out. A valve is opened to divert the dirty water to waste, and the filter is cleaned and ready to be put back into use.

Slow sand filters have a sand bed with an active microbial layer on the top of the sand. The microbial layer consumes the organic material that the water deposits on it, leaving filtered water to trickle slowly through the sand layer. Slow sand filters can be run in remote locations with no pumps.

Membrane filters consist of fine tubes or membranes with very small pores or holes in them. Membrane filters are very good at filtering water with particles and can have smaller pore sizes than cartridge. Water pumped through the pores and any dirt or other particles are left on the outside of the membranes. Membrane filters have a high energy use and higher level of maintenance compared to other filtration options. An important maintenance task is to clean the membranes. This involves chemicals that present health risks to operators which must be managed, and waste products which must be disposed of safely, generally to a wastewater sewer.

Why do deep groundwater bores not need filtration? T2.7

Groundwater often has lower turbidity than surface water sources. Deeper bores usually have more stable turbidity than shallower bores, though this can depend on the characteristics of the bore and the bore infrastructure. Because of this, if your water is abstracted from deeper than 30 metres below the ground surface, filtration is not compulsory.

However, deep groundwater can have high turbidity too, so it is important to monitor the turbidity in the source water. If turbidity is an issue in a deep groundwater, filtration may need to be installed to allow effective UV treatment, or it may be a sign the bore infrastructure has degraded significantly and may require maintenance.

How do I arrange my cartridge filter and pump set up? T2.8

Cartridge filters are designed to have water pushed through them, so it is important to ensure any pumps are upstream of the cartridge filters. If water is to be pumped somewhere after cartridge filtration, the water coming out of the filters must be discharged into a tank from which the water can then be pumped. This provides a physical separation between the filters and the pumps downstream.

Why do I need UV treatment? What do the requirements for UV treatment mean? T2.9 T2.10

UV treatment works by damaging the DNA in microorganisms, preventing them from multiplying and infecting people. To be effective the UV light inside the UV unit must be strong enough to inactivate pathogens. This is known as UV intensity (UVI). UV intensity is measured in energy output in millijoules (mJ) over an area measured in square centimetres (cm^2), resulting in the unit mJ/cm^2. Essentially, a UV dose of 40 mJ/cm^2 is required to ensure bacteria are inactivated. This dose is also effective for other pathogens like protozoa.

UV Transmittance (UVT) must be monitored monthly or continuously. UVT measures how much UV light is passing through the water. UV intensity or UV dose must be monitored twice weekly or continuously. Monitoring these values ensures the UV unit is operating according to required specifications.

Flow through the UV unit must also meet the manufacturer's specifications and be restricted or monitored to ensure that it does not exceed specifications. Additionally, lamp usage must be recorded and alarmed if there is more than one lamp. The duty UVI sensor must be referenced against a new sensor annually and replaced if it reads differently to the new sensor, as per manufacturer recommendations.

The science and engineering that is used to ensure UV units work effectively is complex and requirements have been standardised. Your UV units need to be certified to one of several international standards and operated according to the manufacturer's

instructions to ensure the UV unit inactivates pathogens. Check with the manufacturer to ensure that a UV unit meets the required dose and certification before purchasing.

All UV units require routine maintenance. The UV lamps must be replaced according to the manufacturer's recommendations (typically annually). Quartz sleeves that protect the UV lamp should be cleaned every time the lamp is replaced or more frequently if these get dirty.

What do I do if the UV unit is not meeting the required dose?

If continuous or discrete monitoring shows that the required UV dose is not being achieved, immediate action must be taken to resolve the situation. It might be necessary to stop the treatment plant or issue a boil water notice while the cause is investigated. Sometimes the UV unit is set up so that water stops flowing when the UV dose is not being achieved. Sometimes the UV unit has an alarm that will tell you something is wrong. Causes of a low UV dose could include a fault with the UV unit requiring maintenance or high turbidity reducing the UVT value.

If there are dissolved chemicals in the water, such as iron and manganese, these chemicals can coat the quartz sleeve in the UV unit and block the light. Routine cleaning of the quartz sleeve can prevent this problem.

Distribution rules – networked supplies only

Distribution rules ensure that water suppliers monitor and maintain the quality of treated water in the pipe network. The rules provide guidance about testing frequency and preventing backflow of water from properties into the network.

This module does not apply to self-supplied buildings.

What is a distribution system? What is a distribution zone?

A distribution system is generally the network of pipes and storage tanks that transmit drinking water to consumers and normally starts as water leaves the treatment plant. A distribution zone is then all or part of a distribution system which contains water of a similar character, often defined as a bounded geographic area. Every drinking water supply with a distribution system has at least one distribution zone. Supplies that provide water over a large area may have more than one distribution zone so it is important to make sure each one is tested.

What are *E. coli* and total coliforms?

E. coli are bacteria that indicate faecal contamination. If they are found in a water sample, this indicates that the sample is contaminated with the faeces of a person, animal or bird. It is expected that bacteria and other pathogens that can cause serious illness will also be in the water. Some of these pathogens include bacteria like *Campylobacter* and *Salmonella*, viruses like norovirus, and protozoa like *Cryptosporidium* or *Giardia*. These

pathogens along with *E. coli* can enter a water source, for example, through runoff or wastewater discharges near the surface or groundwater abstraction point, or from animal droppings on the roof collection area. *E. coli* can enter drinking water through storage tanks. Holes in the tank, hatches, air vents and overflows can allow *E. coli* to enter the water. *E. coli* can also be drawn into pipes through pipe breaks and leaks.

Total coliforms are a group of bacteria that live in the wider environment, e.g. on decaying vegetation. If total coliforms are found in a water sample, it indicates that bacteria are present in the water.

If treatment is ineffective or the distribution network is not secure (e.g. pipe breaks, treated storage contamination) then this contamination can carry through to consumers drinking water, and indicates there is a pathway for pathogens to enter the drinking water.

What do I do if a distribution zone result is positive for E. coli or total coliforms? D2.1

If a sample result is positive for *E. coli*, you must take immediate steps to protect consumers and prevent them from becoming unwell from consuming the water. You can do this by advising all consumers to boil the water before they drink it.

You also must notify the Authority if a sample of treated water is positive for *E. coli* as this is in breach of the Standards and is a public health risk. Laboratories will also notify the Authority separately of drinking water test results that are positive for *E. coli*.

Advising consumers to boil all drinking water is only a short-term measure. You must investigate to find the cause of the *E. coli* contamination and fix it (see ss 21(2) and 22(2) of the Act). You must take the following steps:

- if the supply has a treatment system, check it is working properly
- if a suitable treatment system is not installed, consider finding a suitable system and installing it
- investigate for breaks, damage or recent changes to the distribution network
- inspect storage reservoirs for ingress of vermin
- continue testing for *E. coli* and total coliforms as you investigate the contamination

If treated water stops testing positive for *E. coli* before a reason is found, it is important to still look for the cause so that you can remedy the issue and protect drinking water consumers.

Once the source is identified, consider flushing the network and adding an extra dose of chlorine.

How should I sample water from the distribution zone? D2.1 - D2.6

When testing the distribution network, it is important to gather representative samples from across the network. It is also important to check areas more likely to have issues such as the far ends of the network where sediment may accumulate (D2.3 (b)). This ensures consumers are still receiving safe drinking water regardless of where they are connected to the supply.

Samples could be taken from a purpose-built sampling tap or inside a building. If sampling from private or public property, water quality issues may arise from internal plumbing. Check with the laboratory for sampling techniques that minimise risk from contamination at any sample point, such as disinfecting the tap and letting the tap run before taking the sample. It is important to note that sampling for microbiological contaminants (D2.1) requires a different sampling method to metals (D2.5) as described in D2.6.

FAC monitoring must be evenly spaced across each month and on different days of the week. For example, samples could be collected on Monday and Wednesday one week, Tuesday and Thursday the next week, and Wednesday and Friday on a following week. Weekend samples will be valuable if you can collect these.

Why is it important to test for FAC in the distribution zone? D2.2, D2.3, D2.4, D2.7

Free available chlorine (FAC) is an important barrier to microbiological contamination in the distribution zone. Even if bacteria and viruses are removed by a treatment plant, there are opportunities for them to contaminate drinking water in the distribution system (such as via backflow or pipe breaks). Ensuring that FAC is present at 0.2 mg/L (and no less than 0.1 mg/L) protects drinking water after it has been treated. Testing FAC in the network may also indicate a contamination event in the network, which can consume the FAC and cause a very low result.

What is plumbosolvency? D2.5, D2.6

We use the word plumbosolvency to describe how water corrodes and dissolves metal. Plumbosolvency occurs when drinking water remains in contact with metal pipes over time, which can cause harmful metals such as lead to leach into drinking water. Most drinking water in New Zealand is plumbosolvent, which creates a risk of metal contamination wherever metal pipes are used. Rule D2.5 ensures that testing is done for metals associated with plumbosolvency.

Should I test for anything else in the distribution zone?

While the rules for medium drinking water supplies do not require testing of other determinands, you still need to consider the risks of the supply and how to manage them in your drinking water safety plan. For example, a supplier may need to undertake additional testing to manage the risk of lead, plumbosolvency or disinfection by-product issues in the distribution network depending on the treatment and materials used in the

supply. Microbiological testing in the network uses a different sampling methodology to chemical testing. Check with the laboratory conducting the analysis for specific test instructions.

What is backflow? D2.8

Backflow can occur when there is a drop in pressure in the distribution system and water from an open tap is drawn back into the network. The pressure drop could be caused by a pipe break or the fire service pumping water from a hydrant to put out a fire. Water could be drawn back into the network, for example from a hose left filling a swimming pool or in a bucket being used to make a pesticide spray. Backflow is a real risk to medium drinking water supplies and there are many examples of backflow occurring in these supplies resulting in risks to consumers.

While the Building Act does require some levels of backflow prevention on properties, these are to protect the building and not necessarily the water supply the building is connected to. Water suppliers need to undertake their own backflow risk assessments to protect the water supply.

What is a cross connection? D2.8(a)

Contamination can also occur from a cross connection. This is where a pipe that is carrying a substance other than drinking water is connected into the distribution system. It may occur within a domestic premises or farm rather than within the supply piped network. While unlikely, it does happen and can be a serious risk to those drinking the contaminated water. Examples of this include connection to untreated water from a domestic roof supply, stock water, or an industrial chemical.

How do I assess backflow risk? D2.8(a)

To assess backflow risk, you need to investigate the distribution zone for high-risk consumer activities. Activities presenting backflow risks include swimming pools, stock troughs, private water sources, and hairdressing. Water New Zealand has produced a guide *Boundary Backflow Prevention for Drinking Water Supplies Code of Practice* to assist you with this task.

There is some level of backflow risk from every connection to a water supply, including household connections, and best practice is to ensure there is some form of backflow protection device installed at every connection. This is not always practical or achievable so the focus should be on the sites where there are medium or high risks.

What do I include in my backflow risk register? D2.8(b)

When you have assessed where in the distribution system backflow risks are, you need to compile a register of sites where there is a medium or high backflow risk. The register may include information on the location where the risk exists, the property owner and contact

details, details of the activity that is responsible for the risk, whether there is a backflow protection device installed at the premises, and what type of device it is.

What type of backflow prevention devices are there? D2.8 (c)

There are three main types of backflow protection device.

- A **reduced pressure zone device** (RPZD) is used on the highest risk sites. This type of device can be tested to see if it is working.
- A **check valve** usually has a flap that closes when water flows in the direction it is not meant to flow. Check valves generally cannot be tested to see if they are working. Small double check valves can be installed at the point of supply (toby) for domestic households and simple check valves can be attached to taps.
- An **air gap** is a permanently mounted gap between the delivery pipe and the maximum water level of a tank and can be used where the network delivers water to consumers' personal water storage tanks. An air gap needs to be inspected to make sure that it is still in place and has not been undermined by tank configurations such as an overflow outlet that is too high.

Who is a suitably trained or experienced person? D2.8(d)

The Authority does not have a specific test or framework to determine who is a suitably trained or experienced person. However, suppliers need to ensure the people who work on the drinking water supply know what they are doing, and they have a responsibility to determine if someone is suitably qualified, trained or experienced. If someone is engaged to test a backflow device it would be useful to check that they have completed a course in backflow assessment and testing. This can include an Independently Qualified Professional (IQP).

Varying Population rules – Networked Supplies and Self-supplied Buildings

Under Varying Population rules, additional monitoring requirements must be met when the usual base population of a drinking water supply increases for limited periods of time, such as during public holidays, certain seasons or planned events.

Medium supply rules apply when the number of people supplied with water is normal, with nothing unusual happening in the community. When the supply population increases above 500 people, medium drinking water supplies must follow the Varying Population rules that apply.

Why do I need to increase microbiological testing?

The Varying Population rules are addressing two changes to supply risk when populations increase. Medium drinking water supplies are designed for their normal population size,

so if the population increases significantly and water demand increases, the water supply characteristics may change. This could lead to water not being treated sufficiently or breaks to occur in the supply.

When water supplies have limited water treatment and monitoring of water quality, the consequence of things going wrong can rise if the population increases for a short period of time, i.e. more people could get sick. This may occur when you more than 500 people use your water supply for a limited period.

Testing for microbiological contaminants gives you an understanding of the water quality being consumed by the increased population, and an opportunity to detect and address any issues occurring during the time of increased demand on the supply.

How do I know if I need to use the Varying Population module?

If you know that your population increases around public holidays, especially if the supply serves a campground or holiday houses, or if you have recurring events that bring in significant numbers of visitors such as annual festivals, you should plan to use the Varying Population rules module and include this in your drinking water safety plan.

You should also keep up to date with news in the community for any one-off events, as these may also trigger the need to follow one of the Varying Population rules.

The population has risen unexpectedly. How do I meet the rule requirement of monitoring 1 week prior to the population exceedance?

You are only required to increase monitoring the week prior to the population exceeding if the population increase is predictable. If the population increase was not predictable, but you started sampling according to the Varying Population rules as soon as the population increased above the limit, you can still consider yourself compliant.

What do I need to report on Varying Population rules?

Varying Population rules are non-reporting rules so you do not need to report compliance against them. You are still expected to meet these requirements.