Ministry for the Environment
Manatū Mō Te Taiao

DRAFT

Users' Guide

National Environmental Standard for Sources of Human Drinking Water

New Zealand Government

Feedback on the guide

This guide is a draft. Comments on any aspect to improve its usefulness are welcomed. Feedback can be made up until 1 September 2009. A final revised users' guide incorporating your feedback will then be produced.

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Contents

Tables

Figures

1 Introduction

1.1 Purpose of this guide

The aim of this guide is to assist with the implementation of the National Environmental Standard (NES) for Sources of Human Drinking Water. The guide does not replace the NES regulations, but it is intended to make them easier for users to understand.

In keeping with requests from stakeholders during the development of the NES, the wording of the regulation has been designed to provide councils with flexibility in the approaches they take to its implementation. Therefore, this guide should not be viewed as a prescriptive set of requirements to be followed to the letter. Instead, it is intended to provide plain-English guidance on the intent of the regulations and approaches to follow (or matters to consider) during implementation.

It is important to note that this guide is not a legal interpretation of the regulation and has no legal status.

1.2 Status of the national environmental standard

The NES is a regulation made under sections 43 and 44 of the Resource Management Act 1991 (RMA). The NES was gazetted in December 2007. A six-month phase-in period provided councils, water suppliers and consent applicants time to become familiar with its requirements. The regulation came into force on 20 June 2008.

1.3 Purpose of the national environmental standard

The purpose of the NES is to improve drinking water management by ensuring that catchments are included in the management of drinking water.

The NES has come about as a result of the Ministry for the Environment and the Ministry of Health working together to improve the management of drinking water in New Zealand. Although the quality of New Zealand drinking water is generally very good, disease-causing micro-organisms are present in many water sources. These enter water from a range of sources, including animal and human waste. This places drinking water supplies at risk. New Zealand has one of the highest rates of gastroenteritis in the developed world. While the reasons for this are not fully understood, drinking water is one of the routes by which people are exposed to the micro-organisms that cause disease.

Water quality monitoring involving the collection and analysis of water samples has historically been the main method for managing the quality of drinking water supplies. Relying solely on monitoring is, however, a poor defence against water-borne contaminants. Because of the time taken to analyse samples, results only provide historical water quality information unless monitoring is continuous. Thus consumers may have been receiving contaminated water for some time before a water supplier learns that the supply is contaminated.

Effective management of drinking water requires reducing the risk of contamination – from source through to the treatment plant and distribution system. If the risk of contamination is minimised at every step of the process, a failure at one step will not lead to catastrophic consequences. This is known as the 'multiple barrier' approach and is recommended by the World Health Organization.

1.4 The multiple barrier approach

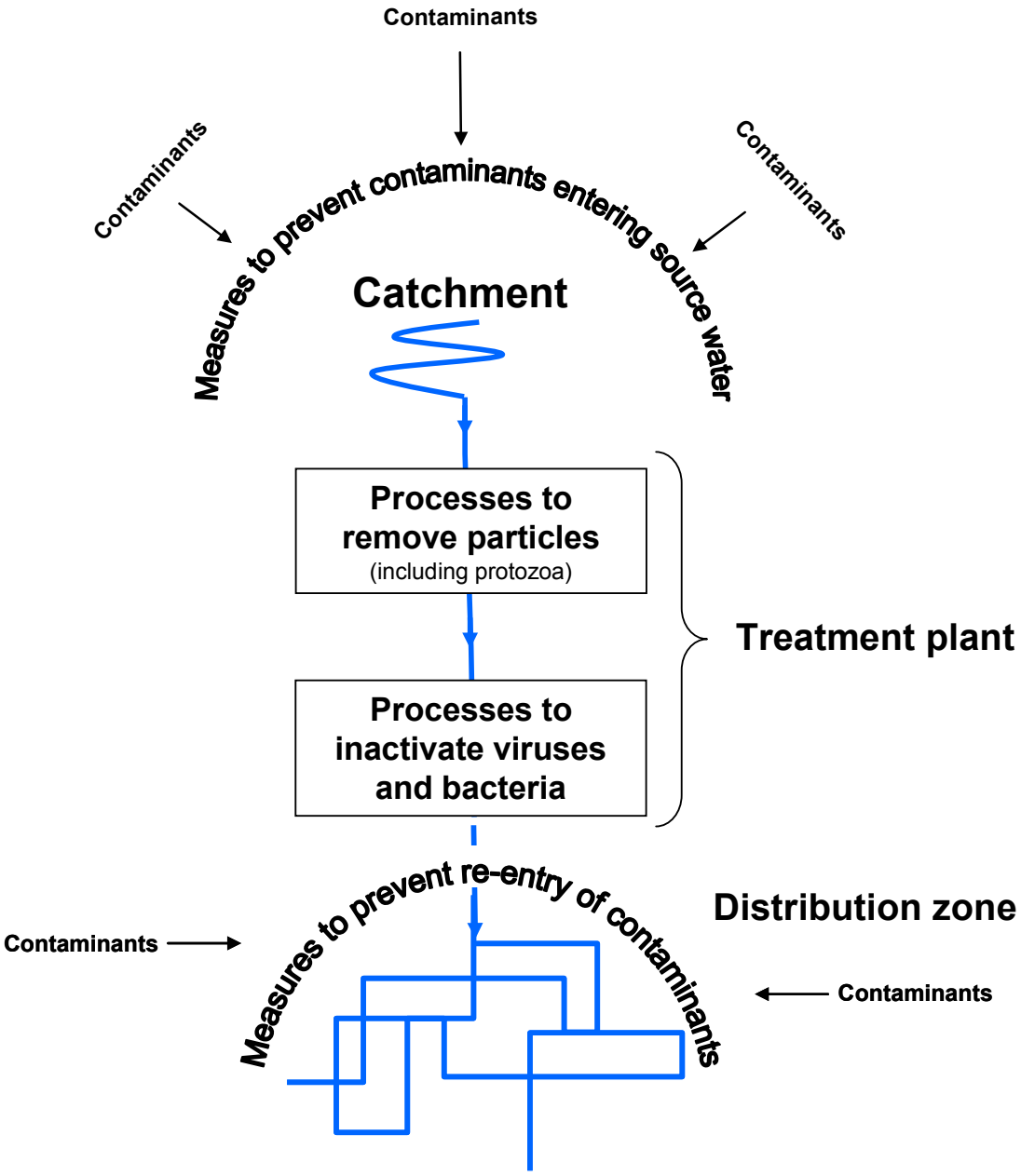
The multiple barrier approach principle is internationally recognised as a cornerstone for managing risk in water supplies. The use of more than one barrier is encouraged in the *Drinking-water Standards for New Zealand 2005* (DWSNZ). The presence of more than one barrier between water consumers and possible sources of pollution reduces the likelihood of contaminated water being supplied. If one barrier fails, there are others in place to protect consumers.

Key barriers include:

- protection of source water from contamination (eg, fencing rivers or streams so animals cannot get direct access to the water source. This reduces the type and concentration of contaminants that have to be dealt with by the water treatment plant)
- treatment plant processes:
  - filtration improves water quality by removing particles
  - disinfection (following particle removal) inactivates disease-causing micro-organisms (pathogens)
- protection of water after treatment to prevent re-contamination (eg, ensuring there is some chlorine in all pipes between the treatment plant and consumers, and regularly checking pipes to ensure there are no leaks).

The NES for Sources of Human Drinking Water was introduced to strengthen the protection of source water. This is possibly the most important barrier because it reduces the contaminant load that later barriers have to remove. Figure 1 illustrates the multiple barrier approach to drinking water management.

Figure 1: Elements of the multiple barrier approach



Internationally, failure to recognise the importance of the multiple barrier approach has resulted in severe outbreaks of water-borne disease in developed countries, leading to serious illness and deaths. Analysis of numerous disease outbreaks linked to water supplies worldwide has revealed that contamination of water sources is often the cause.

Notable examples are outbreaks in Walkerton and Milwaukee in North America. In the small rural town of Walkerton, Canada, an outbreak of the toxin-producing bacteria *Escherichia coli* (*E. coli)* O157 in 2000 led to around 2000 cases of illness and seven deaths. Costs were estimated at CAN$155 million. The contamination that caused this event entered the water supply from effluent run-off. The other well-known case was water supply contamination by cattle feed lots in 1993. This led to an estimated 400,000 people becoming ill and over 100 dying in Milwaukee, in the United States.

New Zealand has been fortunate enough to avoid large-scale outbreaks of disease caused by contaminated drinking water, but a number of smaller outbreaks have occurred in the past 30 years. The largest of these was in Queenstown, where in 1984 an estimated 3500 people became ill as a result of drinking contaminated water. In July 2006 contamination of a drinking water source at Cardrona ski field resulted in over 120 cases of illness.[1]

A study for the Ministry of Health estimated that the annual cost to New Zealand of water-borne disease was $25 million.[2,3]

1.5 Legislative context

Before the enactment of the NES there was no explicit legislative requirement to consider the effects of activities on sources of human drinking water in regional or district plans. This gap left community water sources potentially vulnerable to contamination.

The power to control the effects of activities in catchments on drinking water sources rests with local government, under the RMA. Regional councils (including unitary authorities) have primary responsibility for managing water quality in the environment under section 30 of this Act.

Health, local government, building and civil defence legislation applies to water only after it is taken from its source for treatment and/or delivery to the consumer. From the point of abstraction from source water, drinking water quality comes under the jurisdiction of health legislation, implemented by health agencies and local government (see Figure 2).

To achieve integrated management of water from source to tap, and therefore implement the multiple barrier approach, controls are needed under both the RMA and health legislation.

Before the NES, the degree of regulatory protection for drinking water sources in New Zealand varied greatly around the country. At the time the NES was developed only three of the country's 16 regional councils comprehensively addressed protection of drinking water sources in their plans.[4] The NES now requires regional councils to consider effects on drinking water sources when making decisions on resource consents and regional plans. Previously there was no clear mandate.

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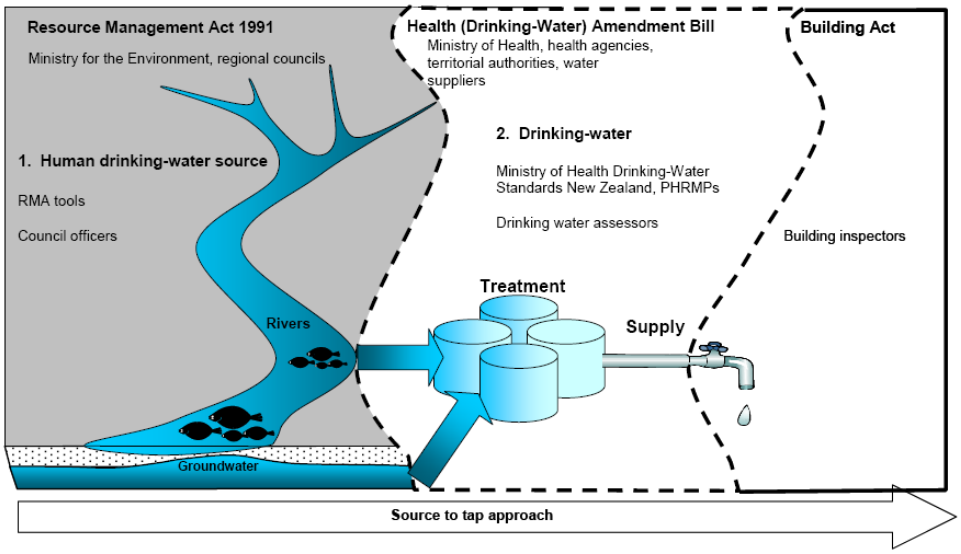
1 There have been many other outbreaks of water-borne disease in New Zealand. Further examples can be found in: A Ball. 2007. Estimation of Burden of Water-Borne Disease in New Zealand: Preliminary Report. Unpublished report prepared for ESR.

2 Harris Consulting Ltd, Cowie B, Nokes C. 2006. Economic Appraisal and Section 32 Preparation for Sources of Human Drinking-water. Unpublished report prepared for the Ministry for the Environment.

3 Ministry for the Environment, 2007. *Proposed National Environmental Standard for Sources of Human Drinking-water Resource Management Act Section 32 analysis of the costs and benefits.* Wellington: Ministry for the Enviroment.

4 Ministry for the Environment, 2004. Unpublished. Community Drinking Water Supply Provisions in Regional Plans.

Figure 2: Key legislation and agencies involved in drinking water management



Notes:

1 This figure shows only the key legislation associated with the management of drinking water. Other associated legislation includes the Local Government Act 2002 and the Civil Defence and Emergency Management Act 2002. The Local Government Act 2002 requires local authorities to undertake a specific assessment of the quality and adequacy of drinking water supplies (Part 7, section 126). However, there is no mandated requirement to manage source water quality. The shaded part of the diagram indicates the area of drinking water management where the NES applies.

2 PHRMP = Public Health Risk Management Plans.

1.6 Development of the national environmental standard

In September 2005, the Ministry for the Environment publicly notified the proposed NES for sources of human drinking water. Details of the original proposal were described in a discussion document, *Proposed National Environmental Standard for Sources of Human Drinking Water*, which was distributed during the submission period.

Four workshops on the proposed NES were held in Wellington, Dunedin, Christchurch and Hamilton in October 2005. Several separate meetings were also held with local government, drinking water assessors and other stakeholder groups. Also in 2005, the Ministry for the Environment's Talk Environment roadshow travelled throughout New Zealand, holding over 30 meetings in 16 regions and talking to over 2700 people, and the proposed NES was one of the key topics discussed.

When the submission period closed on 28 November 2005 the proposal had been delivered to over 3100 people and 82 submissions had been received. An overview of these submissions is contained in the report *Proposed National Environmental Standard for Sources of Human Drinking-water: Report on Submissions*, available on the Ministry for the Environment website at www.mfe.govt.nz

The NES was approved by Cabinet in November 2006 and gazetted in December 2007. It then had a six-month phase-in period before it officially came into effect on 20 June 2008.

2 Drinking Water Management

2.1 Introduction

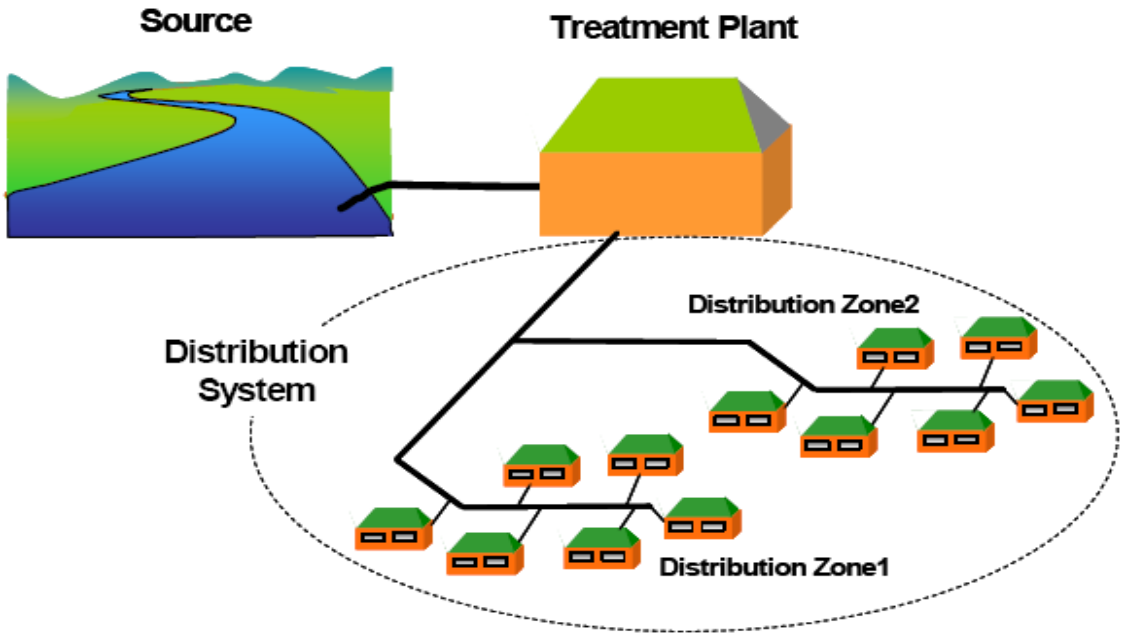
It is useful to have a basic understanding of how drinking water is managed in New Zealand to effectively implement the NES. This chapter gives background information on the processes and organisations involved.

It is important to note, however, that applicants and council officers are not expected to have an in-depth knowledge of drinking water management to carry out their functions under the NES.

2.2 Structure of water supplies

Water supplies in New Zealand can generally be divided into three components: source, treatment plant, and distribution system. Figure 3 is a graphical representation of the structure of water supplies. The subsections that follow describe each component.

Figure 3: The components of the water supply system, including a distribution system with two distribution zones



Source: *A Guide to the Ministry of Health Drinking-water Standards for New Zealand*.

2.2.1 Source

The three main sources for drinking water are:

- surface water (eg, streams, rivers, lakes)
- groundwater (water drawn from bores or wells)
- roof catchment (rain water collected on roofs and stored for later use).[5]

Often water suppliers have limited control over activities in the catchment of their surface water source or in the recharge zone of a groundwater source.[6] This means they have very limited control over the quality of the source water they have to treat. Suppliers are also unlikely to be informed if there is a change of activities in their catchment that could lead to a decrease in source water quality. The NES was put in place to rectify this situation and give drinking water quality more weight as an issue.

2.2.2 Treatment plants

Treatment plants range from large operations that consist of a series of treatment processes running under automated control, through small plants using a manually controlled single treatment process, to a single pump drawing water from a source (usually groundwater) without any treatment. Where drinking water is drawn straight from the source and there is no treatment, the Ministry of Health regards the bore head as the treatment plant.

2.2.3 Distribution system

Distribution systems carry water from the treatment plant to the consumers. The Ministry of Health defines the distribution system as the pipes, water storage facilities (tanks or reservoirs) and any other components situated between the treatment plant and the consumer's property boundary. Storage facilities at the treatment plant are not considered to be part of the distribution system; they are regarded as part of the treatment plant.

Distribution systems can be divided into separate distribution zones. The quality of water within a distribution zone should be consistent.

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[5] Roof catchments are mentioned for completeness, but they are rarely a water source that serves large communities of the population size specified in the NES. The catchment activities of concern for this type of source (ie, roof water) are those introducing contaminants into the air, or encouraging the congregation of birds (eg, landfill sites).

[6] The exception is for supplies with protected catchments. For example, the majority of Auckland's water supply is sourced from protected catchments in the Hunua and Waitakere Ranges.

2.3 Local management: drinking water suppliers and public health units

The following organisations and groups play a part in the distribution, treatment and management of drinking water:

- water suppliers, who produce and supply drinking water for their consumers
- health protection officers and drinking water assessors working within the public health units of district health boards, who are responsible for checking whether water suppliers meet the requirements of legislation and the DWSNZ, and can also provide advice where required
- the Ministry of Health, which develops legislation, provides 'tools' and support material to water suppliers to encourage and assist with good management of water supplies, and distributes support funding when available.

All these organisations and groups are likely to have information and knowledge that can help councils implement this NES.

The Ministry of Health maintains a database of public health services on its website (see http://www.moh.govt.nz/moh.nsf/indexmh/contact-us-public-health-services). It includes contact details for the public health units.

2.3.1 Drinking water suppliers

Most of New Zealand's population is supplied with water by their local authority water suppliers (city or district councils). In Auckland and Wellington, residents are supplied by the local authority's retailers, who in turn receive their water from bulk water suppliers. The bulk water supplier in Auckland is the quasi-public-owned company Watercare Services Limited, and in Wellington it is the regional council. Other suppliers include:

- government departments, such as Defence (military bases), Justice (prisons) and Conservation (national parks)
- schools
- large industries, which may provide water to a substantial number of workers
- camping grounds
- private individuals or groups of individuals, including marae.

The water supplier is responsible for providing safe drinking water to their consumers. Local authorities running water supplies will employ an engineer or manager with overall responsibility, whereas treatment plants are run by treatment plant operators. When assessing a consent for a discharge or water permit, and when developing permitted activity rules, it may be helpful to contact these treatment plant operators.

2.3.2 Public health units and drinking water assessors

The Ministry of Health and district health boards have responsibilities for public health, which includes undertaking activities to protect health and prevent population-wide disease. Public health units, which operate within district health boards, carry out these activities, including some related to drinking water supplies. Contaminated water supplies can cause widespread illness and are thus of public health importance.

Twelve public health units provide core public health services across the country. Some public health units cover more than one district health board. Two types of staff in public health units may have responsibility for the public health aspects of water supplies: health protection officers and drinking water assessors. Health protection officers have postgraduate training in public health. They may have responsibility for water supplies only, or broader responsibilities that require them to work in other health protection areas or health promotion. Drinking water assessors have received additional training to increase their expertise in water supplies, water treatment and associated regulations.

Refer to the Ministry of Health website for public health unit information, including contact details (http://www.moh.govt.nz/moh.nsf/indexmh/contact-us-public-health-services).

2.4 Health legislation and standards

The Ministry of Health develops legislation and management systems designed to ensure New Zealand drinking water is safe. To support regulatory and legislative initiatives, it has developed a suite of 'tools'. These gather information about the way in which water supplies are being managed and also help water suppliers provide a safe product by better managing their supplies.

2.4.1 Drinking-water Standards for New Zealand 2005

The Drinking Water Standards for New Zealand (DWSNZ) are prepared by the Ministry of Health and aim to protect public health. The standards set out requirements for safe drinking water and apply only to water that has been treated. These standards work in tandem with the NES to provide a multiple barrier approach to providing safe drinking water.

Despite the name of the DWSNZ, these standards initially had no legal status. However, the Health (Drinking Water) Amendment Act 2007 refers to these standards and gives them legal standing (see below). The DWSNZ are revised every two years and updated every five years. The most recent revision was published in 2005.

The DWSNZ explain how to assess the quality and safety of drinking water by providing two types of information.

- **Water quality standards** define the maximum concentrations of contaminants acceptable in safe drinking water. This is done in the form of maximum acceptable values (MAVs), which apply to treated water only. A MAV is the maximum concentration of a contaminant (microbes or chemicals) in drinking water that will not make consumers ill, even if they drink the water all their lives. MAVs provide a yardstick by which the safety of drinking water can be judged. Water is safe to drink if none of the contaminants it contains exceed their MAVs.

- **Compliance criteria** specify how a water supplier is to monitor its supply to show that the water it is producing meets the water quality standards. It is the responsibility of the water supplier to show that their water supply complies with the DWSNZ.

The DWSNZ can apply to drinking water supplies of any size, irrespective of whether they are public or private. The standards specify requirements for ensuring that drinking water is safe while minimising unnecessary monitoring.

2.4.2 Health (Drinking Water) Amendment Act 2007

Until recently compliance with the Ministry of Health's DWSNZ was voluntary. However, health legislation passed in October 2007 changed this situation. The Health (Drinking Water) Amendment Act 2007 requires drinking water suppliers to take all practicable steps to ensure they provide an adequate supply of drinking water that complies with the DWSNZ.

This Act includes a list of dates from which drinking water treatment plants must take all practicable steps to comply. These are set out in Table 1. The larger the drinking water supply, the sooner it must comply.

Table 1: Dates when the Health (Drinking Water) Amendment Act 2007 comes into force (s69c as at 20 May 2009)

Supply type	Population served	Compliance from
Large	> 10,000	1 July 2009
Medium	5001–10,000	1 July 2010
Minor	501–5000	1 July 2011
Small	101–500	1 July 2012
Very small	25–100	1 July 2013
Rural agricultural	N/A	1 July 2013

Note: Very small = neighbourhood drinking water supply.

These dates have implications for the implementation of Regulations 7, 8 and 10 of the NES.

The date of particular relevance is the compliance date for water supplies serving more than 500 people: this threshold applies to Regulations 7, 8, 9 and 10 of the NES. If the majority of these drinking water supplies comply by this date, a much greater number of drinking water sources can be assessed under Regulation 7 of the NES rather than under the stricter Regulation 8. (Regulations 7 and 8 are explained in greater detail in section 4.6). Therefore, as time goes on the requirements of the NES will become less onerous as compliance with the DWSNZ becomes more common.

The DWSNZ are also important for the implementation of the NES because they set out the standards that drinking water must meet. The Ministry for the Environment commissioned the Institute of Environmental Science and Research Limited (ESR) to prepare two reports, *An Introduction to Drinking Water Contaminants, Treatment and Management: For Users of the National Environmental Standard for Sources of Human Drinking Water* and *A Guide to the Ministry of Health Drinking-water Standards for New Zealand*. Both of these guides were published in 2008 and are available on the Ministry for the Environment website at www.mfe.govt.nz/laws/standards/drinking-water-source-standard.html/

Further information about the Act can be found on the Ministry of Health's website at www.moh.govt.nz/moh.nsf/indexmh/drinking-water-proposed-legislation/

2.5 Partnerships and cooperation under the national environmental standard

Regional councils have a statutory responsibility for making determinations on whether approval of a consent application is consistent with the provisions of the NES. However, we recognise that regional councils are not experts in drinking water treatment, and the NES does not require that they become so.

Resource consent applicants are expected to include sufficient information with their assessments of environmental effects (AEEs) for council staff to be able to make a decision on how a proposed activity will affect water quality in a drinking water source. Other organisations – chiefly public health units and drinking water suppliers – can assist councils by providing information on how a proposed activity could affect drinking water quality. This could help regional councils to then make decisions on whether an individual resource consent application can be granted in accordance with the NES. If council staff require advice on how a particular proposal would affect drinking water quality, including whether existing treatment will be able to provide safe drinking water if the activity goes ahead, they should obtain advice from expert staff in public health units and/or drinking water suppliers.

The NES does not specify how each agency should operate in implementing the NES. It may be helpful for the agencies in each region that are likely to be involved in, or are directly affected by, the NES to meet to agree on procedures and protocols for handling applications affected by the NES. This could be done by having a regional meeting of agencies with responsibilities for decision-making under the NES, along with those who have public health responsibilities and/or technical knowledge that would assist in assessing the effects of proposed activities on drinking water supplies. Participants could include:

- regional council staff (including consent officers and regional planners)
- district council officers (both planning/consent staff and those directly involved in drinking water supply)
- water suppliers, including treatment plant operators
- public health unit staff, including drinking water assessors and health protection officers.

All parties could discuss how the NES would best be implemented in their area, including identifying the types of applications that other agencies (eg, public health unit) may wish to comment on. This could include highlighting activities and/or contaminants of particular concern from a public health perspective, and for which consent applications may require particular attention. General discussion of the main water sources in the area could also be helpful, including identifying sources or locations particularly vulnerable to contamination. Water suppliers could give an overview of different types of water treatment in the area, including plants that may be particularly vulnerable to specific kinds of contaminants.

Other issues could include:

- the types of proposed activity that are most likely to have an effect on drinking water source quality in an area, and thus for which consent applications should be passed on to relevant agencies for comment
- agencies and/or contacts that regional council policy officers should consult when drafting permitted activity rules in regional plans
- the process for regional councils referring consent applications for consideration by other agencies

- the time other agencies would require to consider consent applications
- how to obtain contact details for water suppliers to place in emergency notification consent conditions.

It may be useful to record any agreed procedures resulting from the meeting. Agencies may even wish to draw up a formal memorandum of understanding to confirm procedures and responsibilities. Annual meetings could be held to evaluate how procedures are working and whether they need to be updated.

3 What Does the National Environmental Standard Require?

3.1 Introduction to requirements

This national environmental standard (NES) applies to groundwater sources such as aquifers or springs, rivers, lakes and other natural waters that are sources of human drinking water. All these sources are able to be managed under the RMA, which is the legislation under which the NES has been created.

The NES applies only to water sources *before* they are abstracted by a drinking water treatment plant. After the water treatment plant, Ministry of Health legislation and standards apply.

The NES also only applies to sources from which water is abstracted for use in registered drinking water supplies. These supplies are those recorded in the drinking water register maintained by the Ministry of Health.

The NES has three main components that apply to:

1. resource consents
2. permitted activity thresholds in regional plans
3. emergency notification conditions that may be placed on resource consents.

The first part of the NES, Regulations 7 and 8, apply to discharge permits and water permits issued by regional councils and unitary authorities (Regulations 7 and 8). The second part applies to permitted activity rules in regional plans (Regulations 9 and 10). The third part relates to conditions that may be placed on any resource consents (Regulations 11 and 12).

Table 2 summarises what each of the regulations relates to.

Table 2: National environmental standard regulations and their content

Regulation	Content
1–5	Definitions
6–8	Water and discharge consents
9–10	Permitted activities
11–12	Emergency notification conditions

To understand the NES, some common terminology used in the regulations and in drinking water management needs to be introduced. All of the terms in the box on the following page are used throughout this guide.

Selected definitions

NES definitions:

Determinand means a determinand described in Table 2.1, 2.2, 2.3, or 2.4 of the Drinking-water Standard

Aesthetic determinand means an aesthetic determinand described in Table A2.1 in Appendix 2 of the Drinking-water Standard

DWSNZ definitions:

Aesthetic determinand – A constituent or property of the water that can adversely affect the water's taste, odour, colour, clarity or general appearance, including substances such as manganese and iron compounds that can stain washing and utensils.

Maximum acceptable value (MAV) – The concentration of a **determinand** below which the presence of the **determinand** does not result in any significant risk to a consumer over a lifetime of consumption. For carcinogenic chemicals, the MAVs set in the DWSNZ generally represent a risk of one additional incidence of cancer per 100,000 people ingesting the water at the concentration of the MAV for 70 years.

Guideline value (GV) – The value for an **aesthetic determinand** that, if exceeded, may render the water unattractive to consumers.

All regulations in the NES apply to the concentration of determinands at the abstraction point for the water treatment plant. This is important to note because there are almost always factors that decrease or increase the concentrations of determinands from the discharge point to the abstraction point. In most instances it is dilution that reduces the levels of a determinand.

Regional plans[7] set out whether an activity requires resource consent. The resource consent component of the regulations (7 and 8) does not change the status of an activity. All the NES does is make it explicit that effects on drinking water need to be included in the matters to be considered when assessing the effects of a proposed activity. For example, if a discharge consent is applied for, the applicant would already have been required to assess the discharge's effects on the environment. Such an assessment would usually address the requirements of the regional plan, such as effects on the recreational use of water or aquatic ecosystems. Effects on drinking water would merely be an additional issue for the report to cover.

This also applies to permitted activities in regional plans. Councils are already required to consider the effects of permitted activities on other aspects such as stock drinking water and recreational uses. All the NES does is make it explicit that effects on drinking water are to be considered when developing a plan.

[7] Sections 14 or 15 of the RMA apply where regional plan rules relating to this issue are not in existence.

3.2 Resource consents

Regulations 6, 7 and 8 apply to water and discharge permits issued by regional councils. The resource consent requirements under these regulations apply only to water permits and discharge permits that have the potential to affect registered drinking water supplies that provide 501 or more people with drinking water for 60 or more calendar days each year.

Each consent that has the potential to adversely affect drinking water quality will need to be assessed to ascertain the level of the effect. The application may have to be altered (or declined by a regional council) if the level of effect is too high. The level of effect allowable will depend on the current status of the drinking water supply (ie, whether the water currently produced complies with health standards). The effect of the activity will need to be estimated either before or after treatment, depending on the status of the water. This is discussed in more detail in section 4.5.5.

Only the existing treatment provided by a plant can be taken into consideration under the NES; ie, the treatment in place at the time an application is made. This approach is both precautionary and to ensure public safety. It cannot be assumed that any planned upgrades to a treatment plant will take place when granting consent: planned treatment upgrades may not be implemented before the consented activity begins or, in a worst-case scenario, may not happen at all.

Most of the details of Regulation 7, and particularly of Regulation 8, are intended to specify exactly how assessments are to be made for contaminants introduced by different activities. Examples in Chapter 4 help clarify this component of the regulation.

3.3 Permitted activity rules

Regulations 9 and 10 apply to permitted activity rules in regional plans. Regulations 14 and 15 provide further detail on the timing at which these regulations will take effect for an individual regional plan. Again, Regulations 9 and 10 apply only to activities with the potential to affect registered drinking water supplies providing 501 or more people with drinking water for more than 60 days of a calendar year.

The principle underlying Regulations 9 and 10 is the same as that for Regulations 7 and 8: any new activity must not deteriorate receiving water quality in a drinking water source to the extent that existing treatment processes cannot make that water safe for people to drink.

As with Regulation 8, much of the detail of Regulation 10 relates to determining the exact circumstances in which an activity may or may not be permitted in a plan. Chapter 5 of this guide provides further discussion on these parts of the regulations.

3.4 Emergency notifications provisions

Regulations 11 and 12 apply to emergency notification provisions for both regional and district council resource consent applications. Under the NES, emergency notification refers to the notification (preferably by phone) of authorities when an unintended activity occurs (this differs from the notification of a consent application under the RMA). One key difference between emergency notification provisions and previous parts of the regulation is that they now apply to a smaller population threshold: activities with the potential to affect registered drinking water supplies that provide 25 or more people with drinking water for 60 or more days of a calendar year must be notified.

There are two reasons for this lower population threshold. Firstly, these consent requirements are much less onerous than those specified in Regulations 7 and 8. Secondly, the regulations are intended to protect public health if a fairly significant but unintended event occurs with a considerable effect on human health (eg, a chemical spill into a river that is a drinking water source). The effects of such an event could be extreme, so the consent holder is required to inform the provider that it has occurred. The lower threshold is warranted because of the potential impact on public health.

Details of Regulations 11 and 12 are given in chapter 6. The underlying requirement is that a council should assess each consent application based on the potential risks to a human drinking water source. If the council deems that something could go wrong at the premises which could affect drinking water, then a condition should be placed on the consent in line with Regulation 12(3).

For example, a new application may have the potential to release large amounts of a toxic chemical, or any amount of chemical with particular toxicity to humans, into a drinking water source. In this case, this regulation should apply and a condition should be placed on the consent.

Circumstances in which the regulation applies are deliberately broad; this enables councils to determine whether risks posed by a particular consent are sufficient to use this regulation. Cases when this condition may be considered appropriate, along with an example condition, are set out in section 6.6 of this guide.

4 How Does the National Environmental Standard Apply to Water and Discharge Consents?

4.1 Introduction

Regulations 6, 7 and 8 of the NES apply to applications for water and discharge permits issued by regional councils. The provisions apply only to activities that may affect the quality of a registered drinking water supply providing 501 people or more with drinking water for 60 or more calendar days in a year.

It is important to bear in mind that these regulations should not place a large burden on most consent applicants. Normally an applicant would be required to prepare an assessment of environmental effects for a water or discharge permit. At present these reports may include assessments of effects on the water quality of aquatic ecosystems, recreation or livestock drinking water. What the NES does is explicitly state that the effects on drinking water sources must also be considered in this assessment.

In many instances, particularly for surface water, the requirements for the effects of an activity on aquatic ecosystems, recreational uses or other uses are likely to be more stringent than those for drinking water. Therefore, it is unlikely that many activities will adversely affect the quality of a drinking water source while meeting all other requirements of a regional plan (especially for surface waters). As a result, adding consideration of effects on drinking water should not be a major additional requirement.

As with any other potential effect, the onus is on the applicant to provide an assessment of the effects of their proposal on drinking water sources. If applications for consents do not contain the information needed to make such an assessment, then the application should not be accepted or a further information request should be made (under section 92 of the RMA).

These regulations are relevant for both water and discharge permits. Water permits include all activities listed in section 14 of the RMA (ie, water take, use, damming and diversion).

4.2 Registered drinking water supplies

The NES only applies to sources from which water is abstracted for use in registered drinking water supplies. These supplies are those recorded in the drinking water register maintained by the Ministry of Health. A registered drinking water supply is defined in the NES as “a drinking-water supply that is recorded in the drinking-water register maintained by the chief executive of the Ministry of Health (the Director-General) under section 69J of the Health Act 1956”.

4.3 Treatment status

A consent applicant must consider the status of a drinking water treatment process at the time the application is lodged. Specifically, this means considering both the quality of water from the drinking water supply, in terms of compliance with the DWSNZ, and the type of treatment process in place at the time of the consent application.

Regulation 3 of the NES states that existing treatment:

> *means the treatment process in respect of a registered drinking-water supply at the time an application for resource consent is made or a proposal to include or amend a rule in a regional plan is notified, as the case may be.*

This precautionary approach is used to ensure public safety, because planned treatment upgrades may not occur before consent is given effect to, or, in a worst-case scenario, may not happen at all.

4.4 Effects of the national environmental standard on plan rules and resource consents

The NES applies equally to all consent applications, whether they are for a controlled, a restricted discretionary, or a non-complying activity. This is because a rule or resource consent cannot be more lenient than a national environmental standard under section 43B(3) of the RMA.

The NES is a regulation, so it is binding and prevails over rules and resource consents. Plan rules and consents operate only to the extent that they are consistent with the NES (section 43B). A consent authority cannot grant a consent contrary to any regulations (section 104(3)(c)(iii)). In other words, if an application for a controlled activity is considered not to comply with the NES, then the application cannot be granted even though the activity has controlled status in the regional plan (section 104 (3)(c)(iii)).

4.5 Steps to consider when processing a consent under the national environmental standard

Figure 4 gives a basic overview of the general steps to follow to assess the potential effects of an activity on drinking water quality.

Figure 4: Basic overview of suggested steps to follow when considering a water or discharge consent under the National Environmental Standard for Sources of Human Drinking Water

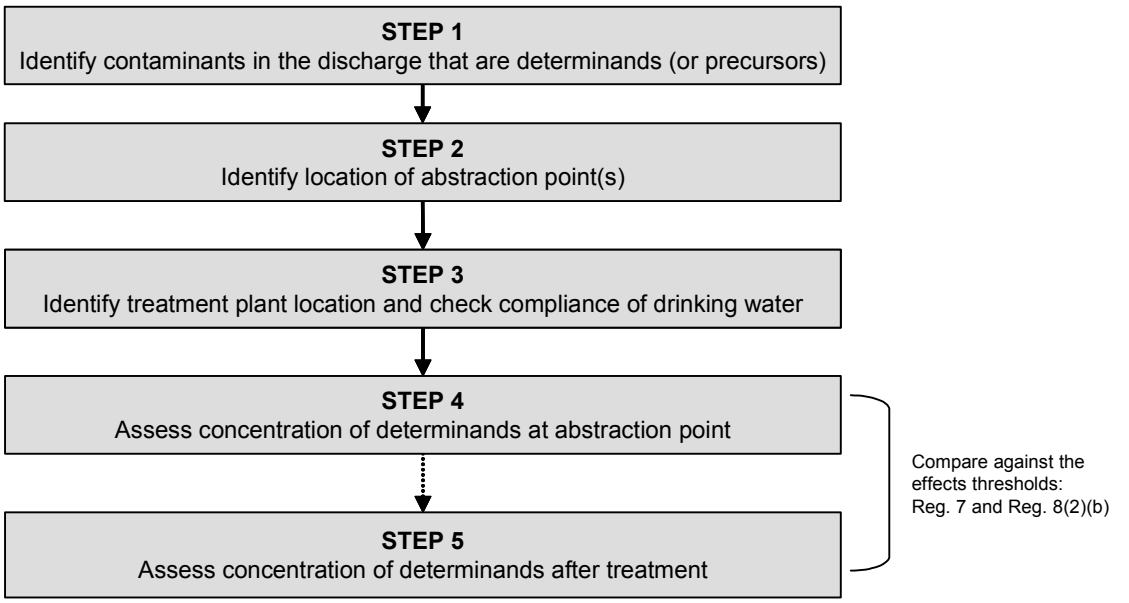
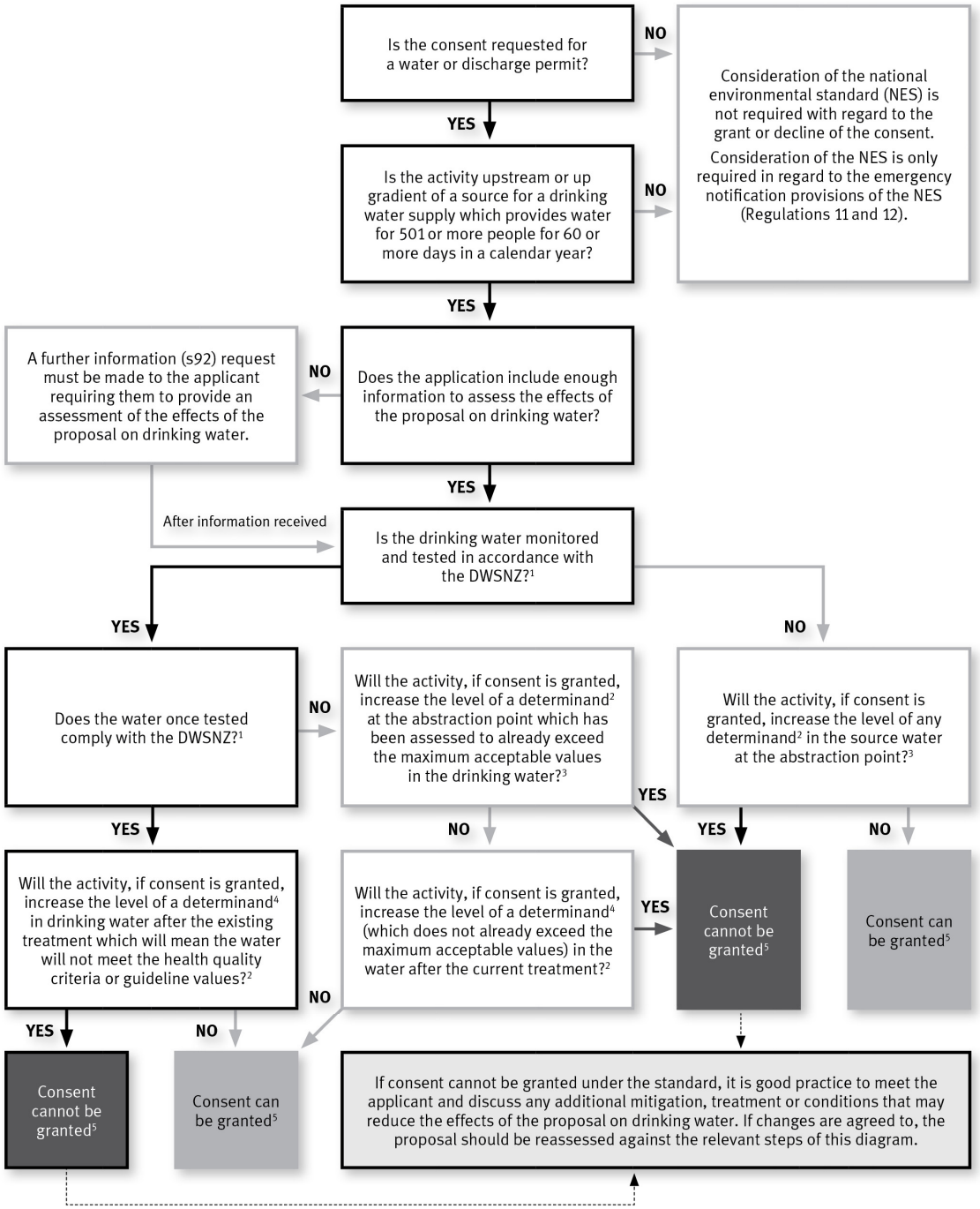


Figure 5 on the following page gives a step-by-step description of making a decision on a resource consent under the NES. On pages 21 – 27 is a more detailed explanation of each step, which should be read in conjunction with Figure 5.

Figure 5: Flow diagram for considering water take and discharge permits under the National Environmental Standard for Sources of Human Drinking Water



Notes:

1 DWSNZ – Drinking Water Standards for New Zealand 2005.

2 Aesthetic determinands must not exceed guideline values in **drinking water after existing treatment**.

3 This assessment needs to take into consideration the possible dilution, inactivation or degradation that will occur between the activity and the abstraction point.

4 Determinand includes aesthetic determinands.

5 This relates only to granting or declining consents in terms of compliance with the national environmental standard. This does not include consideration of any other aspects requiring consent.

4.5.1 Step 1: Does the NES apply?

The first question a resource consent officer should ask to determine whether or not the NES applies to a resource consent application is: What type of resource consent is being applied for? The NES applies to water and discharge permits only. If the application is for any other kind of permit, Regulations 6, 7 and 8 do not apply (although Regulations 11 and 12 may, as discussed in chapter 6).

> ***[6] Type of activity to which regulations 7 and 8 apply***
>
> *Regulations 7 and 8 only apply to an activity that has the potential to affect a registered drinking-water supply that provides no fewer than 501 people with drinking water for not less than 60 days each calendar year.*

The NES applies to discharge permits because they are likely to result in the discharge of contaminants into water. It may be less obvious why this regulation applies to water permits for takes, uses, damming and diversions. The reason is that these consents can affect river volume and flow, which in turn can affect the dilution of determinands, the settlement of sediment and the growth of algal blooms.

Example: discharge consent

A meat-processing plant is applying for consent upstream from the abstraction point of a water treatment plant. The proposed plant requires a consent to discharge contaminated water into the river. The discharge will include several determinands, including *E. coli* (which indicates the potential presence of other microbes that can cause disease).

If the increase in the amount of *E. coli* can not be treated by the existing water treatment processes, this could result in the drinking water not meeting the health quality criteria of the DWSNZ and ultimately causing consumers to become ill.

The effects of the proposal on drinking water quality therefore need to be considered when processing this consent. If the assessment shows that the increase in *E. coli* can be satisfactorily treated by the existing treatment process, so that drinking water still meets health quality criteria and is safe to drink, then consent can be granted. If, however, the assessment shows that the increased concentration of *E. coli* cannot be satisfactorily treated by the existing process, the consent can not be granted. Modification of the proposed activity will be needed before consent can be granted (eg, additional treatment of meat-processing waste before discharge).

Example: water take or diversion

A factory located upstream from the abstraction point of a water treatment plant discharges nutrients. A consent application is made to take water from the river inbetween the factory and abstraction point. This activity could decrease the flow of the river, which could lead to decreased dilution of nutrients, an increase in the travel time for nutrients and/or increased water temperature. Dilution of nutrients, and/or warmer water, can produce an algal bloom, which could flow downstream to the abstraction point for the drinking water plant.

Algal blooms can produce toxins that cause health effects, and can also affect the aesthetic properties of the water. Thus, an algal bloom could affect both the safety and aesthetic properties of finished drinking water. The effects on drinking water therefore need to be considered and minimised before the consent can be approved.

4.5.2 Step 2: Is the application for an activity located upstream of a drinking water source?

The second question to ask is whether or not the application is for an activity that would be likely to affect a registered drinking water supply that provides 501 or more people with drinking water for at least 60 days each year. To determine this, the council officer needs to know the location of drinking water sources in the region. A database including information on the location of these sources is kept by the Ministry of Health for all of New Zealand. The Ministry for the Environment makes a version of this database, which is modified for use by council officers. The database has been developed to be compatible with Geographical Information Systems (GIS), so the data could be shown as another layer in the council's GIS. This database is available to appropriate regional council staff upon request.[8] More detail is provided in Appendix 2 of this report.

Individuals outside local government should contact a drinking water assessor at their local public health unit if they require information about the location of a drinking water source or the quality of drinking water from a particular supply. Some public information on individual drinking water supplies is also available at the website http://www.drinkingwater.org.nz/

[8] The database is available only to regional councils because it contains technical data on aspects of supply monitoring and performance relevant to individual supplies, which can be commercially sensitive and requires Ministry of Health permission for distribution. It is not necessary for understanding the quality of the water supplied for public health purposes; public information on individual drinking water supply compliance with the DWSNZ is available at the website http://www.drinkingwater.org.nz/. It is also restricted because it contains technical information relevant only to individual plants, which is not necessary for other plant operators or water suppliers to know. It is made available to regional councils only because each region contains many water supplies for which the council will need technical information to implement the NES. Some simplified information (ie, the location of abstraction points from source water for individual treatment plants) will be made available by the Ministry for the Environment to territorial authorities to assist with the implementation of Regulations 11 and 12.

4.5.3 Step 3: Will the activity produce any determinands?

At this point the question that needs to be asked is: Will the activity discharge, or lead to the formation of, contaminants that can adversely affect human health or the aesthetic properties of drinking water?

The NES does not apply to all contaminants,[9] only to a group of substances that can adversely affect human health or the aesthetic properties of drinking water. Specifically, it applies to specific substances identified in the DWSNZ. The NES uses the term 'determinand' instead of 'contaminant' to refer to these substances. 'Determinand' has a specific meaning, which is narrower than that of 'contaminant' (as defined in the RMA). It refers only to substances listed in the DWSNZ.[10]

The NES is intended to apply only if the activity will:

- discharge contaminants that have human health effects if present in drinking water
- discharge contaminants that could lead to the formation of determinands that could affect human health. This includes activities that alter the properties of water in a way that could increase the concentration of contaminants or lead to their formation (eg, discharge of warm water could increase the risk of algal blooms, which can produce harmful toxins)
- affect a water body in a way that could lead to increased concentrations of contaminants (eg, diversion of water could lead to reduced volumes and thus reduced capacity for dilution of contaminants; damming of water could decrease the flow and/or increase the retention time, thus increasing the potential for algal blooms)
- generate contaminants that could reduce the effectiveness of drinking water treatment processes (eg, sediment)
- adversely affect the aesthetic properties of the drinking water (eg, taste, smell, appearance).

The DWSNZ specify two main kinds of determinand that can adversely affect human health *microbiological* (eg, bacteria, viruses) and *chemical* (eg, arsenic, nitrate). The DWSNZ specify maximum acceptable values (MAVs) for these determinands. Concentrations of determinands above these levels could adversely affect human health. Under the NES, consent cannot be granted if an activity is likely to result in concentrations of a determinand above the MAV in treated drinking water.

Appendix 1 contains more information on determinands regulated by the NES. Appendix 4 lists the types of determinands produced by different activities.

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[9] The RMA definition of contaminant is (emphasis added):

> *'Contaminant' includes any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat –*
>
> *(a) when discharged into water,* ***changes or is likely to change the physical, chemical, or biological condition of water; or***
>
> *(b) when discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.*

[10] The NES definition of determinand states: "Determinand means a determinand described in Table 2.1, 2.2, 2.3, or 2.4 of the DWSNZ".

4.5.4 Step 4: Does the application include adequate information to assess its effect on drinking water?

The next issue to consider is whether the applicant has provided sufficient information for the consent officer to determine the effects of the proposal on drinking water sources. The onus is on the applicant to provide this information for a full assessment of effects. If the application does not include the information required, then further information can be requested under section 92 of the RMA.

4.5.5 Step 5: Is the drinking water tested in accordance with the compliance monitoring requirements in the DWSNZ?

The next consideration is whether the drinking water supply that is potentially affected by the proposed activity currently complies with health quality criteria. 'Health quality criteria' is a shorthand phrase for water that is safe to drink in accordance with the monitoring and regulatory requirements of the Ministry of Health. Definitions of 'meet the health quality criteria' and 'does not meet the health quality criteria' are given in Regulations 4 and 5 of the Standard, which state:

[4] Meaning of 'meets the health quality criteria'

(1) In these regulations, in relation to drinking water, meets the health quality criteria means drinking water that –

(a) is tested for determinands –

(i) at the point where the drinking water leaves the treatment process concerned but has not yet entered the distribution system concerned; or

(ii) at some point in the distribution system, if any particular determinand is not tested at the point referred to in subparagraph (i); and

(b) is tested in accordance with the compliance monitoring requirements in the Drinking-water Standard; and

(c) when analysed, does not contain or exhibit 1 or more determinands exceeding their maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard.

(2) For the purposes of subclause (1)(c), the most recent complete annual results for the drinking water contained in the Water Information New Zealand database maintained on behalf of the Ministry of Health must be used.

[5] Meaning of does not meet the health quality criteria

(1) In these regulations, in relation to drinking water, does not meet the health quality criteria means drinking water that –

(a) is tested for determinands –

(i) at the point where the drinking water leaves the treatment process concerned but has not yet entered the distribution system concerned; or

(ii) at some point in the distribution system, if any particular determinand is not tested at the point referred to in subparagraph (i); and

(b) is tested in accordance with the compliance monitoring requirements in the Drinking-water Standard; and

(c) when analysed, contains or exhibits 1 or more determinands exceeding their maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard.

(2) For the purposes of subclause (1)(c), the most recent complete annual results for the drinking water contained in the Water Information New Zealand database maintained on behalf of the Ministry of Health must be used.

This part of the regulation and some parts of the definitions (Interpretation: Regulation 3) have the purpose of defining what type of water is safe to drink. It is important to note that this does not mean regional councils now need to be in the business of defining whether water is safe to drink. Nor do they need to become experts in drinking water quality. This role will continue to be filled by water suppliers, drinking water assessors and contractors to the Ministry of Health. The purpose of Regulations 4 and 5 is simply to clarify the situations in which later parts of the NES apply.

Both Regulations 4 and 5 of the NES refer to water that has been "tested in accordance with the compliance monitoring requirements in the DWSNZ". Therefore, these definitions do not apply to water that has not been tested or monitored to these requirements. Figure 5 gives a summary of situations in which the regulations apply.

The testing requirements outlined in the Ministry of Health's DWSNZ require that drinking water supplies are not only monitored, but that monitoring is carried out correctly, including taking a sufficient number of samples for statistical validity and using acceptable sampling and analytical methods. If monitoring is not carried out correctly, it is not possible to have confidence in the results and the quality of water from the supply cannot be known for certain.

Therefore, there are three different situations in which a water treatment facility could fall under Regulation 8:

- the water has not been tested at all (section 8[1])
- the water has been tested, but not in a way that complies with the DWSNZ requirements (section 8[1])
- the water has been tested and does not meet health quality criteria (section 8[2]).

4.5.6 Step 6: Does the drinking water meet the health quality criteria?

The next question is whether the drinking water meets or does not meet health quality criteria. These criteria are not met when monitoring shows that the water contains determinands that exceed the maximum acceptable values (MAVs) specified for the health-based criteria more often than is allowed for by the DWSNZ. The MAVs for determinands are specified in the DWSNZ. For more detail on these standards, please consult the two ESR technical reports *A Guide to the Ministry of Health Drinking-water Standards for New Zealand* and *An Introduction to Drinking Water Contaminants, Treatment and Management*. These guides are available from the Ministry for the Environment's website at http://www.mfe.govt.nz/laws/standards/drinking-water-source-standard.html

The DWSNZ also specify the number of allowable MAV exceedances. This number increases in line with the number of samples taken. Basically, the greater the number of samples taken, the greater the number of exceedances allowed.

Appendix 5 lists the number of exceedances that can be tolerated for 95 per cent confidence that a benchmark is not being exceeded more than 5 per cent of the time. Table 3 is taken from Appendix 5 to give an example of the number of exceedances allowed compared to the number of samples taken.

Table 3: Allowable exceedances (for 95% confidence that the maximum acceptable value is exceeded no more than 5% of the time)

Number of allowable exceedances	Number of samples
0	38–76
1	77–108
2	109–138
3	139–166
4	167–193
5	194–220
6	221–246
7	247–272
8	273–298
9	299–323
10	324–348

Source: *Drinking-water Standards for New Zealand 2005*, p. 129.

Returning to Regulations 7 and 8, the consent application should address whether the water delivered by the supply that may be affected by the activity currently complies or does not comply with the health quality criteria.

Information about whether or not drinking water supplies comply with the health quality criteria is contained in the previously mentioned database supplied to regional councils by the Ministry for the Environment. This is developed from the Water Information New Zealand national database of health quality information on drinking water, maintained on behalf of the Ministry of Health by ESR. Public information on individual drinking water supply compliance with the DWSNZ is available at the website http://www.drinkingwater.org.nz/

Other parties who require information about the compliance status of a drinking water supply (eg, applicants or their agents) should contact a drinking water assessor at the public health unit for the district where the supply is located. The drinking water supplier could also be contacted for this information.

Different regulations apply to the water source depending on whether the source meets the criteria, and whether it is tested. In summary:

- Regulation 7 applies to water that is tested and meets health quality criteria
- Regulation 8(1) applies to water that is not tested, or water that has been tested but not in a way that complies with the DWSNZ requirements
- Regulation 8(2) applies to water that has been tested but does not meet health quality criteria.

Each of these regulations is explained in more detail in section 4.6 below.

4.5.7 Step 7: Will the proposal have an adverse effect on the quality of the drinking water?

The final consideration is whether the proposed activity will affect the quality of drinking water. An initial assessment could ask the following questions.[11]

- For a discharge permit, will the activity produce any:
  - determinands
  - aesthetic determinands (eg, sodium)
  - precursors of determinands (eg, dissolved organic matter)
  - substances that reduce the efficiency of disinfection (eg, sediment).
- For a water permit, will the activity substantially reduce the assimilative capacity of the receiving water to the extent that concentrations of determinands (or precursors) may increase in the source water (eg, consideration of increased temperature because of decreased flows, which can lead to algal blooms)?

If the answer to these questions is Yes, then further work and assessment will be required before the consent can be granted. It may be useful to contact the operators of the treatment plant potentially affected at this stage (or before) as they may have relevant knowledge which could be helpful.

The NES allows different levels of effects depending on the current status of the drinking water. The different levels of effects are discussed in the explanations of Regulations 7 and 8 in section 4.6 below.

4.6 More detail on Regulations 7 and 8

4.6.1 Regulation 7

> ***[7] Granting of water permit or discharge permit upstream of abstraction point where drinking water meets health quality criteria***
>
> *A regional council must not grant a water permit or discharge permit for an activity that will occur upstream of an abstraction point where the drinking water concerned meets the health quality criteria if the activity is likely to –*
>
> *(a) introduce or increase the concentration of any determinands in the drinking water, so that, after existing treatment, it no longer meets the health quality criteria; or*
>
> *(b) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.*

Regulation 7 applies to water supplies that currently meet the health quality criteria. More specifically, it applies to applications for activities that can affect the quality of a drinking water source where the drinking water currently meets the health quality criteria, as specified in Regulation 4.

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[11] In many cases this will require technical assessment by a qualified professional as part of an applicant's assessment of environmental effects.

Regulation 7 states that an activity is not allowed if it will increase the concentration of determinands in the water at the abstraction point *to the extent that existing treatment cannot deliver water that is safe to drink*. This requirement not only applies to determinands that may affect human health, but also to aesthetic determinands (see also Appendix 1).

In summary, if water is sufficiently tested and meets the health quality criteria, an activity cannot obtain consent if it will result in any determinand exceeding the MAV or guideline value (GV) in drinking water after existing treatment.

4.6.2 Regulation 8

Regulation 8 is more complex than Regulation 7 because it applies to two different circumstances. The first, as described in Regulation 8(1), is for a drinking water supply where water has not been adequately tested as required by the DWSNZ. The second circumstance, specified by Regulation 8(2), applies to drinking water that has been sufficiently tested but fails to meet the health quality criteria, which means this water already contains determinand levels above those specified by the MAV in the DWSNZ.

> ***Regulation 8(1)***
>
> ***[8] Granting of water permit or discharge permit upstream of abstraction point where drinking water not tested or does not meet health quality criteria***
>
> *(1) A regional council must not grant a water permit or discharge permit for an activity that will occur upstream of an abstraction point where the drinking water concerned is not tested in accordance with the compliance monitoring procedures in the Drinking-water Standard if the activity is likely to –*
>
> *(a) increase the concentration of any determinands in the water at the abstraction point by more than a minor amount; or*
>
> *(b) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.*

Regulation 8(1) states that if water supplied by a specific registered drinking water supplier is not sufficiently tested,[12] then consent for an activity cannot be granted if that activity is likely *to increase the concentration of any determinands in the water at the abstraction point*. This is a more stringent requirement than that in Regulation 7, which discusses the concentration of determinands *after* treatment.

If water is not sufficiently tested, the level of contamination at its source cannot be increased. The reason behind this stricter requirement is public health protection. When a water supply is not tested, or is insufficiently tested, health authorities can not say whether the water is safe to drink. Limiting the increase of any determinands in the water at the abstraction point ensures there will be no increase in determinand concentrations after the existing treatment.

In other words, only one determinand needs to be insufficiently or incorrectly monitored for the drinking water supply to be classified as not sufficiently tested under Regulation 8(1).

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[12] 'Tested' is defined in the NES in Regulation 4(1)(b) as "is tested in accordance with the compliance monitoring requirements in the Drinking-water Standard". More details of the required testing required by the DWSNZ are included in the report *A Guide to the Ministry of Health Drinking-water Standards for New Zealand* by ESR, available from the Ministry for the Environment's website at http://www.mfe.govt.nz/laws/standards/drinking-water-source-standard.html/

Water that fits into this category (ie, has been tested, but not correctly) needs to be considered under the regulations as if it had not been tested at all. This precautionary approach is taken in the interest of public health, because without appropriate testing the quality of the water can not be determined and therefore the water can not be considered safe for human consumption.

Example: monitoring not adequate

Consider a plant with the following test results:

Treatment plant number	Determinand	Adequately monitored (in accordance with DWSNZ)	Too many exceedances of maximum acceptable values?
TP09999	*E. coli*	No	Unknown*
	Arsenic	Yes	No

In this example, two determinands require monitoring. For this supply, monitoring is adequate for arsenic, but not for *E. coli* (because *E. coli* has not been correctly monitored). Therefore, drinking water from this supply is considered not to have been tested in accordance with the compliance monitoring procedures in the DWSNZ. As a result, applications for new water or discharge consents which could affect this drinking water supply would fall under Regulation 8(1).

* As *E. coli* is not adequately monitored (eg, an insufficient number of samples have been taken), it is not possible to assess whether the MAV for *E. coli* is exceeded.

Regulation 8(2)

[8] Granting of water permit or discharge permit upstream of abstraction point where drinking water not tested or does not meet health quality criteria

(2) A regional council must not grant a water permit or discharge permit for an activity that will occur upstream of an abstraction point where the drinking water concerned does not meet the health quality criteria if the activity is likely to –

(a) increase, by more than a minor amount, the concentration of any determinands in the water at the abstraction point that in the drinking water already exceed the maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard; or

(b) increase the concentration of any determinands in the water at the abstraction point that in the drinking water do not exceed the maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard to the extent that the drinking water, after existing treatment, exceeds the maximum acceptable values for more than the allowable number of times as set out in the table in relation to those determinands; or

(c) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

Regulation 8(2) applies to source waters for supplies where the drinking water has been sufficiently tested, but at least one determinand does not meet health quality criteria. In these circumstances two criteria apply. The first, specified in 8(2)(a), applies to determinands that already exceed maximum acceptable values specified in the DWSNZ:

*(a) increase, by more than a minor amount, the concentration of any determinands in the water **at the abstraction point** that in the drinking water **already exceed the maximum acceptable values** for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard.*

Example: MAV for one determinand already exceeded

A drinking water treatment plant has been sufficiently tested and the MAV for *E. coli* is already being exceeded. In this circumstance, Regulation 8(2)(a) requires that any new activity for which a water or discharge permit is being sought cannot be granted if the activity is likely to increase concentrations of *E. coli* by a more than a minor amount at the abstraction point.

Different criteria apply in a situation where the supply may be complying with maximum acceptable values for some determinands but not for others. Regulation 8(2)(b) applies specifically to those determinands that are currently complying with the MAV specified by the DWSNZ:

> *(b) increase the concentration of any determinands in the water at the abstraction point that in the drinking water **do not exceed the maximum acceptable values** for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard to the extent that the drinking water, **after existing treatment**, exceeds the maximum acceptable values for more than the allowable number of times as set out in the Table in relation to those determinands;*

For example, if a supply is not providing safe drinking water but it complies with the criteria for *E. coli* specified in the DWSNZ, then Regulation 8(2)(b) states that the concentrations of this determinand in the drinking water after existing treatment should not exceed the MAV specified in the DWSNZ.

Therefore, an activity that produces additional *E. coli* may only be granted consent if the concentration of *E. coli* at the abstraction point will not be increased to a level that the existing treatment plant cannot safely treat. In other words, the consent cannot be granted if the activity will result in the water exceeding the DWSNZ for *E. coli*. (This case is similar to that of Regulation 7.)

The reason for this approach is to provide some flexibility in situations where a treatment plant may be adequately removing some contaminants but not others.

The circumstances in which Regulations 7 and 8 apply are summarised in Figure 6 on the following page.

Example: one MAV exceeded and one not

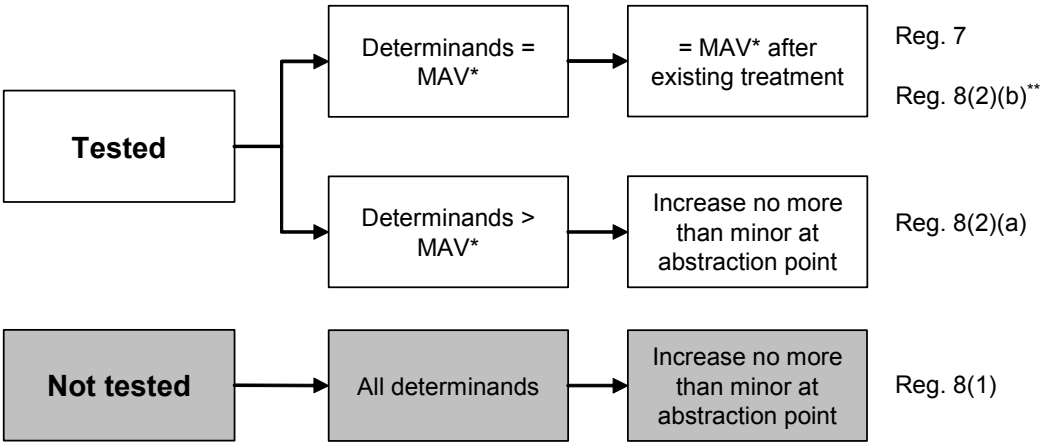
A supply currently complies with the MAVs for *E. coli* but not for arsenic. This supply is tested in accordance with the DWSNZ, so Regulation 8(2) applies.

Because the supply water does not currently comply with the MAV for arsenic, the test for a consent that would discharge arsenic is more stringent than if *E. coli* would be discharged. Consent for an activity that would discharge arsenic into the source water upstream from the abstraction point could be granted only if the proposal will not result in an increase in the level of arsenic in the water at the abstraction point which is more than minor (Regulation 8(2)(a)).

A consent for an activity that releases *E. coli* can be granted as long as the water will still meet the MAV for *E. coli* after treatment.

A precautionary approach is taken because the current treatment plant is known not to sufficiently remove arsenic to protect public health. Therefore, from a health perspective any further increase in the level of arsenic in the finished water is unacceptable.

Figure 6: Summary of Regulations 7 and 8



* MAV = maximum acceptable value.

** Regulation 8(2)(b) applies where two or more determinands are produced by an activity and one of the determinands does not currently exceed its MAV in treated drinking water.

4.7 Applying the national environmental standard to determinands that were not previously monitored

The following examples give an idea of how the NES can be applied to determinands that have not previously been monitored. Note that chemical contaminants are only monitored if the Ministry of Health requires a specific supply to do so, based on risk factors in a catchment. Concentrations of chemical contaminants that do not require monitoring are assumed by the Ministry of Health to be below MAVs for that supply.

Example: new determinand; currently no MAVs exceeded

A water supply monitors *E. coli* and arsenic for compliance with the DWSNZ. For this supply monitoring is carried out in accordance with the DWSNZ and no MAV is exceeded for the measured determinands. Therefore Regulation 7 applies when processing a resource consent application for an activity that may affect the source for this supply.

Regulation 7 applies even if an application is made for an activity that will, for example, discharge nitrate to water, even though nitrate has not previously been monitored for this drinking water supply.

Example: new determinand; currently one MAV compliant, one exceeded

A drinking water supply monitors *E. coli* and arsenic for compliance with the DWSNZ. The monitoring is done in accordance with the DWSNZ. *E. coli* complies but arsenic exceeds its MAV. This means that consent applications for activities upstream must be assessed under Regulation 8(2).

An applicant is seeking resource consent for a discharge that includes *E. coli*, arsenic and nitrate. Different parts of Regulation 8(2) apply when assessing an application for resource consent, depending on which contaminant is discharged by the activity.

Regulation 8(2)(a) applies for arsenic. Because arsenic exceeds the MAV, a consent can not be granted if the activity will increase the concentration of arsenic at the abstraction point by more than a minor amount.

Regulation 8(2)(b) applies for *E. coli* and nitrate. Because *E. coli* concentrations in the water supply are below the MAV, the effects of the activity are assessed in terms of what the concentrations of *E. coli* will be in the drinking water after existing treatment (Regulation 8[2][b]).

Nitrate is not monitored for this drinking water supply. However, it is assumed that the concentrations of nitrate are below the MAV. Chemical contaminants are only monitored if the Ministry of Health requires a specific supply to do so, based on risk factors in a catchment. As explained above, concentrations of chemical contaminants that do not require monitoring for that supply are assumed by the Ministry of Health to be below MAVs. Therefore, the effects of the activity for nitrate will be assessed based on what the post-consent concentrations of nitrate would be in the drinking water after existing treatment (Regulation 8[2][b]).

More information on monitoring chemical contaminants in drinking water can be found in Appendix 1.

4.8 Aesthetic determinands

Aesthetic determinands do not have direct adverse health effects. However, elevated levels of aesthetic determinands are still of public health importance. If drinking water is unpleasant to taste or smell, people may use alternative sources of water (eg, untreated aquifer or river water), which may not be safe.

An aesthetic determinand is defined in the DWSNZ as:

> *A constituent or property of the water that can adversely affect the water's taste, odour, colour, clarity or general appearance, including substances such as manganese and iron compounds that can stain washing and utensils.*

The NES manages aesthetic determinands differently from determinands of health significance because they are not required to be tested under the DWSNZ. The regulation requires that aesthetic determinands be benchmarked against something measurable. The requirement that aesthetic determinands not exceed guideline levels after existing treatment gives councils and applicants a threshold for decision-making.

Most drinking water treatment plants do not routinely monitor aesthetic determinands because their testing can be expensive and it is not required by the DWSNZ. This can create difficulties when estimating concentrations of aesthetic determinands in finished water, given the concentration in the source water is unknown.

To assess the effects of an activity on aesthetic determinands, we suggest applicants follow these steps.

1. Estimate the concentration of an aesthetic determinand arising from an activity at the abstraction point for a drinking water treatment plant.
2. Estimate the concentration of the aesthetic determinand that will be present in the treated drinking water after the water has passed through the existing treatment process at the plant.
3. Compare the estimated concentration of the aesthetic determinand in the treated water with the guideline value given in Table A2.1 of the DWSNZ.

Once again, the onus is on the applicant to prepare an assessment of all of the effects of their proposed activity on the environment. If the information provided is not sufficient, then more information should be requested (under section 92 of the RMA). Councils simply need to assess and evaluate this assessment as they would for any other effect.

Example: consent sought for an activity that generates an aesthetic determinand

An applicant is seeking resource consent for an activity that generates ammonia as a waste product. Ammonia can have an unpleasant odour above certain concentrations. The current concentration of ammonia in the source water is unknown, but the treatment plant operator has not received any complaints about the smell of the water (note that ecological values may have lower ammonia thresholds than drinking water values), so the concentrations are assumed to be below the guideline value for ammonia (1.5 mg/L).

The applicant has several samples of water from near the abstraction point analysed for ammonia. This shows an average ammonia concentration of 0.3 mg/L. Calculations show that the proposed new activity will lead to an increase in ammonia concentrations of 0.5 mg/L above the existing concentrations at the abstraction point (taking into account dilution, etc). This means there will be a total ammonia concentration of 0.8 mg/L at the abstraction point.

As this is well below the aesthetic guideline value of 1.5 mg/L, the NES will not cause the consent to be declined.

It should be noted, however, that ammonia can have adverse ecological effects at lower concentrations than those that cause aesthetic problems for humans. Thus the consent may be declined on other grounds, or have to be modified before the proposal can be granted.

5 How Does the National Environmental Standard Apply to Regional Plans?

5.1 Introduction

Regulations 9 and 10 apply to permitted activity rules in regional council plans. This part of the regulation applies to all activities regulated by regional councils; in other words, activities regulated under sections 9, 13, 14 and 15 of the RMA.

Like the resource consent requirements for Regulations 6, 7 and 8, the permitted activity rule requirements apply only to activities with the potential to affect drinking water sources supplying populations of 501 or more people for 60 or more days of a calendar year.

Regulation 10(1) states that a regional council must not include a rule in its regional plan that allows a permitted activity upstream of an abstraction point if that activity is likely to result in the drinking water becoming unsuitable for human consumption, as specified by the health quality criteria. Regulations 10(2) and 10(3) outline similar principles to those in Regulation 8. These regulations guide decision-making where:

- drinking water supplies are not adequately monitored in accordance with the DWSNZ
- individual determinands do not comply with MAVs specified in the DWSNZ.

[10] Limitations on permitted activity rules for activities upstream of abstraction points

(1) A regional council must not include a rule or amend a rule in its regional plan to allow a permitted activity, under section 9, 13, 14, or 15 of the Act, upstream of an abstraction point where the drinking water concerned meets the health quality criteria unless satisfied that the activity is not likely to –

(a) introduce or increase the concentration of any determinands in the drinking water so that, after existing treatment, it no longer meets the health quality criteria; or

(b) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

(2) A regional council must not include a rule or amend a rule in its regional plan to allow a permitted activity, under section 9, 13, 14, or 15 of the Act, upstream of an abstraction point where the drinking water concerned is not tested in accordance with the compliance monitoring procedures in the Drinking-water Standard unless satisfied that the activity is not likely to –

(a) increase the concentration of any determinands in the water at the abstraction point by more than a minor amount; or

(b) introduce or increase the concentration of any aesthetic determinands in the drinking water, so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

(3) A regional council must not include a rule or amend a rule in its regional plan to allow a permitted activity, under section 9, 13, 14, or 15 of the Act, upstream of an abstraction point where the drinking water concerned does not meet the health quality criteria unless satisfied that the activity is not likely to –

(a) increase, by more than a minor amount, the concentration of any determinands in the water at the abstraction point that in the drinking water already exceed the maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard; or

(b) increase the concentration of any determinands in the water at the abstraction point that in the drinking water do not exceed the maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard to the extent that the drinking water, after existing treatment, exceeds the maximum acceptable values for more than the allowable number of times as set out in the Table in relation to those determinands; or

(c) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

The regulation does not state how a council should go about assessing whether or not an individual permitted activity rule would comply with the NES. A deliberate decision was made not to go into too much detail or set out a process. This was done in response to feedback the Ministry received during consultation indicating that councils would like maximum flexibility when preparing regional plans. Therefore the regulation specifies only that the council needs to be satisfied that the activity is not likely to result in the drinking water becoming unacceptable for human consumption.

The amount and kind of information gathered by the council to support the permitted activity standard should be similar to that used when making determinations in accordance with section 70 of the RMA, which states:

[70] Rules about discharges

(1) Before a regional council includes in a regional plan a rule that allows as a permitted activity –

(a) A discharge of a contaminant or water into water; or

(b) A discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water, –

the regional council shall be satisfied that none of the following effects are likely to arise in the receiving waters, after reasonable mixing, as a result of the discharge of the contaminant (either by itself or in combination with the same, similar, or other contaminants)

(c) The production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials

(d) Any conspicuous change in the colour or visual clarity

(e) Any emission of objectionable odour

(f) The rendering of fresh water unsuitable for consumption by farm animals

(g) Any significant adverse effects on aquatic life.

Note that the test set out in section 70 is similar to that given in the NES. Section 70 states that a regional council shall be satisfied that none of a range of specified effects are likely to arise (in receiving waters) from activities before they are permitted. This is very similar to the requirement in the NES that states that a regional council must not include a rule unless it is satisfied that the activity is not likely to adversely affect drinking water quality (ie, result in increased concentrations of determinands to the point where drinking water will not meet health quality criteria) after existing treatment.

A council could undertake its assessment of how activities could affect sources of human drinking water in concurrence with other assessments required to satisfy section 70 when preparing its regional plan. Although section 70 does not explicitly state how a regional council should come to its decisions, it does specify that certain effects should not occur as a result of permitted activities. These effects include rendering fresh water unsuitable for consumption by farm animals (section 70(1)(f)), and any significant adverse effects on aquatic life (section 70(1)(g)). The NES is a regulation and therefore does not add to section 70 requirements. However, for practical purposes it could be viewed as making explicit that effects on sources of human drinking water need to be considered when preparing permitted activity rules in a regional plan.

Note that there is guidance on planning for surface water on the Quality Planning website (http://www.qp.org.nz/plan-topics/surface-water-quality.php). This material addresses planning for the management of surface water quality in rivers, lakes and wetlands, but it will be of some relevance to drinking water.

5.2 Treatment plant status

The status of drinking water treatment plant processes *at the time that the plan is prepared* must be the status considered.

Treatment plant upgrades may be planned or possibly underway through separate water supplier decision-making processes at the time that a proposed regional plan is under development. However, there is no certainty that a potential future plant upgrade will go ahead at the specified time, or that the plant will perform to specifications and deliver safe drinking water. Therefore, the cut-off time for considering an upgrade is the time of notification of a new or amended rule in a regional plan.

Regulation 3 of the NES states that 'existing treatment':

> *means the treatment process in respect of a registered drinking-water supply at the time an application for resource consent is made or a proposal to include or amend a rule in a regional plan is notified, as the case may be.*

Thus, it is the existing treatment plant process that is relevant, and must be considered when making a decision on whether a permitted activity rule may be amended, or what should be attached to a permitted activity rule.

Obviously there may be quite some time between initial planning for a new regional plan and the time of notification. It is perfectly legitimate for a council to have discussions with a treatment plant operator about the nature of planned or proposed upgrades, provided the status of the plant at the time of notification is used in final decision-making.

5.3 Timing of the application of the national environmental standard to permitted activity rules

The NES does not require councils to amend existing rules in their regional plans until the relevant regional plan is scheduled for review.

> ***[14] Regional council not required to immediately amend rules in plan***
>
> *A regional council is not required to amend an existing rule in a plan that does not comply with regulation 10 until the earlier of the following:*
>
> *(a) a scheduled review of the plan; or*
>
> *(b) a plan change or variation that relates to the existing rule is introduced.*

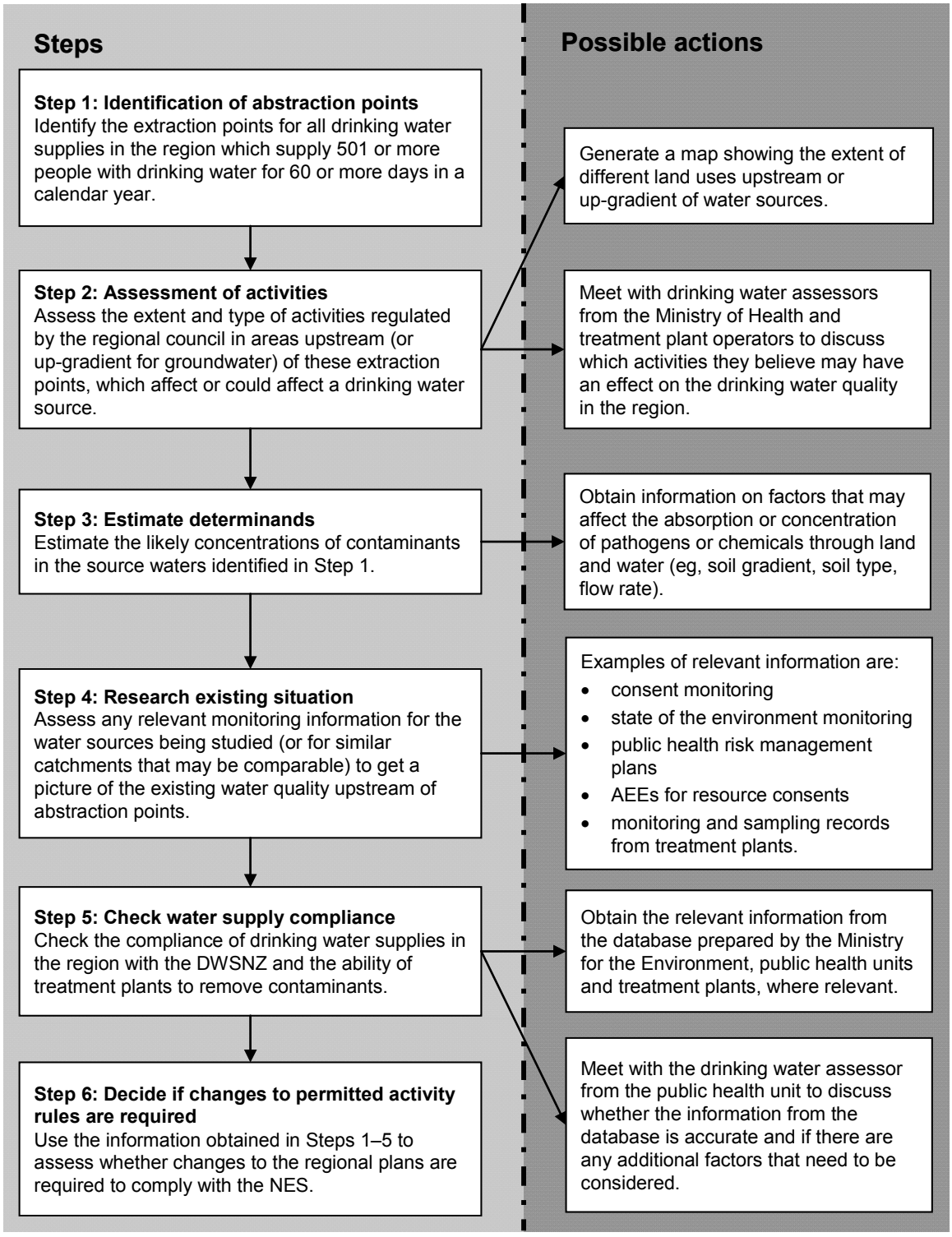
Note that the NES states that a regional council is not required to amend an existing rule in their regional plan until either (a) a scheduled review of the plan or (b) a plan change or variation that relates to the existing rule is introduced.

Remember, however, that the NES applies not only to permitted activity rules that exist in regional plans at the time of the NES but to *all* permitted activity rules in regional plans from that time forward. In other words, if a new permitted activity rule is placed in a regional plan, regardless of whether or not a similar rule existed in a previous plan, that rule must comply with the provisions of the NES.

5.4 Suggested approach to implementing permitted activity rule provisions of the national environmental standard

Figure 7 on the following page outlines the suggested approach to applying Regulations 9 and 10 during the development of the regional plan. Many of these steps can be undertaken in parallel with existing regional council actions taken during the preparation of permitted activity rules that relate directly or indirectly to effects on water quality.

Figure 7: Suggested approach to apply the National Environmental Standard for Sources of Human Drinking Water to permitted activities in regional plans



Note: AEE = assessment of environmental effects.

5.4.1 Step 1: Identification of abstraction points

One of the first steps when assessing a permitted activity rule is to identify abstraction points for drinking water supplies. This can be done using the Ministry for the Environment database that is supplied to regional councils. Applicants can contact the local public health unit or regional council to obtain information about the location of abstraction points relevant to the proposed activity.

The database identifies registered drinking water treatment plants that supply 501 people or more with drinking water for at least 60 days each year. From this information it can easily be determined which plants are relevant to Regulation 10.

5.4.2 Step 2: Assessment of activities

The next step is to assess the extent of activities regulated by regional councils in areas upstream of the abstraction points. It is up to individual councils to decide how much information they need in order to be satisfied that the NES requirements are met. In many instances a desktop assessment may be adequate.

For example, a council may generate maps that show the extent of different land covers using the Land Cover Database (refer to the Terralink website at http://www.terralink.co.nz/products_services/satellite/land_cover_database_of_new_zealand/). Agriculture databases such as Agribase (refer to the Agriquality website at http://www.agriquality.com/corporate/it_services/agribase.cfm) and other readily available data on different activities within a region can also help in collecting information on the types of activities currently conducted upstream of abstraction points.

The Ministry for the Environment recommends that the council meet with drinking water assessors from the local public health unit and treatment plant operators. This would improve council understanding of a drinking water supply and provide an overview of the types of activities that are posing actual or potential threats to the source waters for the supply.

5.4.3 Step 3: Estimate determinands

The next step is to estimate potential concentrations of determinands already present in source waters. We recognise this will usually be only an estimate because the concentration of determinands is based on current activities and discharges in the catchment. Identifying the types and locations of current activities and discharges in the catchment is the first step in estimating the likely types and concentrations of determinands in source water.

Data on soil types, land gradient and other factors that may mitigate the absorption of pathogens or chemicals will also be useful. There are several information sources on the range of determinands and their expected concentrations in effluents, surface waters and, in some cases, ground waters as a result of particular activities.[13] However, these concentrations can be highly variable: they depend on the scale of the activity, distance from the receiving water, soil type, land gradient, seasonal factors such as rainfall, and peaks in activities (eg, during calving).

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[13] These include data in published literature (both journals and reference texts), commissioned reports and information from professionals with expertise in the field.

Monitoring information from existing consents may also be useful for determining concentrations of determinands that are likely to be present in receiving waters as a result of different activities. If no such monitoring data is available for the catchment in question, information from a similar catchment may provide some guidance.

5.4.4 Step 4: Research the existing situation

Once an estimate of determinands has been made, the existing situation needs to be researched. Ideally this is done by obtaining existing monitoring data, but this kind of information on source water quality may not always be available. Most regions have a large number of water sources, and regional council monitoring networks are unlikely to include all these sources. (Note that the NES does not explicitly require such monitoring.)

It is up to a council whether they choose to increase their water quality monitoring regime to gain a more accurate idea of water quality at certain drinking water abstraction points. It is also important to consider whether there is any other data on drinking water quality at or near the abstraction points. It may be worth contacting the operators of the treatment plant potentially affected at this stage (or before). They may have knowledge that can be helpful.

Possible sources of information include:

- state of the environment monitoring
- other monitoring conducted by the regional council (including consent monitoring and compliance data)
- public health risk management plans
- individual assessments of environmental effects (AEEs) that may have been conducted by the applicants for resource consent elsewhere in the catchment
- records from treatment plant operators.[14]

5.4.5 Step 5: Check water supply compliance

The next step is to check an individual water supply's compliance with the DWSNZ. The council needs to know the status of each supply in the region to which the regulation applies in terms of its compliance with the health quality criteria specified in Regulations 4 and 5. This is necessary because different parts of Regulation 10 will apply based on whether a supply is currently delivering water that complies with health quality criteria. This information can be obtained from the database supplied by the Ministry for the Environment (see Appendix 2) or by contacting the public health unit for the area.

[14] Water treatment plant operators are not required to carry out routine monitoring of source waters. However, some will have conducted such monitoring for individual parameters such as turbidity, to optimise plant performance in dealing with varying conditions or to determine the need for treatment in order to meet the requirements of the DWSNZ. It is recommended that the regional council request any such information from individual treatment plant operators.

Information may already be available on whether a treatment plant has sufficient capacity to remove or reduce the levels of determinands that are likely to be present in the source water. Again, the regional council could contact the drinking water assessor or the relevant local public health unit at this point to check that information obtained from the database is accurate. The drinking water assessor may be aware of additional factors relating to treatment plant status or capacity.

5.4.6 Step 6: Decide if changes to permitted activity rules are required

If, on completion of the above research, you find that some current permitted activities could have an adverse effect on drinking water quality, you have several options. These include:

- retain the existing permitted activity rule but add more stringent conditions/terms (sections 9 and 10)
- retain the existing permitted activity rule but, in addition, implement non-regulatory measures throughout the catchment to reduce inputs of the contaminants of concern from other sources
- change the status of the permitted activity rule to discretionary.

The second option is relevant where a drinking water source is at risk of contamination from activities whose impact could be reduced by non-regulatory methods. For example, a catchment may be at risk of high levels of sedimentation, which can decrease the effectiveness of the disinfection processes at the water treatment plant (see Appendix 1). The council may decide that it is more effective to establish riparian planting in high sediment yield areas around the catchment than to add conditions to permitted activity rules. In this case, the permitted activity status could be retained for possible sediment-generating activities. However, other rules, council incentives, regulations, bylaws, or other methods could be used to encourage wider riparian planting throughout the catchment to ensure source water quality in the catchment does not deteriorate.

If the third option above is chosen (to increase the status of the activity to discretionary), this would not necessarily mean that all activities of this nature would now be regulated as discretionary. Instead, a threshold could be set above which the activity would be discretionary and below which the activity would be permitted. This would result in (i) a new discretionary activity rule and (ii) a new modified permitted activity rule similar to the original, but with a lower threshold of effects or more stringent requirements. An example is provided on the following page.

Whichever option is chosen, the council will need to ensure the new permitted activity rule is consistent with regulation 10 of the NES.

Example: permitted activity rule

(Note: this example is fictitious and is provided for illustrative purposes only. It is not based on any calculations or actual farm practice.)

Consider a permitted activity rule that states:

Original Rule: Discharge of Farm Animal Effluent onto Land

The discharge of contaminants onto land from the application of farm animal effluent, and the subsequent discharge of contaminants into air or water, is a **permitted activity** subject to the following conditions.

a. No discharge of effluent to water shall occur from any effluent holding facilities.
b. Storage facilities and associated facilities shall be installed to ensure compliance with condition (a).
c. All effluent treatment or storage facilities (eg, sumps or ponds) shall be sealed so as to restrict seepage of effluent.
d. Effluent shall not enter surface water by way of overland flow, or pond on the land surface following application.
e. The total nitrogen loading rate for grazed pasture shall not exceed 150 kg N/ha/year.*

If an assessment of this rule was carried out during plan review, and it was found that effluent discharge to land at this loading rate could result in levels of nitrogen in source water that would lead to the water supply exceeding the MAV for nitrate, the rule could be changed by decreasing the permitted nitrogen loading rate to 130 kg N/ha/year*.

This could be done if calculations showed that decreasing the loading rate by this amount would result in levels of nitrogen at the abstraction point for the treatment plant that would continue to allow drinking water to comply with the MAV for nitrate.

The status of activities where the loading from effluent discharge exceeds the stated rate would then need to change (eg, to discretionary activities). The new rule would be:

New Rule: Discharge of Farm Animal Effluent onto Land

The discharge of contaminants onto land from the application of farm animal effluent, and the subsequent discharge of contaminants into air or water, is a **permitted activity** subject to the following conditions.

a. No discharge of effluent to water shall occur from any effluent holding facilities.
b. Storage facilities and associated facilities shall be installed to ensure compliance with condition (a).
c. All effluent treatment or storage facilities (eg, sumps or ponds) shall be sealed so as to restrict seepage of effluent.
d. Effluent shall not enter surface water by way of overland flow, or pond on the land surface following the application.
e. The total nitrogen loading rate for grazed pasture shall not exceed 130 kg N/ha/year.*

* Tables could be provided in the plan to assist with the calculation of stocking rates to achieve the loading rates stated for nitrogen. For example The Operative Waikato Regional Plan includes such tables to explain their nitrogen loading rates (see Table 3-7 under Rule 3.5.5.1 at http://www.ew.govt.nz/Policy-and-plans/Regional-Plan/Waikato-Regional-Plan/3-Water-Module/35-Discharges/355-Implementation-Methods---Farm-Effluent-Discharges/).

Pathogens

In addition, farm animal effluent can contain pathogens that can cause human illness. The plan review process may result in a decision to consider this dimension of risk to drinking water quality. Investigations may show that the discharge of effluent could result in increased pathogen levels (as indicated by *E. coli* concentrations) in the source water, which could result in levels of *E. coli* in drinking water exceeding the MAV after existing treatment. The new permitted activity rule could include controls on the discharge of pathogens. This could be done by adding *E. coli* to contaminants regulated under the rule, and/or by adding conditions/terms that would reduce the entry of pathogens to water bodies.

6 National Environmental Standard Emergency Notification Conditions

6.1 Introduction

This part of the guide relates to Regulations 11 and 12 of the NES. These regulations require councils to place an emergency notification condition on relevant consent holders. Specifically, they require the consent authority to assess whether an activity could pose a risk to the drinking water supply in the case of an unintended event (eg, a spill or other accident). If the consent authority considers that such a risk exists, a condition must be placed on the consents that requires the consent holder to notify the drinking water supplier if such an event occurs.

In terms of the emergency notification provisions of the NES, it is important to note that the following points differ from the other regulations.

1. Regulation 11 states that Regulation 12 applies to activities with the potential to affect registered drinking water supplies that supply *25 or more people* with drinking water for 60 or more days of a calendar year.[15]
2. Regulation 12 relates to activities regulated by *both district and regional councils*.

Applications for water and discharge consents that are already required to be considered under the other regulations of the NES may also require an emergency notification condition. As a result, the emergency notification provisions of the NES relate to all types of consents, but they are not intended to deal with the normal day-to-day effects of these consents; only unintended events such as spills are addressed.

Regulation 12 in the NES covers circumstances where effects are not anticipated; for example, something that is not part of normal day-to-day running of a facility and that could lead to a significant adverse affect on water quality at the abstraction point for a drinking water supply.

This part of the NES requires the consent authority to consider the consequence for drinking water if an accident occurred on a site. Therefore any structural or procedural aspects of the activity that could result in contaminants entering the drinking water source need to be considered.

The potential for human error, equipment failure or extreme weather events needs to be considered, along with the risk management procedures of the site, when deciding if the condition is necessary.

[15] This is a much lower population threshold than applies to parts of the regulation relating to resource consent and permitted activity rules in regional plans. The other regulations refer to supplies that cater to 501 or more people for 60 or more days of a calendar year.

Example: spill from an effluent pond

An effluent pond on a farm breaches its banks and effluent spills into the adjacent river. The farm is upstream of a drinking water treatment plant, which abstracts water from the river.

Before the NES, the farmer may not have been aware that a spill from the pond could adversely affect the quality of drinking water delivered by the treatment plant downstream from the farm. They would also probably be unaware that they should contact the water treatment plant operator if a spill occurred; at least, such a requirement was not in force.

As the water treatment plant would not have been alerted by the farmer, increased determinand levels in the water would only be discovered when it was tested (or if another party, such as the council, was informed of the discharge). Water samples are usually sent to a laboratory for analysis, so there can be a significant time lag between taking a sample and receiving the results. By the time the results had been received, the contaminated water would have passed through the system and on to consumers.

Had the treatment plant been made aware of the spill in the first place, treatment could either have been increased or the water intake from the river stopped until the contamination had cleared.

6.2 Regulation 12(1)

[12] Condition on resource consent if activity may significantly adversely affect registered drinking-water supply

(1) When considering a resource consent application, a consent authority must consider whether the activity to which the application relates may –

(a) itself lead to an event occurring (for example, the spillage of chemicals) that may have a significant adverse effect on the quality of the water at any abstraction point; or

(b) as a consequence of an event (for example, an unusually heavy rainfall) have a significant adverse effect on the quality of the water at any abstraction point.

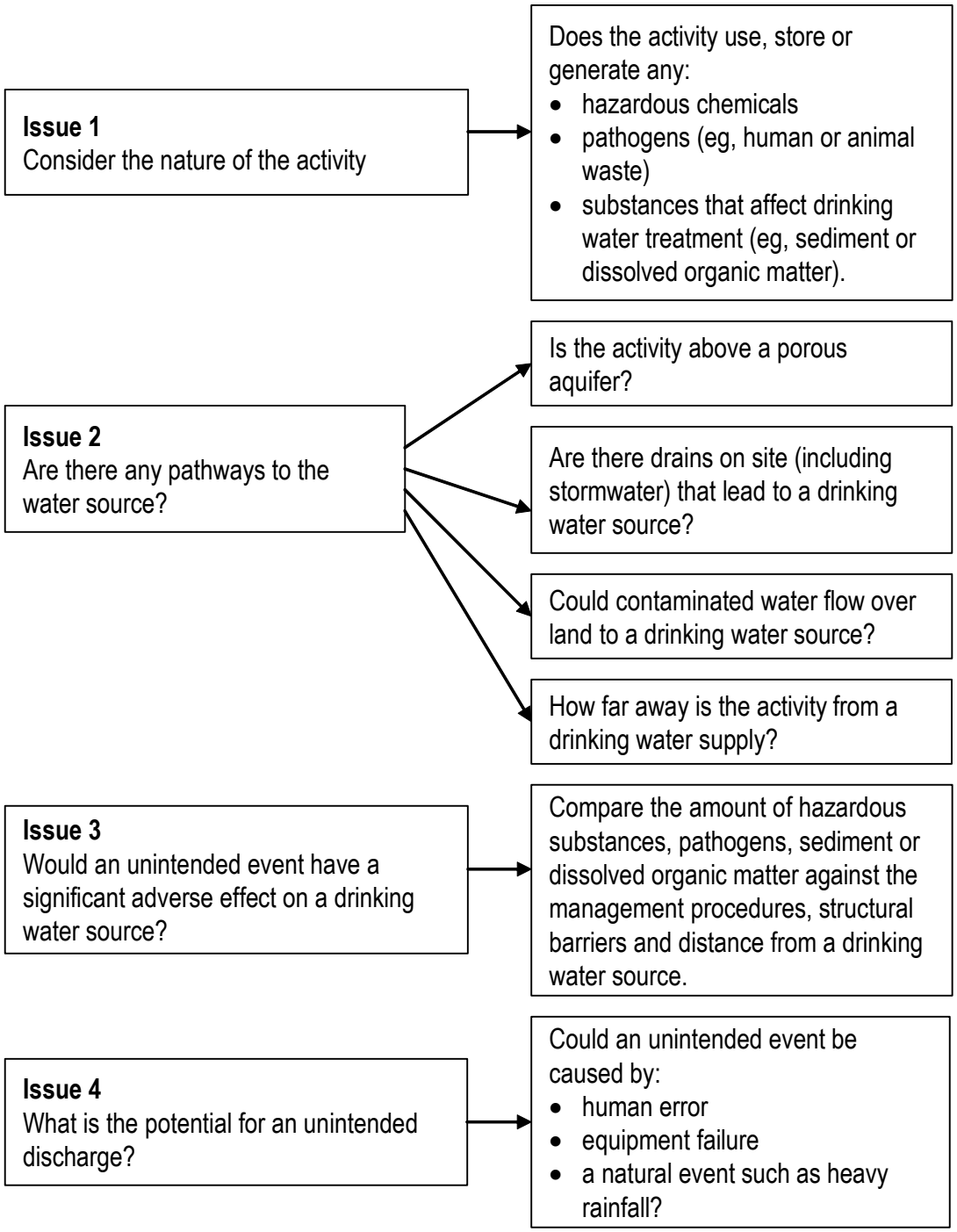
Regulation 12(1) describes circumstances in which a condition must be attached to a resource consent to satisfy the requirements of the NES. Specifically, it specifies two aspects a consent authority must consider when deciding whether a consent condition is required.

The first aspect, Regulation 12(1)(a), relates to the nature of the activity itself. The regulation requires that the consent authority consider whether an event that could have a significant adverse effect on source water quality at any abstraction point could occur during the normal operations at a site. The second aspect, Regulation 12(1)(b), is more indirect. The regulation states that the consent authority must consider whether an activity could affect drinking water as a consequence of an event (such as heavy rainfall).

6.3 Is an emergency notification condition required?

Figure 8 suggests a series of issues to consider when deciding whether an emergency notification is required for a specific resource consent.

Figure 8: Suggested issues to consider when deciding whether an emergency notification condition needs to be placed on a resource consent



6.3.1 Issue 1: Consider the nature of the activity

When deciding whether a condition needs to be added, the council officer needs first to consider the type of activity for which consent is being sought: could anything associated with that activity pose a significant risk to drinking water quality, in terms of the effects at an abstraction point?

The regulation itself gives an example – the spillage of chemicals. The vast range of circumstances in which such a condition could apply are deliberately not specified in the regulation. Instead, it is left to the council's discretion to consider the nature of the activity occurring at the premises. The question is whether that activity has any components, processes or parts that may lead to an event that would have a significant adverse effect on water quality at the abstraction point.

Several factors could be considered. For example, are there any hazardous substances used, stored or produced as waste products at the facility or premises? Could pathogenic micro-organisms be present? (This is particularly likely if an activity involves substantial quantities of human or animal waste. Examples could include septic tanks, pipes conveying sewage, or a dairy farm effluent pond.)

6.3.2 Issue 2: Are there any pathways to the water source?

The next thing to consider is whether there are any pathways by which any pathogenic or hazardous material mentioned can enter a waterway. When deciding whether to attach this condition, the distance of the activity from the drinking water source is very important. The closer the facility is to an abstraction point, the higher the risk of there being a pathway and the greater the likely need for the condition.

Consider also any preferential pathways by which the pathogenic or toxic material may enter a drinking water source. For example, the activity may be situated above an aquifer which is known or suspected to be fractured or porous, in which case the risk of contamination is higher than for an activity above a confining layer of an aquifer. Another preferential flow path to consider is stormwater drains: these often lead to waterways, which in turn may channel stormwater to a drinking water source. Both artificial and natural waterways should be considered with regard to this regulation.

6.3.3 Issue 3: Would an unintended event have a significant effect on a drinking water source?

The subclause contains the phrase "significant adverse effect", which has deliberately not been defined in the regulation. The term 'significant' is used frequently throughout the RMA and is a concept with which most practitioners will be familiar. They are therefore expected to apply their knowledge, including consideration of relevant case law, when using this regulation, as for all other RMA consents and permits that include consideration of relevant case law.

For example, if the amounts of a hazardous material or a pathogenic material used or held at a facility are extremely small and site management procedures are good, then a significant risk to the drinking water supply source is unlikely. By contrast, it may be that there are large quantities of a material present, a material is particularly toxic, or organisms (eg, protozoa) are likely to be present. If the nearby treatment plant is known to lack the capacity to adequately remove that contaminant, these circumstances could constitute a significant adverse effect.

6.3.4 Issue 4: What is the potential for an unintended discharge?

Also consider any structural or procedural aspects of the activity that could result in contaminants entering the drinking water source. For example, if there is a containment bund around an area used to store pathogenic or hazardous material, then consider the likelihood of such a bund being breached. A recycling facility at which some hazardous material is stored would most likely store that material in a contained and bunded area. If such structures are in place, consider their adequacy. For example, could:

- a forklift drive through a containment bund
- a drum be spilt over a shallow-lipped bund
- the containment wall of an effluent pond be breached
- a heavy rainfall event cause a bund or effluent pond to overflow?

The potential for human error, equipment failure or natural events such as heavy rainfall need to be considered, along with the risk management procedures and structures of the site, when deciding if the condition is necessary.

Examples of aspects that could lead to unintended discharges

Facilities with treatment ponds or bund. Are the bunds and pond designed with enough capacity so they will not overflow during extremely heavy rainfall?

Facilities located on flood plains. What is the likelihood of the facility being breached so that hazardous chemicals, pathogens, sediment or dissolved organic matter may leak during a flood or heavy rainfall event?

Activities that generate or store sediment. What is the likelihood of sediment flowing off the site into a drinking water source if there is heavy rainfall?[16]

It is also important to consider whether facilities and activities have significant risk management controls and therefore do not require a condition under subclause 1(a), but do require one under 1(b). For example, a factory may have bunded all its chemicals and have good risk management procedures. However, these precautions may still be inadequate to prevent leaching of chemicals during a flood or very heavy rainfall event. If this is the case, then the condition would need to be added.

[16] This is important to consider because sediment reduces the efficiency of many drinking water treatment processes.

Figure 8 summarises the sections above and the issues to be considered when deciding whether an emergency notification condition should be placed on a consent.

6.4 Regulation 12(2)

> *(2) If the consent authority considers that the circumstances in subclause (1) apply, and it grants the application, it must impose a condition on the consent.*

Regulation 12(2) states that if the consent authority considers that the circumstances in 12(1) apply and the application is granted, then a condition must be imposed on that consent. Therefore, the condition must be placed on a consent if the activity is likely to have an effect as a result of the nature of the activity 12(1)(a), or if an effect is likely only if an extreme event occurs 12(1)(b).

6.5 Regulation 12(3)

> *(3) The condition must require the consent holder to notify, as soon as reasonably practicable, the registered drinking-water supply operators concerned and the consent authority, if an event of the type described in subclause (1) occurs that may have a significant adverse effect on the quality of the water at the abstraction point.*

Subclause 3 outlines the nature of the condition that must be attached to any consent granted. The consent holder must be required to notify drinking water supply operators concerned and the consent authority as soon as practicable if an event occurs (as described in subclause 1) that may have a significant adverse effect on water quality at the abstraction point.

Let's say a bund wall could be breached by an accidental collapse or a drum tipping over, and there is a likelihood the spillage could reach a waterway. If this is anticipated, a condition should be added to the consent requiring notification if such an event occurs. The consent holder for that activity must notify the drinking water supply operator downstream and the consent authority as soon as possible. In this instance, the consent authority is the council that granted the consent for the activity.

The intention of this part of the regulation is to enable drinking water treatment operators to take appropriate action as soon as they are made aware of an event upstream which could pose a risk to their drinking water supply. They may then, for example, be able to switch to another intake point, or shut off their intake until the flush of material has passed, or increase disinfection.

It may not be possible for the water to be treated, or for the water supply to be shut off in time. In this case, giving effect to this condition enables the treatment operator to notify the consumers as soon as possible. The drinking water assessor for the area could issue a notice to the public advising that water should be boiled to avoid health risk. In extreme circumstances (such as a spill of a toxic chemical which cannot be removed by boiling), a public health warning may be issued. In such extreme cases, alternative water supplies may need to be provided until the danger has passed.

The council could include contact details of the drinking water treatment plant that may be affected, either in the condition or as an advice note to the condition. This makes it very clear to the consent holder who they are required to contact. Most large suppliers are operated by territorial authorities, and so obtaining contact details for larger suppliers will be relatively simple for the consent authority. These contact details are best placed on the consent itself.

For smaller suppliers, the territorial authority may not be the treatment plant operator. For example, a camping ground or marae may be privately owned and operated. However, it should still not be too difficult to locate contact details for these individual plants; for example, the database distributed by the Ministry for the Environment includes owners' names. It is not possible for the Ministry database to include contact details for treatment plant operators because these can change frequently with staff turnover. However, a treatment plant operator is usually quite easily identified, either by looking in the local phone book or by contacting the local district council or public health unit.

If there is any difficulty identifying or contacting the treatment plant operator when such a condition is being placed on a consent, the consent officers should talk to the drinking water assessor.

Placing a condition on a consent will not have a big effect on the consent holder. No expenditure on new equipment or labour is required. It should take little time and effort for the consent holder to notify the drinking water treatment facility and consent authority of any event that could compromise water quality at the abstraction point. Also, the consent holder will only have to act on the condition if an unintended event occurs.

6.6 Example condition

Consent conditions should be appropriate to the nature of the activity and sufficiently specific for the consent holder to know what is required. Following is an example of a condition that could be placed on a consent.

Example: consent condition

(a) If an event occurs on-site that may lead to solvents draining to the Waikino stream, the consent holder must notify the <insert treatment plant name> and <insert council name> as soon as reasonably practicable after the spill occurs.

Note: The <insert treatment plant name> Plant can be contacted on <insert phone number>. If this is not successful, the consent holder should contact the public health unit for the area on <insert phone number>.

<insert council name>[17] should also be contacted via their 24-hour help line on <insert phone number>.

[17] Note that in this case the district council is listed as the consent authority (which Regulation 12[3] requires be notified), not as the drinking water supplier. In some cases the drinking water supplier and local authority may be one and the same.

The above condition is an example of how the emergency notification condition could be written. The condition states who has to be notified and the contact number. Such conditions placed on consents should include details of how to notify the parties involved to allow quick action in an urgent situation such as after a spill.

The example above would need to be adjusted depending on the likely event on-site and the nature of the drinking water source located within the vicinity. Each council could also keep a list of the relevant names and contact details (if possible) so processing officers do not have to seek these out themselves whenever they impose the condition. Drinking water assessors and public health units should be contacted to help provide contact information.

Appendix 1: Understanding Determinands and Water Treatment

A1 Introduction to determinands

This appendix gives a basic introduction to determinands and their possible derivation. For more detail, please refer to the ESR report *A Guide to the Ministry of Health Drinking-water Standards for New Zealand*, which is available from the Ministry for the Environment's website at http://www.mfe.govt.nz/laws/standards/drinking-water-source-standard.html/

The NES uses the term 'determinand' instead of 'contaminant'. 'Determinand' has a specific meaning which is narrower than that of contaminant (as defined in the RMA). The *Drinking-water Standards for New Zealand 2005* (DWSNZ) define determinand as:

> *A constituent or property of the water that is determined, or estimated, in a sample, for example:*
>
> - *microbial determinand: total coliforms*
> - *chemical determinand: chloride*
> - *physical determinand: turbidity*
> - *radiological determinand: radon.*

In the NES regulations, 'determinand' specifically refers to the health-related determinands specified in the DWSNZ.

> ***Determinand** means a determinand described in Table 2.1, 2.2, 2.3, or 2.4 of the Drinking-water Standard.*

There are two different kinds of determinands: those of health significance and those that are not of immediate health significance. Determinands that are *not* of immediate health significance are those that either:

- are not damaging to health in themselves and therefore have no specified maximum acceptable value (MAV), but can affect the water's safety for drinking by leading to the formation of other contaminants referred to as precursors
- affect the aesthetic properties of the water (taste, odour, appearance).

These determinands need to be considered when assessing the impact of a new activity in a catchment on the drinking water received by a community. The acceptability of a water supply to a community can be as strongly influenced by these determinands as by those with health significance.

An aesthetic determinand is defined in the DWSNZ as:

> *A constituent or property of the water that can adversely affect the water's taste, odour, colour, clarity or general appearance, including substances such as manganese and iron compounds that can stain washing and utensils.*

In the NES regulations:

> ***Aesthetic determinand*** *means an aesthetic determinand described in Table A2.1 in Appendix 2 of the Drinking Water Standard.*

Health and aesthetic determinands have different characteristics, so they are measured in different ways. Determinands of health significance are measured by their maximum acceptable value (MAV), and aesthetic determinands are measured using guideline values (GVs).

The DWSNZ define these terms as follows.

> ***Maximum acceptable value (MAV)*** *– the concentration of a determinand below which the presence of the determinand does not result in any significant risk to a consumer over a lifetime of consumption. For carcinogenic chemicals, the MAVs set in the Drinking-water Standards for New Zealand generally represent a risk of one additional incidence of cancer per 100,000 people ingesting the water at the concentration of the MAV for 70 years.*
>
> ***Guideline value (GV)*** *– the value for an aesthetic determinand that, if exceeded, may render the water unattractive to consumers.*

There is no definition of precursors in either the NES or the DWSNZ. However, precursors can be placed in three general categories:

- nutrients, which encourage the development of algal blooms
- organic matter, which leads to the formation of disinfection by-products
- turbidity, which can affect the ability of treatment plants to remove protozoa from the water.

Precursors have no health significance in themselves, but they can affect the potability of water because they can result in treated water containing contaminants that are a health concern.

A2 Water contaminants of health significance

For public health purposes, drinking water contaminants fall into three broad classes:

- microbiological
- chemical
- radiological.

This outline focuses on microbiological and chemical contaminants because they are the most frequently encountered.

A2.1 Microbiological contaminants

In general, microbiological contaminants are considered to be a greater threat to health than chemical contaminants. This is because they are:

- fast acting, usually causing sickness in a few days or weeks
- capable of multiplying within a host
- transmittable from person to person
- capable of causing fatal illness.

In New Zealand, exposure to microbiological contaminants is a concern because of the relatively high density of domesticated animals. Conversely, New Zealand's low level of heavy industry reduces the likelihood of industrial chemical contaminants in source waters.

The DWSNZ recognise three classes of micro-organisms that may cause disease: bacteria, viruses and protozoa.

Bacteria

The bacterial indicator organism *Escherichia coli* (*E. coli*) is used in the DWSNZ to assess the potential for faecal contamination of water. The bacterial quality of treated water is satisfactory if the *E. coli* concentration is less than 1 organism per 100 millilitres.

Apart from a few strains, *E. coli* is not a disease-causing organism (pathogen) itself. It is found in very high numbers in the gut of all warm-blooded animals. Fresh faeces almost always contain *E. coli*, although it may not survive in the environment as long as some pathogens. The presence of *E. coli* confirms that water has been in contact with faeces, meaning that pathogens may also be present. The types of pathogen in water and their concentration will depend on the nature of the organisms that are infecting the source of the faeces (animal or human) and the number of animals or humans that are infected.

Viruses

Insufficient information is available to derive an MAV for viruses, or a viral indicator, because a virus suitable to act as a viral indicator (similar to *E. coli* for bacteria) is yet to be found. Potential candidates have proved unsatisfactory because:

- they respond differently from viral pathogens to treatment with disinfectants
- there is no correlation between their concentration and the concentration of viral pathogens in the water
- test methods are unsuitable (the incubation time is too long, too complex or too expensive).

Although there is no MAV for viruses in the DWSNZ, this does not mean they do not present a threat to health. Faecally polluted water can harbour disease-causing viruses (viral pathogens). The presence of *E. coli* in water, although a bacterial indicator, may also signal the presence of viral pathogens. Viruses that cause water-borne disease tend to be enteric (ie, they infect the gastrointestinal tract and are excreted by infected humans). Some viruses that infect animals may also infect humans. Human and animal viruses are highly infective.

Protozoa

Protozoa (eg, *Giardia* and *Cryptosporidium*) are among the most common causes of infection and disease in humans and other animals. The largest recorded outbreak of water-borne disease in a first-world country was due to *Cryptosporidium*. This outbreak occurred in Milwaukee, USA, in 1993, with an estimated 400,000 people becoming ill.

The DWSNZ give a MAV for the total concentration of protozoa in treated water of less than 1 organism per 100 litres. Note that the units for protozoa are for litres of water, not millilitres as for bacteria. *Giardia* and *Cryptosporidium* are the protozoa of primary concern in drinking waters.

Giardia and *Cryptosporidium* exist as environmentally robust spores outside a host. Both organisms are resistant to water treatment processes *Cryptosporidium* is more difficult to remove by filtration because it is smaller. It is also more resistant to chlorine.

Applying the NES for protozoa

Catchment activities that are likely to increase the concentration of *Cryptosporidium* in a source water could lead to an increase in the log credits a water supply requires to achieve compliance with the DWSNZ with respect to protozoa. Log credits are explained in more detail in Appendix 7 of this guide.

Chemical contaminants

The health effects of greatest concern associated with chemical contaminants are those arising from prolonged exposure to low concentrations. Three notable exceptions, when chemical contaminants can have immediate consequences for health, are:

- nitrate (specifically for bottle-fed infants)
- cyanotoxins (the toxins produced by cyanobacteria)
- copper, which may arise from the corrosion of copper plumbing (if present in high enough concentrations).

Exposure to chemical contaminants can also have immediate consequences when a contaminant's concentration is very high; this may happen as the result of accidental spillage.

Maximum acceptable values for chemical contaminants, both natural and of human origin, are listed in two tables in the DWSNZ. The first (Table 2.2 in the DWSNZ) lists inorganic chemicals such as nitrate, metals and chemicals used to disinfect water. Classes of chemical contaminants in the table are:

- metals and metalloids
- inorganic disinfection by-products
- disinfectants
- a miscellaneous group outside the above classifications: beryllium, boron, cyanide, fluoride, nitrate and nitrite.

The second table of chemical contaminants (Table 2.3 in the DWSNZ) lists organic substances:[18]

- compounds utilised in industry (including contaminants in water treatment products)
- agrichemicals (eg, pesticides)
- substances formed in the water during the disinfection process (disinfection by-products)
- cyanotoxins (toxins produced by cyanobacteria and blue-green algae)
- polycyclic aromatic hydrocarbons (PAHs, which result from incomplete combustion).

[18] Organic substances are chemical substances containing carbon, but not including carbon dioxide.

Radioactive contaminants

The final table of MAVs in the DWSNZ covers radioactive contaminants of water. These are seldom a concern in New Zealand, and are expected to arise from natural sources only.

A3 Contaminants that affect the aesthetic properties of water

The taste, odour and appearance of water are collectively called *aesthetic properties*. Aesthetic properties are important because they determine a water's acceptability to consumers. Problems with a water's aesthetic properties are also usually more rapidly evident to consumers than MAV exceedances by contaminants that affect health.

The World Health Organization's *Guidelines for Drinking-water Quality* (3rd ed, 2004) state:

> *The provision of drinking-water that is not only safe but also acceptable in appearance, taste and odour is of high priority. Water that is aesthetically unacceptable will undermine the confidence of consumers, lead to complaints and, more importantly, possibly lead to the use of water from sources that are less safe.*

The DWSNZ contain a list of guideline values for aesthetic determinands, using the term 'wholesome' to describe water that is potable and acceptable to consumers with respect to taste, odour or appearance.

Guidelines are met at the discretion of the water supplier, and are not a requirement for DWSNZ compliance. This is because it is not always straightforward – and is often expensive – to treat aesthetic determinands. The two most likely reasons for water suppliers undertaking this monitoring are to:

- address consumer complaints about water quality
- achieve a high public health grade.

Sampling in response to complaints about the aesthetic aspects of water (eg, taste and smell) occurs more frequently than monitoring for health-significant contaminants. Samples may be taken from the source water and/or following treatment, depending on where the investigation leads. Which determinands are tested will depend on the nature of the complaint received.

A monitoring programme that addresses a particular consumer concern is likely to last only a short while, continuing only until the problem is identified and a solution found. If it is an ongoing problem, which the water supplier has difficulty overcoming, monitoring may continue.

Although aesthetic determinands do not cause toxic effects, health issues can arise if people seek alternative water sources. When alternative sources are used they are often unsafe supplies such as untreated aquifer or river water.

A4 Precursors

Several contaminants of water do not have direct health effects themselves but can have adverse health consequences through reducing the effectiveness of treatment processes or leading to the production of harmful chemical compounds. These contaminants include: turbidity, natural organic matter, hardness, and some major ions such as sodium ions. For more information on the performance of treatment processes, refer to the ESR report *A Guide to the Ministry of Health Drinking-water Standards for New Zealand* available from the Ministry for the Environment website at http://www.mfe.govt.nz/laws/standards/drinking-water-source-standard.html/

Turbidity

Turbidity (particles suspended in water) needs to be removed to avoid the deterioration in the effectiveness of filtration, disinfection and adsorption processes. If a new activity is likely to result in a major increase in the turbidity of the source water, the treatment plant's ability to adequately treat water to remove particles must be evaluated.

Filtration processes in water treatment plants can remove particles from the water to some extent, but there is a limit to how much they can remove. Filters will rapidly clog, or particles can break through if the turbidity of the source water entering the filters is too high.

The efficacy of all disinfection processes, chemical and physical, are adversely affected by particles in the water. Microbes can be adsorbed onto the surfaces of particles, which makes them harder to remove using chemical disinfection. Ultra-violet (UV) radiation efficiency is also reduced by turbidity because particles can cause the radiation to scatter.

Some processes (eg, activated carbon adsorption and ion-exchange adsorption) remove contaminants by adsorption; their effectiveness depends on the contaminants of concern reaching the adsorbing surface. Unacceptably high levels of particles in the water will rapidly reduce the available surface area for adsorption and therefore reduce the efficacy of the process.

Natural organic matter

Natural organic matter is made up of large organic molecules formed by the decay of vegetation and animal remains. The efficacy of disinfection, oxidation and adsorption processes is reduced by natural organic matter. Catchment activities that increase the natural organic matter concentration in the source water can therefore reduce the effectiveness of a treatment plant.

Chemical disinfectants (eg, chlorine) are commonly used in water treatment to inactivate microbes, but these disinfectants react with natural organic matter, reducing the disinfectant's concentration and therefore reducing its disinfection ability. Chlorine and ozone both react with natural organic matter, which reduces their effectiveness in disinfecting water. The disinfectant dose added to the water can be increased to compensate for this, but this also increases the concentration of disinfection by-products,[19] which is undesirable because of their possible health effects.

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[19] Disinfection by-products (DBP) are defined in the DWSNZ as "a contaminant produced in the drinking-water supply as a by-product of the disinfection process". Examples of these are listed in Table 2.3 of the DWSNZ. Their suspected health effects include cancer, and liver and kidney damage. Note that some disinfection by-products do not have a health effect so are not listed as determinands in this table. However, these are aesthetic determinands and are included in Table 2.3 of Appendix 2 of the DWSNZ.

Natural organic matter also reduces the effectiveness of disinfection by UV radiation, because it absorbs light at the same wavelength generated by the UV lamps that are used to kill harmful organisms.

Hardness and other effects of major ions

Water hardness arises from calcium and magnesium ions in the water, and is often the result of the water having been in contact with limestone or marble. High hardness creates problems of scale formation on water heating-elements, and inhibits the lathering of soap.

Any treatment using ion-exchange and UV irradiation is made less effective by waters that are hard or contain high concentrations of other major ions. If the primary use of ion exchange in a particular situation is to remove iron and manganese, an increase in source water hardness may result in the exchange resin removing calcium and magnesium instead. High sodium levels may also compromise the removal of iron and manganese.

The formation of calcium scale on the quartz sleeves in hard waters can also reduce the intensity of the output from UV lamps, which in turn affects their disinfection capability.

Appendix 2: Drinking Water Information Sources

1 Treatment plant operators

Treatment plant operators undertake the day-to-day running of water treatment plants and are therefore a source of detailed information about the operation of their water supply. Information from treatment plant operators is best obtained through contacting the water supply manager at your local authority.

If the water supply is not operated by a local authority, a drinking water assessor at the public health unit may be able to put you in touch with the water supplier, who in turn can give the operator's details if the treatment plant operator is a different person from the water supplier.

Depending on their level of training and experience with the treatment plant, the treatment plant operator may be able to provide the following information relevant to making decisions on the NES:

- the monitoring undertaken at the treatment plant, which may include samples taken for compliance purposes (eg, *E. coli*) and operational monitoring of parameters, such as turbidity and acidity/alkalinity (pH)[20]
- advice on how the treatment plant copes with increases in turbidity in the source water, and the level of turbidity increase that might be tolerated without compromising the plant's ability to comply with the DWSNZ
- activities in the catchment that contribute to the contaminants that must be removed by the treatment plant
- the degree of removal of common chemical contaminants, such as iron and manganese, providing they have already been identified as a problem and there are treatment processes in place to remove them
- how the flow rate or level of the source water at the abstraction point affects the finished water quality.

It will be more difficult for treatment plant operators to estimate their treatment plant's ability to remove a new contaminant: the treatment may not have been specifically designed to remove it, and they may not previously have needed to carry out such treatment. For example, if cyanide contamination is a possible consequence of a proposed catchment activity, the operator may be unable to estimate the extent to which existing treatment processes will remove this contaminant. In such situations, an independent consulting engineer could be asked for advice on the likely extent of removal. For applications where this is necessary, this should be assessed as part of the assessment of environmental effects (AEE). If this information is not provided, it should be officially requested via a section 92 letter.

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[20] Treatment plant monitoring information is usually primarily for finished water and the plant operator's parameters. Source water monitoring is usually sparse, and for most plants is undertaken only sporadically (if at all).

2 Water Information New Zealand

Water Information New Zealand (WINZ) is a national database of information on water supply management and water quality. It is maintained by ESR on behalf of the Ministry of Health. It provides water supply information, including the characteristics of supplies, public health grades, and compliance with the DWSNZ. Both permanent (location and details of the supply system) and transitory (compliance with DWSNZ grading) data are stored in the database.

WINZ software is developed and maintained by the Water Information Systems group of ESR. The group distributes software updates to water suppliers, district health boards and other organisations that may be running WINZ.

Three levels of WINZ have been developed to meet the specific needs of different organisations involved in the management of drinking water supplies. Explained in more detail below, these are:

- WINZ for water suppliers
- WINZ for district health boards
- National WINZ.

WINZ for water suppliers

Not all water suppliers use WINZ. Those that do are provided with a version that contains information relevant to their water supply only. From the supply-specific information, the software is able to calculate monitoring requirements and provide a suggested sampling schedule.

Once monitoring data is generated, the water supplier can store it in WINZ. The software will determine the compliance status of the supply when sufficient information is available. Events such as transgressions,[21] and actions taken in response, can be recorded and stored in WINZ. The software generates warnings of the need to take corrective actions in the event of a transgression.

WINZ for district health boards

All district health boards use a version of WINZ that is essentially the same as the version provided to water suppliers, but with some additional functions. Individual suppliers receive information about their supply only; district health boards have access to database information about all supplies in their district.

The district health board collects compliance information from water suppliers and uploads a summary of the information to National WINZ, maintained by ESR. This is then used for preparing the annual Ministry of Health publication on water quality on New Zealand drinking water supplies, the *Annual Review of Drinking-water Quality in New Zealand* (the *Review*).

[21] Transgressions are exceedances of the MAV for a determinand; see Appendix 1 for more information.

National WINZ

National WINZ is maintained by ESR on behalf of the Ministry of Health. The database stores high-level information uploaded from public health units; it also shows supply details and public health grading information. The National WINZ data is used for:

- compilation of Ministry of Health publications – the *Register of Community Drinking-water Supplies and Suppliers in New Zealand* and the *Review*
- analysis of water supply information to help the Ministry of Health develop policy
- research requiring national-level information about water supplies and compliance, or information about specific water supply systems (eg, the treatment processes in use).

WINZ and NES implementation

Two types of information contained within WINZ will be relevant to implementing the national environmental standard: supply details and compliance information. Drinking water assessors in public health units are a useful first point of contact for obtaining and understanding information in WINZ about individual water supplies.

Supply details

When a water supply is registered, each component of that supply is given a unique identification code. Some basic details about each supply component are stored in WINZ. For treatment plants, these details include the grid reference of the treatment plant and the regional authority in which the plant is located. Details about treatment operations and treatment chemicals used at each treatment plant are also retained.[22]

Compliance information

Compliance information can help establish how well a water supply's treatment plant is functioning, and therefore how well it will deal with new contaminants or increased levels of existing contaminants.

Drinking Water for New Zealand website

The Drinking Water for New Zealand website (www.drinkingwater.org.nz) is managed by ESR for the Ministry of Health. This includes valuable information about the quality and safety of New Zealand's drinking water.

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[22] Types of contaminants the treatment plant should be able to reduce in concentration can be identified from knowledge of the treatment processes in use. However, WINZ should be used for this purpose as a first approximation only. Check with the water supplier to confirm which processes are operational, and the degree to which treatment plant processes will reduce concentrations of expected contaminants.

3 Annual review of drinking water

Each year, ESR prepares the *Annual Review of Drinking-water Quality in New Zealand* (the *Review*) for the Ministry of Health. The *Review* contains information from all registered community water supplies and provides:

- an overview of drinking water quality in New Zealand, which assists the Ministry of Health to evaluate the effectiveness of its policies and water supply management tools (eg, public health risk management plans) in improving the quality of drinking water, therefore minimising the risk of water-borne disease
- an overview for district health boards of drinking water in their district so they are better able to plan where efforts for improving drinking water quality should be directed
- detailed information on the performance of individual water supplies for those wanting to know about the quality of a supply.

Much of the information needed to assess the effects of a resource consent on the quality of drinking water and, in particular, the performance of a water treatment plant, is available in the *Review* and WINZ.

Note that there can be a considerable delay between the end of the monitoring year and public release of the *Review*. This is because substantial cross-checking of data is required by drinking water suppliers, public health units, ESR and the Ministry of Health to ensure that both individual supply information and the resulting national summary are accurate. This can lead to delays of a year or more.

4 Ministry for the Environment

The Ministry for the Environment has prepared a database to help implement the NES. The information in this database has been obtained from ESR, which maintains the WINZ database on behalf of the Ministry of Health.

This database is compatible with Geographic Information Systems (GIS) and has been sent to all regional councils. It includes drinking water source abstraction points, drinking water treatment plants, and some information on drinking water supply compliance with the DWSNZ. This will help councils determine whether drinking water from an individual supply meets the health quality criteria. The database is in Microsoft Access format and is intended to be integrated with existing GIS systems at regional councils.

This database is provided only to regional councils to assist with their regulatory functions under the NES. Permission has been obtained from the Ministry of Health to supply this database to regional councils for this purpose. The Ministry for the Environment distributes the database to regional councils. Wider distribution of the database is not permitted.

The Ministry for the Environment cannot release its database, which is based on WINZ data, until the most recent annual *Review* is publicly released by the Ministry of Health (see section 3 above). This is because earlier release of the database would mean a public release (albeit limited) of data that has not yet been released by its owner (the Ministry of Health). Councils will need to continue using the previous year's database until the Ministry of Health has published the annual *Review*, and has thereby publicly released drinking water quality compliance data nationally.

Appendix 3: Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007

2007/396

Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007

Anand Satyanand, Governor-General

Order in Council

At Wellington this 17th day of December 2007

Present:
His Excellency the Governor-General in Council

Pursuant to section 43 of the Resource Management Act 1991, His Excellency the Governor-General, acting on the advice and with the consent of the Executive Council (given on the recommendation of the Minister for the Environment after consultation in accordance with section 44 of that Act), makes the following regulations.

Contents

1

Regulations

1 Title

These regulations are the Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007.

2 Commencement

These regulations come into force 6 months after the date of their notification in the *Gazette*.

3 Interpretation

(1) In these regulations, unless the context requires another meaning,—

abstraction point means a place at which water in the environment is abstracted for use in a registered drinking-water supply (for example, the place at which water is abstracted from a river, stream, or lake or from a groundwater source)

Act means the Resource Management Act 1991

activity includes a proposed activity

aesthetic determinand means an aesthetic determinand described in Table A2.1 in Appendix 2 of the Drinking-water Standard

determinand means a determinand described in Table 2.1, 2.2, 2.3, or 2.4 of the Drinking-water Standard

distribution system means the trunk main and the storage and other components of a registered drinking-water supply that relate to its distribution

does not meet the health quality criteria, in relation to drinking water, has the meaning set out in regulation 5

drinking water—

(a) means water intended to be used for human consumption; and

(b) includes water intended to be used for food preparation, utensil washing, and oral or other personal hygiene

Drinking-water Standard means *Drinking-water Standards for New Zealand 2005*, Wellington, Ministry of Health, August 2005

existing treatment means the treatment process in respect of a registered drinking-water supply at the time an application for resource consent is made or a proposal to include or amend a rule in a regional plan is notified, as the case may be

guideline value, in relation to an aesthetic determinand, means the value for the determinand stated in the column headed GV in Table A2.1 in Appendix 2 of the Drinking-water Standard (being the value for the aesthetic determinand that, if exceeded, may render the drinking water concerned unattractive to a consumer)

maximum acceptable value, in relation to a determinand, means the concentration of the determinand stated in the column headed MAV in Table 2.1, 2.2, 2.3, or 2.4, as the case

may be, of the Drinking-water Standard (being the concentration below which the presence of the determinand concerned does not result in any significant risk to a consumer over a lifetime of consumption)

meets the health quality criteria, in relation to drinking water, has the meaning set out in regulation 4

registered drinking-water supply means a drinking-water supply that is recorded in the drinking-water register maintained by the chief executive of the Ministry of Health (the Director-General) under section 69J of the Health Act 1956

treatment process—

(a) means a chemical, biological, or physical process carried out after water is abstracted from an abstraction point to enhance its quality before it enters the distribution system concerned; and

(b) includes merely abstracting water from the abstraction point without further chemical, biological, or physical processing before it enters the distribution system, if the water does not contain or exhibit 1 or more determinands exceeding their maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard

upstream, in relation to an abstraction point, means—

(a) in the case of surface water (other than a lake), upstream of the abstraction point:

(b) in the case of groundwater, up-gradient of the abstraction point:

(c) in the case of a lake,—

(i) anywhere within the lake that could affect the water quality at the abstraction point (in the lake):

(ii) upstream of any river that could affect the water quality at the abstraction point (in the lake):

(iii) up-gradient of any groundwater that could affect the water quality at the abstraction point (in the lake).

(2) Unless the context requires another meaning, any term used but not defined in these regulations, but defined in the Act, has the same meaning as in the Act.

4 Meaning of meets the health quality criteria

(1) In these regulations, in relation to drinking water, **meets the health quality criteria** means drinking water that—

(a) is tested for determinands—

(i) at the point where the drinking water leaves the treatment process concerned but has not yet entered the distribution system concerned; or

(ii) at some point in the distribution system, if any particular determinand is not tested at the point referred to in subparagraph (i); and

(b) is tested in accordance with the compliance monitoring requirements in the Drinking-water Standard; and

(c) when analysed, does not contain or exhibit 1 or more determinands exceeding their maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard.

(2) For the purposes of subclause (1)(c), the most recent complete annual results for the drinking water contained in the Water Information New Zealand database maintained on behalf of the Ministry of Health must be used.

5 Meaning of does not meet the health quality criteria

(1) In these regulations, in relation to drinking water, **does not meet the health quality criteria** means drinking water that—

(a) is tested for determinands—

(i) at the point where the drinking water leaves the treatment process concerned but has not yet entered the distribution system concerned; or

(ii) at some point in the distribution system, if any particular determinand is not tested at the point referred to in subparagraph (i); and

(b) is tested in accordance with the compliance monitoring requirements in the Drinking-water Standard; and

(c) when analysed, contains or exhibits 1 or more determinands exceeding their maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard.

(2) For the purposes of subclause (1)(c), the most recent complete annual results for the drinking water contained in the Water Information New Zealand database maintained on behalf of the Ministry of Health must be used.

Water and discharge permits in respect of activities with potential to affect certain drinking-water supplies

6 Type of activity to which regulations 7 and 8 apply

Regulations 7 and 8 only apply to an activity that has the potential to affect a registered drinking-water supply that provides no fewer than 501 people with drinking water for not less than 60 days each calendar year.

7 Granting of water permit or discharge permit upstream of abstraction point where drinking water meets health quality criteria

A regional council must not grant a water permit or discharge permit for an activity that will occur upstream of an abstraction point where the drinking water concerned meets the health quality criteria if the activity is likely to—

(a) introduce or increase the concentration of any determinands in the drinking water, so that, after existing treatment, it no longer meets the health quality criteria; or

(b) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

8 Granting of water permit or discharge permit upstream of abstraction point where drinking water not tested or does not meet health quality criteria

(1) A regional council must not grant a water permit or discharge permit for an activity that will occur upstream of an abstraction point where the drinking water concerned is not tested in accordance with the compliance monitoring procedures in the Drinking-water Standard if the activity is likely to—

(a) increase the concentration of any determinands in the water at the abstraction point by more than a minor amount; or

(b) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

(2) A regional council must not grant a water permit or discharge permit for an activity that will occur upstream of an abstraction point where the drinking water concerned does not meet the health quality criteria if the activity is likely to—

(a) increase, by more than a minor amount, the concentration of any determinands in the water at the abstraction point that in the drinking water already exceed the maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard; or

(b) increase the concentration of any determinands in the water at the abstraction point that in the drinking water do not exceed the maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard to the extent that the drinking water, after existing treatment, exceeds the maximum acceptable values for more than the allowable number of times as set out in the Table in relation to those determinands; or

(c) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

Permitted activity rules in respect of activities with potential to affect certain drinking-water supplies

9 Type of activity to which regulation 10 applies

Regulation 10 only applies to an activity that has the potential to affect a registered drinking-water supply that provides no fewer than 501 people with drinking water for not less than 60 days each calendar year.

10 Limitations on permitted activity rules for activities upstream of abstraction points

(1) A regional council must not include a rule or amend a rule in its regional plan to allow a permitted activity, under section 9,

13, 14, or 15 of the Act, upstream of an abstraction point where the drinking water concerned meets the health quality criteria unless satisfied that the activity is not likely to—

(a) introduce or increase the concentration of any determinands in the drinking water so that, after existing treatment, it no longer meets the health quality criteria; or

(b) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

(2) A regional council must not include a rule or amend a rule in its regional plan to allow a permitted activity, under section 9, 13, 14, or 15 of the Act, upstream of an abstraction point where the drinking water concerned is not tested in accordance with the compliance monitoring procedures in the Drinking-water Standard unless satisfied that the activity is not likely to—

(a) increase the concentration of any determinands in the water at the abstraction point by more than a minor amount; or

(b) introduce or increase the concentration of any aesthetic determinands in the drinking water, so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

(3) A regional council must not include a rule or amend a rule in its regional plan to allow a permitted activity, under section 9, 13, 14, or 15 of the Act, upstream of an abstraction point where the drinking water concerned does not meet the health quality criteria unless satisfied that the activity is not likely to—

(a) increase, by more than a minor amount, the concentration of any determinands in the water at the abstraction point that in the drinking water already exceed the maximum acceptable values for more than the allowable number of times as set out in Table A1.3 in Appendix 1 of the Drinking-water Standard; or

(b) increase the concentration of any determinands in the water at the abstraction point that in the drinking water do not exceed the maximum acceptable values for more than the allowable number of times as set out in Table

A1.3 in Appendix 1 of the Drinking-water Standard to the extent that the drinking water, after existing treatment, exceeds the maximum acceptable values for more than the allowable number of times as set out in the Table in relation to those determinands; or

(c) introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values.

Resource consents in respect of activities with potential to affect certain drinking-water supplies

11 Type of activity to which regulation 12 applies

Regulation 12 only applies to an activity that has the potential to affect a registered drinking-water supply that provides no fewer than 25 people with drinking water for not less than 60 days each calendar year.

12 Condition on resource consent if activity may significantly adversely affect registered drinking-water supply

(1) When considering a resource consent application, a consent authority must consider whether the activity to which the application relates may—

(a) itself lead to an event occurring (for example, the spillage of chemicals) that may have a significant adverse effect on the quality of the water at any abstraction point; or

(b) as a consequence of an event (for example, an unusually heavy rainfall) have a significant adverse effect on the quality of the water at any abstraction point.

(2) If the consent authority considers that the circumstances in subclause (1) apply, and it grants the application, it must impose a condition on the consent.

(3) The condition must require the consent holder to notify, as soon as reasonably practicable, the registered drinking-water supply operators concerned and the consent authority, if an event of the type described in subclause (1) occurs that may

have a significant adverse effect on the quality of the water at the abstraction point.

Consent authority requirements may be more stringent than regulation requirements

13 Consent authority may impose requirements more stringent than requirements in these regulations

A consent authority may do either or both of the following:

(a) make or amend rules in a regional plan that are more stringent than the requirements of these regulations:

(b) impose conditions on resource consents that are more stringent than the requirements of these regulations.

Transitional provisions

14 Regional council not required to immediately amend rules in plan

A regional council is not required to amend an existing rule in a plan that does not comply with regulation 10 until the earlier of the following:

(a) a scheduled review of the plan; or

(b) a plan change or variation that relates to the existing rule is introduced.

15 Proposed plan not affected by these regulations if submissions already closed

(1) A regional council is not required to amend a rule in a proposed plan that does not comply with regulation 10 if the closing date for submissions on the plan has passed before the commencement of these regulations.

(2) This regulation applies whether the proposed plan is a new plan or an amendment to an existing plan.

(3) In this regulation, **closing date** means the date referred to in clause 7(1) of Schedule 1 of the Act.

Rebecca Kitteridge,
for Clerk of the Executive Council.

10

Explanatory note

This note is not part of the regulations, but is intended to indicate their general effect.

These regulations are the Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007. The regulations are made under the Resource Management Act 1991 and come into force 6 months after the date of their notification in the *Gazette*.

The purpose of the regulations is to reduce the risk of contamination of drinking-water sources by requiring regional councils to consider the effects of certain activities on drinking-water sources when—

- granting water permits or discharge permits (*regulations 7 and 8*); and
- including or amending rules in a regional plan in relation to permitted activities (*regulation 10*).

The regulations also require regional councils and territorial authorities to impose a notification requirement on certain resource consents in the circumstances where an event occurs that may have a significant adverse effect on a drinking-water source (*regulation 12*).

Under the regulations, different criteria apply for granting resource consents or writing permitted activity rules depending on whether the drinking water concerned currently meets the health quality criteria or does not meet the health quality criteria. These terms are defined in *regulations 4 and 5* with reference to the *Drinking-water Standards for New Zealand 2005*, a Ministry of Health publication, and the Water Information New Zealand database maintained on behalf of the Ministry of Health (currently by ESR (Environmental Science and Research)).

The circumstances in which the regulations apply also vary depending on—

- the number of people that are supplied with drinking water; and
- the number of days in each calender year that the people are supplied with the drinking water.

Regulation 13 authorises a consent authority to impose requirements in relation to rules in a plan or resource consents that are more stringent than the requirements in the regulations.

Regulations 14 and 15 are transitional provisions and set out when a regional council must comply with *regulation 10* (which relates to rules for permitted activities).

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Appendix 4: Activities and Contaminants that may Contribute to Source Waters

Table A1 contains information about possible contaminants that may arise from a given activity. Note that this is not an exhaustive tabulation either of all possible activities or of all contaminants that could arise. Activities could produce contaminants that are not included in the table. Also, the specific details of an activity will determine whether all or only some of the contaminants listed may be a concern.

This table is therefore a good starting point for determining which contaminants may arise from an activity, but is only a guide. The details of each specific activity should be determined in each case to gather a complete understanding of the possible contaminants.

The table includes indirect contaminants as well as those arising directly from the activity. For example, where the activity could introduce nutrients into a water source, cyanotoxins are potential indirect contaminants arising from the growth of algae encouraged by the nutrients. (Cyanotoxins have not been listed where the quantities of nutrients being released seem likely to be relatively small.)

Note that the table includes a wider list of contaminants as well as determinands. (Determinands are listed in the DWSNZ 2005 and are subject to regulation under the NES).

The information contained in Table A1 can be augmented by information from the Ministry for the Environment's Hazardous Activities and Industries List.

Abbreviations used in Table A1:

DBP	Disinfection by-products
NOM	Natural organic matter
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
TPH	Total petroleum hydrocarbons

Notes to the table

1. Superscript 'I' indicates indirect contaminants not introduced by the activity but which develop in the water as the result of other contaminants from the activity.
2. The term 'pesticides' refers to pesticides and herbicides. The term 'herbicides' is expressly used when only herbicides is meant.

Table A1: Possible contaminants from activities grouped by land use

Activity	Contaminating material	Contaminants		Comment
		Chemical	Microbiological	
Land-use category 1. Agriculture				
Use of pesticides	Range of pesticides, metals	Pesticides, zinc, copper, cadmium, manganese		
Use of artificial fertilisers	Range of artificial fertilisers	Ammonia, nitrite, nitrate, urea, phosphate, potassium, sulphate, calcium, magnesium, cadmium, manganese, cyanotoxins[l]		Under suitable conditions the introduction of nutrients into source water may lead to algal growth and the presence of cyanotoxins, and taste and odour compounds.
Use of manure as fertiliser	Manure	Ammonia, nitrite, nitrate, copper, zinc, cyanotoxins[l]	Bacteria, viruses, protozoa	The period of manure storage before use will affect the microbial risk. Under suitable conditions the introduction of nutrients into a source water may lead to algal growth and the presence of cyanotoxins, and taste and odour compounds
Fuel storage and use	Petrol, diesel	Benzene, toluene, xylene, ethylbenzene, TPH		
Silage production	Silage leachate	Ammonia, nitrite, nitrate, cyanotoxins[l], NOM	Bacteria, viruses, protozoa	Acids formed in the silage may influence the pH of the water. Under suitable conditions the introduction of nutrients into a source water may lead to algal growth and the presence of cyanotoxins, and taste and odour compounds.
Dairy shed operation	Wash water	Ammonia, nitrite, nitrate, phosphate, cyanotoxins[l], chlorine, chloramines, DBPs	Bacteria, viruses, protozoa	Chlorine could react with organic waste to form chloramines and other DBPs. Under suitable conditions the introduction of nutrients into a source water may lead to algal growth and the presence of cyanotoxins, and taste and odour compounds.
Spray irrigation of effluent	Effluent	Ammonia, nitrite, nitrate, cyanotoxins[l], turbidity, zinc, copper	Bacteria, viruses, protozoa	The level of microbial risk will depend on the time the manure has been stored before use. Levels of contaminants from well-operated effluent ponds should be low. Under suitable conditions the introduction of nutrients into a source water may lead to algal growth and the presence of cyanotoxins, and taste and odour compounds. Grazing close to the water's edge will weaken and erode the bank.
Effluent pond operation	Effluent			
Grazing animals	Manure deposited in pasture			
Cultivation (tilling the soil only)	Soil, silt	Turbidity		Cultivation close to the water's edge will weaken and erode the bank.

Activity	Contaminating material	Contaminants		Comment
		Chemical	Microbiological	
Land-use category 2. Forestry				
Sewage sludge application	Sewage	Ammonia, nitrite, nitrate, phosphate, metals, cyanotoxins[l],	Bacteria, viruses, protozoa	
Use of pesticides	Range of pesticides	Pesticides		
Use of poisons (feral animal control)	Poisoned baits	Cyanide, 1080, brodifacoum		
Use and maintenance of vehicles	Petrol, diesel, oil	Benzene, toluene, xylene, ethylbenzene, TPH		
Fuel storage	Petrol, diesel			
Land-use category 3. Mining and Quarrying				
Use and maintenance of vehicles	Petrol, diesel, oil	Benzene, toluene, xylene, ethylbenzene, TPH		
Fuel storage	Petrol, diesel			
Ore extraction	Extraction chemicals	Cyanide, metals		The metals of concern will depend on the composition of the ore.
Collection and treatment of acid mine drainage	Mine drainage	Metals, sulphate		The low pH of mine drainage may affect the pH of the receiving water and affect the treatment operation.
Open-cast mining and quarrying	Dust	Turbidity		Activities requiring use of explosives will eject particulates into the air.
Land-use category 4. Industry and Commerce (heavy and light industry)				
Brewing	Materials used in the process, and process effluent	Detergents, organic matter		
Ceramics	Glazes	Metals		
Cold storage	Refrigerants	Ammonia, nitrite, nitrate		
Drum reconditioning	Range of organic and inorganic chemicals, degreasers, detergents	Industrial solvents, metals		
Electronics	Alkalis, acids, cyanides, solvents, metals	Cyanide, TPH, metals, PCBs, methylene chloride, tetrachloroethene, trichloroethane, acetone, toluene		Alkalis and acids in large enough quantities may influence the source water pH, and possibly treatment plant operation.
Fertiliser/ agrichemical production	Fertilisers and pesticides	Ammonia, nitrite, nitrate, urea, phosphate, potassium, sulphate, calcium, magnesium, cyanotoxins[l]		Under suitable conditions the introduction of nutrients into a source water may lead to algal growth and the presence of cyanotoxins, and taste and odour compounds.
Fish processing	Process effluent (high in organic waste)	Organic matter		

Activity	Contaminating material	Contaminants		Comment
		Chemical	Microbiological	
Foundries	Acids, metals, fluxes	Metals, nitrate, chloride, sulphate, phosphate		Acids may give rise to nitrate, chloride, sulphate, and phosphate and affect the pH of the source water.
Furniture production	Glues, polishes, paints	Toluene, dichloromethane		
Meat and milk processing	Processing effluent, including cleaning chemicals	Ammonia, nitrite, nitrate, phosphate, chloride, sodium, calcium, magnesium, organic substances, cyanotoxins[l], turbidity, chlorine	Bacteria, viruses and protozoa	Caustic cleaning chemicals can result in high pH effluent. Under suitable conditions the introduction of nutrients into a source water may lead to algal growth and the presence of cyanotoxins, and taste and odour compounds.
Metal cleaning/ electroplating	Cleaning and plating chemicals, metals, acids	Cyanide, metals, industrial solvents, nitrate, chloride, sulphate, phosphate, detergents, editic acid (EDTA)		Acids may give rise to nitrate, chloride, sulphate and phosphate and affect the pH of the source water.
Paper making	Bleaching chemicals, caustic soda	Chlorate, chlorine, sulphate, DBPs, sodium, NOM		The quantities of chlorinated organic compounds (DBPs) should be small in a well-run plant.
Printing	Solvents, inks, dyes	Industrial solvents (eg, dichloromethane, toluene, xylene)		
Product storage	Fumigants	1,3-dichloropropene, chloropicrin, cyanide, methyl bromide		The nature of the fumigation will determine which fumigants are a concern.
Resins	Range of organic chemicals	Formaldehyde, urea, organic acids, esters amines and peroxides		
Rubbers and plastics	Solvents, plasticisers, paints and other organic substances	Industrial solvents, cyanide, zinc, formaldehyde, plasticisers		
Tanning	Tanning chemicals	Chromium, calcium, sulphate		
Wood processing	Preservatives and other treatment chemicals	Pentachlorophenol, copper, chromium, arsenic, boron, industrial solvents, chlorpyriphos, creosote, PAHs		
Wool scouring	Degreasing agents, pesticides	Detergents, grease, pesticides (including chlorpyriphos, diazinon)		The classes of pesticides likely to be derived from wool are: organophosphates, synthetic pyrethroids and insect growth regulators.

Activity	Contaminating material	Contaminants		Comment
		Chemical	Microbiological	
Land-use category 4. Industry and Commerce (commerce and community)				
Car washes	Soaps, detergents, waxes, oil	Detergents, TPH, PAHs		
Cemeteries	Embalming fluids, bodies, coffin construction materials, fertilisers	Formaldehyde, arsenic, mercury, lead, copper, zinc, ammonia, nitrite, nitrate, chloride, sulphate, phosphate, sodium, potassium, magnesium, cyanotoxins[l]	Bacteria, viruses	The properties of the soil and age of the cemetery, among other things will influence the nature of contaminants in the groundwater.
Defence establishments	Disinfectants, human waste, chemical dumps, fuel and oil	Chlorine, industrial chemicals, benzene, toluene, xylene, ethylbenzene, TPH	Bacteria, viruses, protozoa	
Dry cleaning	Dry cleaning chemicals	Tetrachloroethene, trichloroethane, ammonia, phosphate, chloride		The phosphate and chloride originate from phosphoric and hydrochloric acids.
Hospitals	Disinfectants, biological waste, radiological waste, other miscellaneous chemicals	Formaldehyde, chlorine	Bacteria, viruses, protozoa	Reticulation of waste disposal should eliminate the hazards associated with this activity.
Laboratories (school, medical and research)	Disinfectants, biological waste, other miscellaneous chemicals	Formaldehyde, chlorine	Bacteria, viruses, protozoa	Viruses and protozoa would not be expected from school laboratories.
Laundromats	Detergents, bleaches, dyes	Chlorine		
Offices	Detergents, solvents	Industrial solvents		
Photographic processing	Photographic processing chemicals	Cyanide, silver, amines		
Prisons	Disinfectants, human waste	Chlorine	Bacteria, viruses, protozoa	
Scrap yards	Petroleum products, solvents, metals, acids, alkalis	TPH, metals, industrial solvents, PAHs		
Swimming pools	Disinfectants, other pool treatment chemicals, human waste	Chlorine, chloramines, DBPs, lithium	Bacteria, viruses, protozoa	Lithium could arise from lithium hypochlorite – a form of pool chlorine.
Land-use category 4. Industry and Commerce (transport , storage and utilities)				
Airport operation	Fuels, fire-fighting foams, solvents, de-icing substances, fumigants	TPH, industrial solvents		
Electricity	Transformer coolants	PCBs, fluorinated hydrocarbons, silicone oils		

Activity	Contaminating material	Contaminants		Comment
		Chemical	Microbiological	
Fuel storage and sale	Fuel storage and sale	Benzene, toluene, xylene, ethylbenzene, TPH		
Railway operation	Spraying of tracks, diesel and oil leaks, human waste (if toilet effluent is vented onto tracks)	TPH, pesticides, PAHs, ammonia, nitrite, nitrate	Bacteria, viruses, protozoa	Spills of cargo carried by rail may result in a wide range of contaminants being introduced into water if there is a pathway to the source water.
Road transport	Asphalt, fuel and oil leaks, chemicals for roadside weed control, metals	TPH, PAHs, benzene, toluene, xylene, ethylbenzene, herbicides, metals		Spills of cargo carried by road may result in a wide range of contaminants being introduced into water if there is a pathway to the source water.
Sewerage reticulation	Sewage (human waste, trade waste)	Ammonia, nitrite, nitrate, metals, industrial solvents, cyanotoxins[l]	Bacteria, viruses and protozoa	A wide range of industrial and domestic contaminants may be present in sewage.
Sewage treatment				
Stock effluent and campervan effluent disposal facilities	Animal and human waste	Ammonia, nitrite, nitrate, metals, cyanotoxins[l]	Bacteria, viruses and protozoa	
Tyre storage	Tyres	TPH, PAHs		
Land-use category 5. Open space				
Car parks	Fuel and oil leaks, asphalt surface	Benzene, toluene, xylene, ethylbenzene, TPH, PAHs		
Clay target clubs	Lead shot	Lead, PAHs		
Disposal of stormwater run-off	Fuel and oil spills and other contaminants on asphalt road surfaces, faecal material from animals, weed and pest control chemicals, fertilisers, metals	Ammonia, nitrite, nitrate, urea, phosphate, potassium, sulphate, calcium, magnesium, pesticides, benzene, toluene, xylene, ethylbenzene, TPH, metals, cyanotoxins[l]	Bacteria, viruses, protozoa	
Golf courses	Chemicals used for up-keep of the course (fertiliser, pesticides); fuel storage	Ammonia, nitrite, nitrate, urea, phosphate, potassium, sulphate, calcium, magnesium, pesticides, benzene, toluene, xylene, ethylbenzene, TPH, cyanotoxins[l]	Bacteria, viruses and protozoa	The inclusion of microbial contaminants assumes an on-site disposal system
Recreational parks	Fertilisers, weed control chemicals, fuel and oil from vehicles			Parks without reticulated sewerage will require on-site sewage disposal systems
Sports fields	Fertilisers, weed control chemicals, fuel and oil from vehicles			Sports fields without reticulated sewerage will require on-site sewage disposal systems
Land-use category 6. Residential (urban, lifestyle block, rural)				
Disposal of household waste	Household chemicals, garden chemicals, petrol, diesel and oil	Metals, TPH, benzene, toluene, xylene, ethylbenzene, industrial solvents, nitrate, phosphate, pesticides, industrial solvents, metals, chlorine		The contamination risk associated with this activity is likely to be small because of their small scale.

Activity	Contaminating material	Contaminants		Comment
		Chemical	Microbiological	
Use of fertilisers	Fertilisers	Ammonia, nitrite, nitrate, urea, phosphate, potassium, sulphate, calcium, magnesium		
Keeping pets or livestock (lifestyle blocks)	Animal waste, pest control chemicals	Ammonia, nitrite, nitrate, pesticides	Bacteria, viruses, protozoa	
Fuel storage	Petrol, diesel, oils	Benzene, toluene, xylene, ethylbenzene, TPH		
On-site disposal of sewage	Human waste, detergents	Ammonia, nitrite, nitrate, detergents, cyanotoxins[l]	Bacteria, viruses, protozoa	
Weed and pest control	Pesticides	Pesticides		
Land-use category 7. Vacant Land				
Illegal dumping	Wide range of possible chemicals	Metals, TPH, benzene, toluene, xylene, ethylbenzene, industrial solvents, nitrate, phosphate, pesticides	Bacteria, viruses and protozoa	Acids or alkalis in the dumped material may result in extreme pH values in receiving water.
Land-use category 8. Landfill				
Disposal of industrial waste	Wide range of possible chemicals	Metals, TPH, benzene, toluene, xylene, ethylbenzene, industrial solvents, nitrate, phosphate, pesticides, cyanide		
Disposal of waste from water and wastewater treatment systems	Waste sludge (which includes treatment chemicals)	Metals, cyanotoxins[l], NOM, acrylamide	Bacteria, viruses and protozoa	
Disposal of household waste	Household chemicals, garden chemicals, petrol, diesel and oil	Metals, TPH, benzene, toluene, xylene, ethylbenzene, industrial solvents, nitrate, phosphate, pesticides, industrial solvents, metals, chlorine		Which contaminants are present will depend on how well the landfill system is controlled.
Land-use category 9. Fishing				
Onshore aquaculture	Faecal matter, pesticides	Pesticides, ammonia, nitrite, nitrate, phosphorus, pesticides, cyanotoxins[l]	Bacteria, viruses and protozoa	
Land-use category 10. Conservation land				
On-site sewage disposal	Human waste	Ammonia, nitrite, nitrate, cyanotoxins[l]	Bacteria, viruses and protozoa	
Disposal of domestic waste	Tin cans	Metals		Burial of cans if they are not taken off site.
Feral animal control	Poisons	Cyanide, 1080, brodifacoum		

Note: This should not be considered an exhaustive list of all possible activities, nor of all contaminants that could arise.

Appendix 5: Permitted Exceedances of Maximum Acceptable Values under the Drinking-water Standards for New Zealand 2005[23]

Appendix A1.8, Table A1.3 lists the number of exceedences that can be tolerated for 95 percent confidence that a benchmark is not being exceeded more than 5 percent of the time.

Appendix A1.8, Table A1.3 refers to the number of samples, irrespective of the frequency of sampling. Thus the number of permissible transgressions in 250 samples is the same (7) whether all 250 samples were collected in one day or taken over the course of a year.

Table A1.3: Allowable exceedances (for 95% confidence that the MAV is exceeded for no more than 5% of the time)

Exceedences	Number of samples
0	38–76
1	77–108
2	109–138
3	139–166
4	167–193
5	194–220
6	221–246
7	247–272
8	273–298
9	299–323
10	324–348

Table A1.4: Allowable exceedances (for 95% confidence that the MAV is exceeded for no more than 2% of the time)

Exceedences	Number of samples
0	95–193
1	194–274
2	275–349
3	350–420
4	421–489
5	490–556
6	557–621
7	622–686
8	687–750
9	751–813
10	814–875

[23] The information in Appendix 5 is directly quoted from pages 128–129 of the *Drinking-water Standards for New Zealand 2005*.

Appendix 6: Maximum Acceptable Values for Determinands in the Drinking-water Standards for New Zealand 2005[24]

Table 2.1: Maximum acceptable values (MAV) for microbial determinands

Micro-organism	MAV[1]
Escherichia coli (E. coli)[2]	Less than 1 in 100 mL of sample
viruses	No value has been set due to lack of reliable evidence
total pathogenic protozoa	Less than 1 (oo)cyst per 100 L of sample

Notes

1 These are maximum acceptable values (MAVs) for regulatory purposes. They do not represent a dose/response relationship that can be used as the basis for determining acceptable concentrations of pathogens in drinking-water.

2 Indicator organism.

[24] The information in Appendix 6 is directly quoted from pages 8–13 of the *Drinking-water Standards for New Zealand 2005*.

Table 2.2: Maximum acceptable values (MAVs) in mg/L for inorganic determinands of health significance

Name	MAV	Remarks
antimony	0.02	
arsenic	0.01	For excess lifetime skin cancer risk of 6×10^{-4}. PMAV used because of analytical difficulties
barium	0.7	
beryllium[1]	0.004	PMAV
boron[2]	1.4	
bromate	0.01	For excess lifetime cancer risk of 7×10^{-5}. PMAV
cadmium	0.004	
chlorate	0.8	PMAV. Disinfection must never be compromised. DBP (chlorine dioxide)
chlorine	5	Free available chlorine expressed in mg/L as Cl_2. ATO. Disinfection must never be compromised
chlorite	0.8	Expressed in mg/L as ClO_2. PMAV. Disinfection must never be compromised. DBP (chlorine dioxide)
chromium	0.05	PMAV. Total. Limited information on health effects
copper	2	ATO
cyanide	0.08	Total cyanides
cyanogen chloride	0.08	Expressed in mg/L as CN. Total. DBP (chloramination)
fluoride[3]	1.5	
lead	0.01	
lithium[1]	1	PMAV
manganese	0.4	ATO
mercury	0.002	Total
molybdenum	0.07	
monochloramine	3	DBP (chlorination)
nickel	0.02	PMAV
nitrate, short term[4]	50	Expressed in mg/L as NO_3. The sum of the ratio of the concentrations of nitrate and nitrite to each of their respective MAVs should not exceed one
nitrite, long term	0.2	Expressed in mg/L as NO_2. PMAV (long term)
nitrite, short term[1,4]	3	Expressed in mg/L as NO_2. The sum of the ratio of the concentrations of nitrate and nitrite to each of their respective MAVs should not exceed one
selenium	0.01	
silver	0.1	PMAV
uranium	0.02	PMAV

Notes: Where WHO Guideline values are based on 60 kg bodyweight, the DWSNZ uses 70 kg bodyweight. See the datasheets for calculations (WHO 2004).

1 MAV retained despite no WHO guideline value.

2 WHO guideline PMAV is 0.5 mg/L.

3 For oral health reasons the Ministry of Health recommends that the fluoride content for drinking-water in New Zealand be in the range of 0.7–1.0 mg/L. This is *not* an MAV.

4 Now short term only. The short-term exposure MAVs for nitrate and nitrite have been established to protect against methaemoglobinaemia in bottle-fed infants.

Table 2.3: Maximum acceptable values (MAVs) in mg/L for organic determinands of health significance (including cyanotoxins and pesticides)

Name	MAV	Remarks
acrylamide	0.0005	For excess lifetime cancer risk of 10^{-5}
alachlor	0.02	Pesticide. For excess lifetime cancer risk of 10^{-5}
aldicarb	0.01	Pesticide
aldrin + dieldrin	0.00004	Pesticide. The sum of, not each
anatoxin-a	0.006	Cyanotoxin. PMAV
anatoxin-a(s)	0.001	Cyanotoxin. PMAV
atrazine	0.002	Pesticide. Cumulative for atrazine and congeners DEA, DIA, and DACT
azinphos methyl	0.004	Pesticide. PMAV
bentazone	0.4	Pesticide. PMAV
benzene	0.01	For excess lifetime cancer risk of 10^{-5}
benzo(α)pyrene	0.0007	For excess lifetime cancer risk of 10^{-5}
bromacil	0.4	Pesticide. PMAV
bromodichloromethane	0.06	For excess lifetime cancer risk of 10^{-5}. THM
bromoform	0.1	THM
carbofuran	0.008	Pesticide
carbon tetrachloride	0.005	
chlordane	0.0002	Pesticide
chloroform	0.2	THM
chlorotoluron	0.04	Pesticide
chlorpyriphos	0.04	Pesticide
cyanazine	0.0007	Pesticide
cylindrospermopsin	0.001	Cyanotoxin. PMAV
2,4-D	0.04	Pesticide
2,4-DB	0.1	Pesticide
DDT + isomers	0.001	Pesticide. Sum of all isomers
di(2-ethylhexyl)adipate	0.1	PMAV
di(2-ethylhexyl)phthalate	0.009	
diazinon	0.01	Pesticide. PMAV
1,2-dibromo-3-chloropropane	0.001	Pesticide. For excess lifetime cancer risk of 10^{-5}
dibromoacetonitrile	0.08	DBP (chlorination)
dibromochloromethane	0.15	THM
1,2-dibromoethane	0.0004	PMAV. For excess lifetime cancer risk of 10^{-5}
dichloroacetic acid	0.05	PMAV. DBP (chlorination)
dichloroacetonitrile	0.02	PMAV. DBP (chlorination)
1,2-dichlorobenzene	1.5	ATO
1,4-dichlorobenzene	0.4	ATO
1,2-dichloroethane	0.03	For excess lifetime cancer risk of 10^{-5}
1,1-dichloroethene	0.03	
1,2-dichloroethene	0.06	Total of cis and trans isomers
dichloromethane	0.02	
1,2-dichloropropane	0.05	Pesticide. PMAV.
1,3-dichloropropene	0.02	Pesticide. Total of cis and trans isomers. For excess lifetime cancer risk of 10^{-5}
dichlorprop	0.1	Pesticide
dimethoate	0.008	Pesticide
diquat	0.01	Pesticide. PMAV
diuron	0.02	Pesticide. PMAV
EDTA (editic acid)	0.7	
endosulfan	0.02	PMAV
endrin	0.001	Pesticide

Name	MAV	Remarks
epichlorohydrin	0.0005	PMAV
ethylbenzene	0.3	ATO
fenoprop	0.01	Pesticide
fluoranthene	0.004	PMAV
formaldehyde	1	DBP
heptachlor and its epoxide	0.00004	Pesticide. PMAV. Mainly occurs as the epoxide
hexachlorobenzene	0.0001	Pesticide. PMAV
hexachlorobutadiene	0.0007	
hexazinone	0.4	Pesticide. PMAV
homoanatoxin-a	0.002	Cyanotoxin. PMAV
isoproturon	0.01	Pesticide
lindane	0.002	Pesticide
malathion	1	Pesticide. PMAV
MCPA	0.002	Pesticide
MCPB[1]	0.03	Pesticide. PMAV
mecoprop	0.01	Pesticide
metalaxyl	0.1	Pesticide. PMAV
methoxychlor	0.02	Pesticide
methyl parathion	0.01	Pesticide. PMAV
metolachlor	0.01	Pesticide
metribuzin	0.07	Pesticide. PMAV
microcystins	0.001	Cyanotoxin. PMAV (Expressed as MC-LR toxicity equivalents)
molinate	0.007	Pesticide
monochloroacetic acid	0.02	DBP (chlorination)
monochlorobenzene	0.3	PMAV. ATO
nitrilotriacetic acid (NTA)	0.2	
nodularin	0.001	Cyanotoxin. PMAV
oryzalin	0.4	Pesticide. PMAV
oxadiazon	0.2	Pesticide. PMAV
pendimethalin	0.02	Pesticide
pentachlorophenol	0.009	Pesticide. PMAV
permethrin	0.02	Pesticide. PMAV
phenylphenol	1.4	Pesticide. PMAV
picloram	0.2	Pesticide. PMAV
pirimiphos methyl	0.1	Pesticide. PMAV
primisulfuron methyl	0.9	Pesticide. PMAV
procymidone	0.7	Pesticide. PMAV
propanil	0.02	Pesticide. PMAV. Some degradation products may be toxic
propazine	0.07	Pesticide. PMAV
pyridate	0.1	Pesticide. PMAV
pyriproxifen	0.4	Pesticide
saxitoxins	0.003	Cyanotoxin. Expressed as STX equivalent. PMAV
simazine	0.002	Pesticide
styrene	0.03	ATO
2,4,5-t	0.01	Pesticide
terbacil[1]	0.04	PMAV
terbuthylazine	0.008	Pesticide
tetrachloroethene	0.05	
thiabendazole	0.4	Pesticide. PMAV
toluene	0.8	ATO
tributyltin oxide	0.002	PMAV
trichloroacetaldehyde	0.01	PMAV
trichloroacetic acid	0.2	DBP (chlorination)

Name	MAV	Remarks
trichlorobenzenes	0.03	PMAV. Total concentration of all isomers. ATO
1,1,1-trichloroethane	2	PMAV
trichloroethene	0.08	PMAV
2,4,6-trichlorophenol	0.2	For excess lifetime cancer risk of 10^{-5}. ATO
triclopyr	0.1	Pesticide. PMAV
trifluralin	0.03	Pesticide. Technical grade may contain carcinogens
trihalomethanes (THMs)		The sum of the ratio of the concentration of each THM to its respective MAV should not exceed one
		The individual members of this group are indicated in the table as THM
vinyl chloride	0.0003	For excess lifetime cancer risk of 10^{-5}
xylenes (total)[1]	0.6	ATO
1080	0.0035	Pesticide. PMAV

Notes:

- DBP indicates a disinfection by-product. Any difficulty in meeting a MAV must never be a reason to compromise adequate disinfection. Trihalomethanes are DBPs. Some DBPs may also have other sources.
- Where WHO Guideline values are based on 60 kg bodyweight, the DWSNZ uses 70 kg bodyweight. See datasheets for calculations (WHO 2004).

1 Institute of Environmental Science and Research report Gallagher LM and Fowles JF 22.03.05.

Table 2.4: Maximum acceptable values (MAVs) in Bq/L for radiological determinands

Radioactive constituents	MAV	Unit
total alpha activity	0.10	Bq/L excluding radon
total beta activity	0.50	Bq/L excluding potassium-40
Radon	100	Bq/L

Abbreviations used in Appendix 6 tables

PMAV Provisional MAV (because it is provisional in the WHO Guidelines (WHO 2004) or WHO has no guideline value but the DWSNZ has retained a MAV or developed its own).

ATO Concentrations of the substance at or below the health-based guideline value that may affect the water's appearance, taste or odour.

DBP Disinfection by-product. Any difficulty meeting a DBP MAV must never be a reason to compromise adequate disinfection. Trihalomethanes and haloacids are DBPs. Some DBPs may also have other sources.

THM Trihalomethane, of which there are four: bromoform, bromodichloromethane, chloroform and dibromochloromethane.

Appendix 7: Log Credits

The capacity of a treatment process to reduce the number of infectious[25] *Cryptosporidium* oocysts[26] in water is specified by the number of log credits[27] it is assigned. The greater the number of log credits assigned to a treatment process, the larger the percentage of oocysts the process is able to remove or inactivate. The DWSNZ specify the number of log credits each treatment process can earn.

Treatment plants often have more than one treatment process that can remove or inactivate *Cryptosporidium*. The overall effectiveness of the treatment plant (ie, the total contribution made by all treatment processes) is calculated by adding together log credits of the individual processes.[28] (For more information, see the *Guide to the Ministry of Health Drinking-water Standards for New Zealand*, chapter 6 (Compliance requirements for protozoa) http://www.mfe.govt.nz/publications/water/guide-moh-drinking-water-standards-nz-jun08/html/page6.html)

To determine whether the number of log credits accrued by the treatment plant is sufficient to produce safe water, the water supplier needs to know the average concentration of *Cryptosporidium* in the source water. Once this has been measured directly, or estimated from a risk assessment of activities in the catchment, the minimum number of log credits required to treat the water can be determined. The DWSNZ provide a table that specifies the number of log credits required to treat a source water based on the results of the monitoring or catchment risk assessment.

For example, the risk assessment or source water monitoring undertaken by a water supplier in accordance with DWSNZ may have shown that the concentration of protozoa in the source water is approximately 1 oocyst per 10 litres. This means that testing (for the purposes of Regulation 4(1)(c)) has been undertaken. The drinking water treatment plant needs a minimum of 4 log removal capacity to deliver water that complies with health quality criteria in terms of concentrations of protozoa.[29] If this plant has 4 or more log credits, it can be assumed to have complied with the maximum acceptable values for protozoa. Water from the plant is therefore assessed as satisfying Regulation 4(1)(c). Therefore, consent applications for activities that could affect source water for this plant will be assessed under Regulation 7.

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[25] Particle removal processes take *Cryptosporidium* out of the water. Inactivation by disinfection does not take *Cryptosporidium* out of the water, but renders the organisms incapable of causing infection.

[26] An (oo)cyst is defined in the Drinking-water Standards for New Zealand as a thick-walled structure within which *Cryptosporidium* zygotes develop and which serve to transfer the organism to new hosts. A cyst is the non-motile dormant form of *Giardia*, which serves to transfer the organism to new hosts.

[27] Log credits are a logarithmically based scale used to measure the level of removal of oocysts by a treatment process. For example, 1 log credit means there is a 10^1 (10-fold) reduction in the oocyst concentration; 2 log credits is a 10^2 (100-fold) reduction, and so on.

[28] Although this is generally true, some combinations of processes are exceptions. These are specified in the Drinking-water Standards for New Zealand.

[29] Refer to Table 5.1, *Drinking-water Standards for New Zealand 2005*.

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