WATER NEW ZEALAND COMPETENCY FRAMEWORK

Drinking Water Treatment Operator

water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

Water New Zealand Competency Framework Drinking Water Treatment Operator

ABOUT WATER NEW ZEALAND

Water New Zealand is a national not-for-profit sector organisation comprising approximately 1900 corporate and individual members in New Zealand and overseas.

Water New Zealand is the principal voice for the water sector, focusing on the sustainable management and promotion of the water environment and encompassing the three waters: drinking water, waste and storm waters.

www.waternz.org.nz

KEY CONTRIBUTORS

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The Water New Zealand Competency Framework is still in the development stage and we are interested in your feedback as we develop it further. If you have any questions, queries or comments, please contact training@waternz.org.nz.

Further refinements of this framework will be issued on the Water New Zealand website.

www.waternz.org.nz/competence

Executive Summary

A workforce with the right skills and capabilities is key to developing an effective, efficient, accountable and resilient three waters sector in New Zealand.

This document forms part of Water New Zealand's Competences Framework (the Framework) and should be read in conjunction with the Water New Zealand Competences Framework Overview document.

The framework is intended to help the water industry to identify the knowledge and skills required by their workforce, to help assess levels of staff training that may be required and to develop training programmes.

The framework has been developed on a role-by-role basis, this document describes what ***Drinking Water Treatment Operators*** should be **able to do** and what they **need to know** to competently undertake their work.

Drinking Water Treatment Operators.

These are the people who operate, monitor and maintain water treatment plants. Their work involves operating the systems and equipment that are used to treat raw water so that it can be supplied to the community. They operate water treatment processes like chemical dosing, filtration and disinfection. They collect and analyse data on the processes and carry out first line maintenance tasks.

Contents

What is the Water New Zealand Competency Framework?

The Water New Zealand Competency Framework (the Framework) identifies what the workforce:

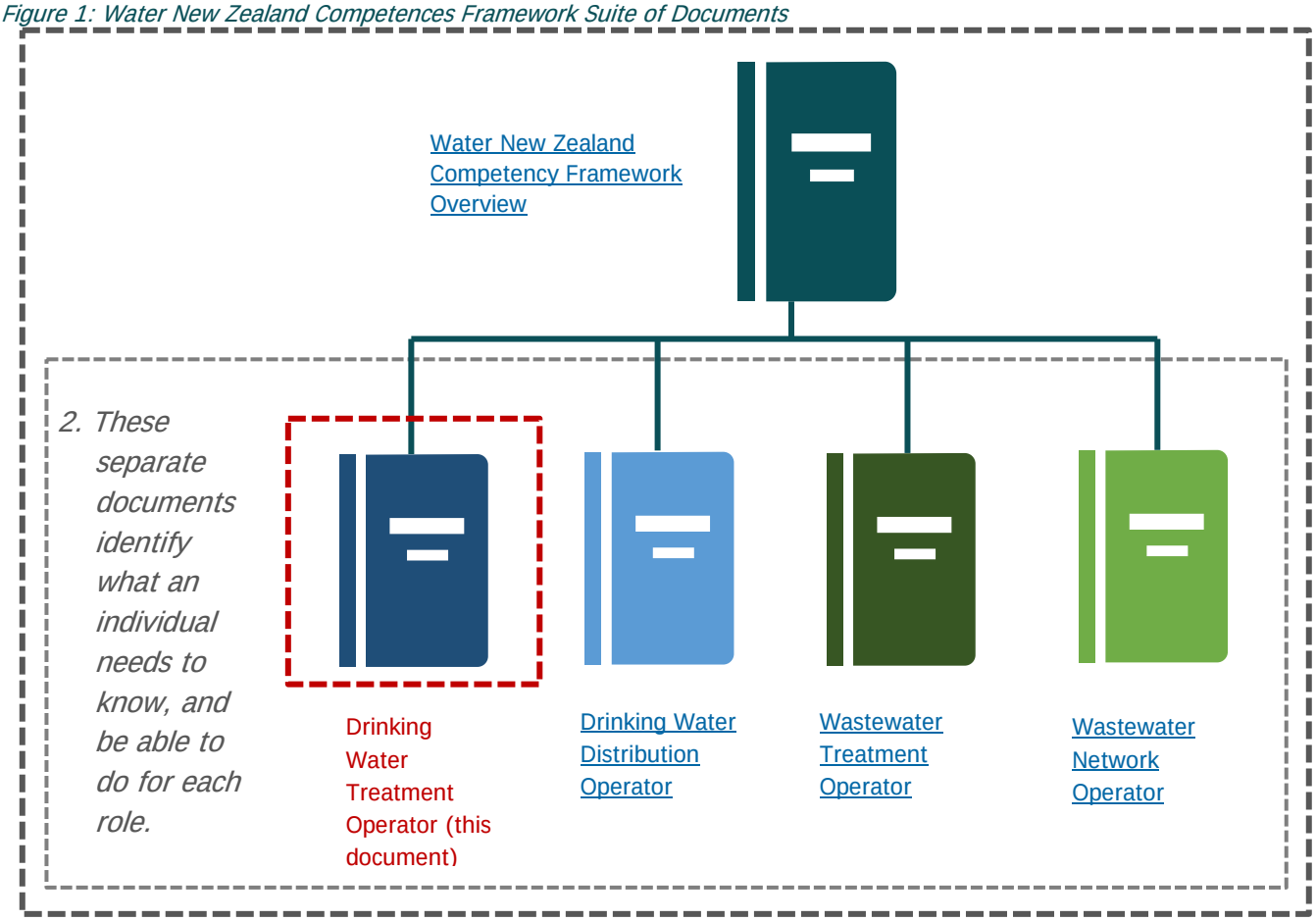
- Needs to be able to do, and
- Needs to know

In order to protect the health of the public by safely and effectively deliver three waters services to the community. While the Framework describes what people working in the three waters industry in New Zealand should be able to do and indicates what they ought to know and understand it does not define how well they should be able to perform or how this should be assessed.

How does this document fit into the Water New Zealand Competence Framework?

The Framework has been structured into a suite of documents, as shown in Figure 1. This document details what it is that **Drinking Water Treatment Operators** need to know and be able to do. It should be read in conjunction with the Water New Zealand Competences Framework Overview document.

Figure 1: Water New Zealand Competences Framework Suite of Documents



Drinking Water Treatment Operator Profile

Drinking Water Treatment Operators take a risk management approach to protect the health of the public. They fulfil a crucial role in ensuring that New Zealand communities are supplied with safe and sufficient water.

They need to have a full understanding of risk assessments and incident and emergency procedures that are documented within the Water Safety Plans that they are responsible for implementing.

To competently carry out their role Drinking Water Treatment Operators need to understand water treatment theories and principles to ensure that processes such as filtration, disinfection and coagulation and clarification are maintained, and the operation of these processes is monitored and controlled. When a fault occurs within a water treatment plant, the Drinking Water Treatment Operator finds the cause of the fault and ensures it is resolved as quickly as possible

Drinking Water Treatment Operator Elements of Competence

The table on the following page lists the elements of competence that are relevant to those roles that **Control Operations** and **Maintain Assets** in the context of operating and maintaining a Water Treatment Plant.

Each element of competence is then further drilled down to give context in a Water Treatment environment, and to identify what it is a Drinking Water Treatment operator needs to know and be able to do.

No one person at an organisation will be expected to be competent in all the elements that this Framework details. The entire breadth of which knowledge and skills will be required by any operator will depend on the type of technology used by each Water Supplier. It will also depend on the depth of experience held within the team that the operator works within; some of the elements of competence will be appropriate for senior operators in a managerial role with other elements appropriate for new entrants to the industry.

What does someone who operates, monitors and maintains a Water Treatment Plant need to know and be able to do?

Water NZ Competency Framework Link & Context		Elements of Competence
Strategy & Planning	**Governance, Legislation and Regulatory Frameworks** Water Treatment Operators are typically employed by Local Government either directly or via an outsourcing contract. They need an understanding of the governance, legal and regulatory frameworks that they are expected to operate within. Everyone involved in the water industry also needs to understand the spiritual and cultural significance of water to Tangata Whenua.	▪ Governance, Legislation and Regulatory Frameworks ▪ The Principles of Safe Drinking Water ▪ Development of Water Safety Plans ▪ The Role of the Drinking-water Standards for New Zealand ▪ Te Mana o te Wai
Asset Management Decision Making	**Operations and Maintenance Decision Making** Decisions made by Water Treatment Operators must reflect and support the principles of delivering safe drinking water as well as the activities and processes involved in determining operations and maintenance requirements.	▪ Critical Control Points ▪ Operational Monitoring and Inspection for Process Control ▪ Apply a knowledge of Science to Water Treatment Processes
Lifecycle Delivery	**Technical Standards** The activities that Water Treatment Operators are responsible for must comply with relevant technical standards.	▪ Technical Standards Related to Water Treatment
	Maintenance Delivery Water Treatment Operators need to be able to safely maintain the different types of equipment used in the delivery of water treatment	▪ Safe Isolation of Plant and Equipment ▪ Drinking Water Hygiene Requirements ▪ Maintenance and Repairs of Water Treatment Equipment ▪ Validation and Calibration of Monitoring Equipment ▪ Inventory Management ▪ Cranes and Lifting Equipment ▪ Maintaining Specified Building Systems
	Reliability Engineering & Root Cause Analysis Water Treatment Operators need to be able to ensure that potential problems are identified as early as possible in an assets' life cycle, identifying the root cause of any lack of reliability	▪ Root Cause Analysis
	Asset Operations and Optimisation Water Treatment Operators monitor, operate, control and optimise water treatment assets in a manner that ensures they meet their objectives, within appropriate design, maintenance and operational parameters.	▪ Water Demand and Hydraulics ▪ Use Automated Systems to control the Process Plant and Collect Data ▪ Operate the Source Water Abstraction Process ▪ Operate Pre-treatment processes ▪ Operate Coagulation and Clarification Processes ▪ Operate Filtration and Adsorption Processes ▪ Operate Sludge Dewatering and Disposal Processes ▪ Operate Disinfection Processes ▪ Operate Treatment Processes for Aesthetic Considerations ▪ Operate Fluoridation Processes ▪ Operate Water Storage Assets ▪ Operate Pumping Systems ▪ Operate Emergency Power Systems
	Shutdown & Outage Management Water Treatment Operators need to be able to manage plant shutdowns and the restarting processes. These can occur in planned, or unplanned, and emergency situations.	▪ Water Treatment Plant Isolation / Shutdown / Re-commissioning of Process Streams
	Fault & Incident Response Responding to failures and incidents in a systematic manner, including incident detection and identification, fault analysis, use of standard responses, temporary and permanent repairs is the responsibility of Water Treatment Operators. This includes the need to develop plans to respond to unplanned events and managing the resources required for the response to the events, and escalation criteria.	▪ Incident and Emergency Response Plans
	Asset Decommissioning and Disposal The processes used to decommission and dispose of assets due to aging or changes in performance and capacity requirements.	▪ Assisting with the Process to Decommission, Dispose or Abandon Assets
Asset Information	**Data and Information Management** Water Operators gather much of the data and information that is used in asset management data analysis or is supplied to regulators.	▪ Provide Data to assist in Asset Management Decision Making ▪ Provide Data to Taumata Arowai - the Water Services Regulator
Risk & Review	**Risk Assessment and Management** Water Treatment Operators need to recognise, and be able to respond to, risks to the delivery of safe drinking water.	▪ Implementing the Water Safety Plan ▪ Health and Safety ▪ Hazardous Substances Management ▪ Plant Security and Asset Protection ▪ Source Water Protection and Catchment Management Plans
	Asset Performance and Health Monitoring Water Treatment Operators need to understand how to monitor the performance of the assets that they are responsible for, how to report on asset performance and how to escalate problems they identify.	▪ Verification Monitoring ▪ Contaminants of Emerging Concern ▪ Resource Consent Compliance Monitoring and Reporting
	Stakeholder Engagement Water Treatment Operators need to be able to communicate with the community and they also need to engage with other stakeholders like Drinking Water Assessors.	▪ Engage with Stakeholders and the Community

Element of Competence:	Governance, Legislation and Regulatory Frameworks
Context	The work that Water Treatment Operators are responsible for is regulated by several different pieces of legislation. The key legislation that Water Treatment Operators need to be aware of includes: ▪ The Health Act, which covers drinking water quality ▪ The Resource Management Act (RMA) which covers taking water and discharging wastes to the environment ▪ The Local Government Act (LGA) which covers the broad management and governance obligations that Water Treatment Operators are required to work within, including the setting of any specific local bylaws. ▪ The Building Act which includes backflow requirements for water connections and also the compliance requirements of buildings with specified systems ▪ The Health and Safety at Work Act (HSWA) which covers health and safety requirements. ▪ Taumata Arowai – the Water Services Regulator Bill which when passed by parliament will cover regulation of water services.
Outcome	The work undertaken by Water Treatment Plant Operators meets all legal and regulatory requirements.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Operate the Water Treatment Plant in a manner that follows the Water Safety Plan for the supply and meets the Drinking Water Standards. The requirements for Water Treatment Operators are detailed further in the competency framework within the elements for Implementing the Water Safety Plan and The Role of the Drinking-water Standards for New Zealand.
- Provide information to the appropriate people regarding the performance of the Water Treatment Plant to facilitate asset management planning as required under the Local Government Act. The requirements for Water Treatment Operators are detailed further in the competency framework within the element Provide Data to assist in Asset Management Decision Making.
- Operate the Water Treatment Plant within any requirements that have been set out in the local Bylaws specific to their territorial authority.
- Operate the Water Treatment Plant within the conditions set in the Resource Consent(s) for the water take, and any waste and air discharges for the plant. The requirements for Water Treatment Operators are detailed further in the competency framework within the element for Resource Consent Compliance Monitoring and Reporting.
- Safely operate the Water Treatment Plant in a manner that addresses health and safety risks, including the correct use and storage of hazardous substances. The requirements for Water Treatment Operators are detailed further in the competency

framework within the elements for Health and Safety, Hazardous Substances Management and Cranes and Lifting Equipment.

To do this, Drinking Water Treatment Operators ***need to know***

- About the Health Act, which requires Drinking Water suppliers to meet the Drinking Water Standards, and to have and implement, a Water Safety Plan for each supply.
- About the Resource Management Act which regulates the source of water and requires the taking of water and the discharge of wastewater and air from the site to conform to the requirements of a resource consent.
- About the Local Government Act which requires Councils to set local bylaws
- About the Local Government Act requirement for Councils to identify the level of service to be delivered by the Water Supply and to be prudent in the stewardship of critical assets like Water Treatment Plants.
- About the Building Act which requires backflow prevention at points of connection to the drinking water supply.
- About the Building Act requirement for a compliance schedule for buildings with specified systems.
- About the Health and Safety at Work Act which is concerned with the Health and Safety of workers and visitors to the site.
- About the Health and Safety at Work (Hazardous Substances) Regulations 2017 which set out the rules for work-related activities involving hazardous substances and replaces the HSNO (Hazardous Substances and New Organisms) regulations for the workplace. Note that in the absence of specific HSWA guidance existing HSNO codes of practice (HSNOCOP) still provide useful guidance.
- About the Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations 1999.

Element of Competence:	The Principles of Safe Drinking Water
Context	There are six fundamental principles of safe drinking water in New Zealand [1] that are essential to the management of drinking water supply.
Outcome	The vulnerability of the drinking water supply to contamination is reduced by ingraining the Principles of Drinking Water Safety into operation of the entire drinking water supply.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Embrace a high standard of care in the work that they undertake. Vigilance, diligence and competence are minimum requirements.
- Understand, manage and address risks to source water.
- Understand how the treatment processes provide multiple barriers to contamination and the importance of maintaining these barriers against failure.
- Monitor treatment processes for any changes and respond accordingly.
- Maintain a personal sense of responsibility and dedication to providing consumers with safe drinking-water.
- Understand the risks to the water supply, how these risks are managed, and the control measures that are used to ensure that management is occurring properly. This includes the requirement for operators to monitoring the performance of each barrier.

To do this, Drinking Water Treatment Operators ***need to know***

The six fundamental principles of drinking water safety:

- Principle 1: A high standard of care must be embraced
- Principle 2: Protection of source water is of paramount importance
- Principle 3: Maintain multiple barriers against contamination
- Principle 4: Change precedes contamination
- Principle 5: Suppliers must own the safety of drinking-water
- Principle 6: Apply a preventive risk management approach

Element of Competence:	Development of Water Safety Plans
Context	Water Safety Plans (WSPs) consider the potential risks to the water supply and identify ways to manage those risks. This essential tool promotes a multi-barrier approach to managing risks and articulates how the supply addresses the principles of drinking water safety in New Zealand. Given their knowledge of the water treatment operation and maintenance Drinking Water Treatment Operators must have input into the development of the Water Safety Plan. They are also responsible for the implementation of large parts of the Water Safety Plan, the requirements of which are documented in the Implementing the Water Safety Plan element of competence.
Outcome	The publics' health is safeguarded through the development and implementation of the Water Safety Plan.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Assist with identifying the Critical Control Points (CCPs) for the supply.
- Assist with identifying and documenting the corrective actions which are required for the CCPs when defined action and critical limits are reached.
- Use their operational knowledge to help identify improvement items to include within the Water Safety Plan.
- Assist with reviewing customer complaints to help identify whether operational changes can be made to improve consumer satisfaction.
- Be involved in long-term engagement plans on the awareness and involvement in safe and secure drinking-water.

To do this, Drinking Water Treatment Operators ***need to know***

- What their role is in the development of the Water Safety Plan (WSP).
- The requirements of the New Zealand Drinking-water Safety Plan Framework.
- The Principles of Safe Drinking Water in New Zealand.
- The characteristics of the drinking-water supply system, what hazards might arise, how these hazards arise and create risks, and the processes and practices that affect drinking-water quality.
- The available water quality information and be able to analyse and interpret this information which identifies actual and potential water quality issues.
- What the barriers to contamination are for the Water Treatment Plant, so that the failure of one barrier will be compensated for by the effective operation of the remaining barriers. Possible barriers might include:
  - Preventing hazards entering the raw water (e.g. source protection)

- Removing particles and hazardous chemicals from the water by suitable treatment
- Killing, or inactivating pathogens by disinfection
- Maintaining the quality of the water in the distribution system

- What Critical Control Points are.
- How the New Zealand Drinking-Water Standards provide requirements for drinking-water safety by specifying the:
  - maximum amounts of substances or organisms or contaminants or residues that may be present in drinking-water
  - criteria for demonstrating compliance with the Standards
  - remedial action to be taken in the event of non-compliance with the different aspects of the Standards.
- About the Guidelines for Drinking-Water Quality Management in New Zealand which complement the Drinking-Water Standards for New Zealand and provides advice for achieving high level of drinking-water quality management. The Guidelines will assist water suppliers to achieve the Standards and are updated on an ongoing basis with new information.
- The commitment to drinking-water quality management from their employer and the relationship of the WSP to organisational policy and strategy.
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Element of Competence:	The Role of the Drinking-water Standards for New Zealand
Context	Drinking Water Treatment Operators are instrumental in ensuring that drinking water supplied to the community is safe to drink. They protect public health by ensuring that the treatment process meets the Drinking-water Standards for New Zealand (DWSNZ).
Outcome	Safe drinking water is supplied to the community that, at a minimum, complies with the Drinking-water Standards for New Zealand.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Operate the Water Treatment Plant in a manner that ensures that the supply meets the operational requirements associated with the treatment processes and does not exceed 50% of the maximum acceptable valves (MAVs) in the New Zealand Drinking-water Standards (DWSNZ) for determinants of public health significance.
- Operate the Water Treatment Plant in a manner that ensures that the supply does not exceed the guideline values (GVs) in the New Zealand Drinking-water Standards (DWSNZ) for aesthetic determinants.
- Verify the overall performance of the Water Treatment Plant by confirming that the following has occurred:
  - The concentration of a determinant in a sample of the drinking-water does not exceed 50% of the MAV or the GV more often than is permitted in the DWSNZ.
  - An operational requirement does not move outside its limit for more than its allowed frequency or duration of the compliance monitoring period.
  - The number of measurements made for each compliance criterion is equal to or greater than that specified in the DWSNZ.
  - Sampling, standardising, testing and reporting procedures meet the requirements of the DWSNZ.
  - The requirements of the compliance criteria have been met throughout the previous 12 months.
  - The remedial actions specified in the DWSNZ and water safety plans have been carried out when there has been a transgression or an excursion beyond an operational requirement.

To do this, Drinking Water Treatment Operators ***need to know***

- How the New Zealand Drinking-Water Standards provide requirements for drinking-water safety by specifying the:
  - maximum amounts of substances or organisms or contaminants or residues that may be present in drinking-water
  - criteria for demonstrating compliance with the Standards
  - remedial action to be taken in the event of non-compliance with the different aspects of the Standards.

- About the Guidelines for Drinking-Water Quality Management in New Zealand which complement the Drinking-Water Standards for New Zealand and provides advice for achieving high level of drinking-water quality management. The Guidelines will assist water suppliers to achieve the Standards and are updated on an ongoing basis with new information.
- That the drinking water supply requires an approved Water Safety Plan. This document is implemented by the Water Treatment Operator and considers the potential risks to the water supply and identify ways to manage those risks, it promotes a multi-barrier approach to managing risks and articulates how the supply addresses the principles of drinking water safety in New Zealand.
- The requirements for verification monitoring within the Drinking-water compliance monitoring plan that is referenced in Water Safety Plan. Including typical measured levels, trends and action levels for water quality parameters and the role of water quality alarms
- The actions to be taken in event of an exceedance of an operational target value.
- The implications and consequences of regulatory water quality sample failures, and actions to be taken as detailed in the Incident and Emergency Response Plan for the water supply.
- The importance of investigation process in the event of water quality incidents, and the regulatory requirements regarding the reporting of these.
- That the water supply they operate should be included on the Register of Drinking-Water Supplies in New Zealand which provides information on who is registered as a drinking-water supplier and gives information about their supplies or sources of water. Inclusion on the register is mandatory for all drinking-water supplies or suppliers serving more than 25 people.
- That the compliance monitoring data about the water supply must be uploaded to Drinking-Water Online, a reporting tool that helps suppliers report the results of their drinking-water supply compliance reporting to meet their obligations under the Health Act 1956.
- That the compliance of the water supply they operate will be reported to the public via the Annual Report on Drinking-Water Quality which is published each year and covers previous year's compliance for registered networked drinking-water supplies The report describes how drinking-water suppliers met the requirements of the Drinking-water Standards for NZ and how they met their statutory requirements of the Health Act.
- That the Health Act requires that only recognised laboratories may be used to carry out tests and analysis of raw water and drinking-water to demonstrate compliance with the Standards.
- What the roles and powers of Taumata Arowai, the Water Services Regulator, and Drinking Water Assessors are.

Element of Competence:	Te Mana o te Wai
Context	Te Mana o Te Wai refers to the integrated and holistic wellbeing of a freshwater body. Each community decides what Te Mana o te Wai means to them, based on their own unique relationship with water in their area or rohe. Te Mana o te Wai is upheld by acknowledging the mana and mauri of the freshwater body which provides the source of water for the water treatment plant. The National Policy Statement for Freshwater Management (Freshwater NPS) recognises Te Mana o te Wai as an integral part of freshwater management.
Outcome	Protecting Te Mana o te Wai provides for the mauri of the water. This includes providing for: ▪ Te hauora o te taiao (health of the environment), ▪ Te hauora o te wai (health of the waterbody) and, ▪ Te hauora o te tangata (the health of the people).

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Te Hauora o te Taiao – Drinking Water Treatment Operators help to protect the health of the environment by ensuring that the conditions of any resource consent relating to the discharge of contaminants from the site are adhered to.
- Te Hauora o te Wai – Drinking Water Treatment Operators help to protect the health of the waterbody by ensuring the conditions of the resource consent to take water from the source are adhered to. This also aligns with the Principle of Safe Drinking Water that identifies that protecting the water source is of paramount importance.
- Te Hauora o te Tangata – Drinking Water Treatment Operators protect the health of the people by operating the Water Treatment Plant in a manner that reflects the Implementing the Water Safety Plan for the supply.

To do this, Drinking Water Treatment Operators ***need to know***

- What te Mana o te Wai means to their community. Under the Freshwater NPS it is up to the community and each Regional Council to consider and recognise Te Mana o te Wai in their regions.
- The conditions of all resource consents related to the operation of the Water Treatment Plant.
- The Water Safety Plan for the supply.

Element of Competence:	Critical Control Points
Context	A Critical Control Point (CCP) is a measure that can be operated as a process control for a water quality hazard. They are particularly important for managing microbiological hazards and being able to supply a sufficient quantity of water. CCPs help to ensure the safety of drinking water from the source to the tap. A few of the parameters monitored by Water Treatment Operators will have been identified as CCPs within the Implementing the Water Safety Plan.
Outcome	CCPs are monitored regularly (ideally continuously) to ensure that barriers are effective. Appropriate actions to optimise the system, or to bring the system back into control, are undertaken when action limits are reached. Incident and emergency plans are activated when critical limits for individual parameters are reached.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Undertake operational monitoring and inspections of the Critical Control Points.
- Undertake corrective actions when routine monitoring and inspections indicate that a CCP is deviating from its expected performance and is reaching its action limit. This may include:
  - adjustments or process control changes,
  - communicating and notifying others of the issue,
  - additional monitoring and inspection to confirm that the corrective action has been effective.
- Activate incident and emergency response procedures when critical limits for a CCP is reached or because the corrective action at the trigger level has not improved the performance of the CCP.
- Have input into a review into the underlying cause of why the corrective action, or incident and emergency response procedures, were needed. This includes identifying:
  - how effective the monitoring and inspection plan was,
  - how effective the corrective action was,
  - whether the Implementing the Water Safety Plan needs to be updated as a result.

To do this, Drinking Water Treatment Operators ***need to know***

- What the Critical Control Points for the water supply are. CCPs are documented within the Implementing the Water Safety Plan for each drinking water supply. For each of the Critical Control Points this will include:
  - Process control summary.
  - A monitoring procedure for each control point

- Defined target, action and critical limits
- Predefined corrective actions.

- The defined values documented in the CCP for target, action and critical limits.
- The corrective actions listed in the Implementing the Water Safety Plan which are considered to be necessary when the control limit is reached
- The corrective actions, that are listed in the Implementing the Water Safety Plan. Where the Implementing the Water Safety Plan only lists the corrective actions, the Water Treatment Operator needs to know where to find the actual documented procedure, e.g. in the Operations and Maintenance Manual for the Water Treatment Plant.
- The health-based targets, or maximum acceptable values (MAV), for any parameter being monitored. The CCP trigger and critical limits should always ensure that alarms and corrective actions are undertaken before MAVs are reached to ensure that the supply of non-compliant water is prevented.

Element of Competence:	Operational Monitoring and Inspection for Process Control
Context	Controlling the processes at a Water Treatment Plant is an important part of ensuring the safety of drinking water. The operational monitoring and inspection requirements for each Water Treatment supply is documented within the Implementing the Water Safety Plan (WSP). Water Treatment Operators undertake the operational monitoring and inspection of processes. They also instigate appropriate corrective actions to resolve potential problems before they escalate. This type of monitoring is additional to the Verification Monitoring programme required to comply with the Drinking-water Standards for New Zealand.
Outcome	Water Treatment process are operating correctly and optimally. Appropriate actions to optimise the system, or to bring the system back into control, are undertaken when action limits for individual parameters is reached.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Obtain, review and interpret trends on SCADA and telemetry systems.
- Identify target and action limits which identify when intervention may be required.
- Carry out key calibration or instrument checks of equipment using the results to identify issues with performance.
- Assess the condition of the instrument and any supply tubing. Cleaning may be required if a sensor is coated in chemical deposits.
- Identify whether equipment has deteriorated and whether it is no longer operating in accordance with its design.
- Take representative samples of water from key points within the treatment process, safely using appropriate sampling equipment
- Carry out bench top analysis of samples for process performance monitoring, record and interpret the results.
- Review and analyse the performance of the water process by using laboratory, site and network quality reports.

To do this, Drinking Water Treatment Operators ***need to know***

- The monitoring and inspection plans documented within the Implementing the Water Safety Plan for the drinking water supply system including knowledge of:
  - The parameters to monitor / inspect
  - The purpose of each parameter

  - The method of monitoring including instrument used, location, timing, frequency, by whom, and what needs to be recorded
  - What actions to take in response to monitoring / inspection results
  - Procedures for reporting anomalies
  - The equipment that provides the process.
- The instruments used to monitor variables in the water treatment process and the basic scientific principles of these key analytical instruments. Chapter 17 of the Guidelines for Drinking-water Quality Management for New Zealand identifies common instruments used to monitor the operation of Water Treatment Plants.
- The care and maintenance of monitoring equipment including instrument condition assessments and calibration records.
- The need for accurate and precise recording and reporting of process performance, in line with the Implementing the Water Safety Plan requirements.
- Which of the parameters being monitored are Critical Control Points (CCPs).

Element of Competence:	Apply a knowledge of Science to Water Treatment Processes
Context	Water Treatment processes may include physical, biological and chemical methods. The science that underpins the water treatment processes must be understood by those responsible for operating them.
Outcome	Decisions made in the day-to-day operations and maintenance of the Water Treatment Plant are made through an understanding of the scientific principles on which the treatment process is based

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Perform mathematical calculations used in the water industry, for example to calculate:
  - volumes,
  - levels,
  - flow rates; and
  - chemical concentrations
- Use their understanding of chemistry to operate and control chemical methods of water treatment.
- Use their understanding of physics to operate and control the hydraulics at the Water Treatment Plant and any physical methods of treatment.
- Use their understanding of microbiology to reduce the risk of contamination.
- Select and use appropriate equipment to measure performance of different parameters.
- Take water samples to monitor for the presence of indicator micro-organisms.

To do this, Drinking Water Treatment Operators ***need to know***

- The basic principles of physics which impact on water treatment including understanding hydraulics, pressure and head, water hammer, surges and head loss.
- The basic principles of how physical treatment of water works including the use of membranes, filtration, sedimentation and clarification.
- The chemistry of drinking water supplies and chemicals of public health significance that may be found in drinking water supplies, and the water treatment processes used to reduce chemical risks
- The basic principles of how chemical treatment of water works including activated carbon, coagulation and flocculation processes, fluoridation, ion exchange and softening processes, pH and adjustment, chlorine demand, free available chlorine, disinfection by-products, and plumbosolvency.
- The risks involved with chemical treatment including what will happen if chemicals are mixed inappropriately, and the impact of decomposition related to the storage of water treatment chemicals.

- The microbiology of drinking water and the relationship between drinking water and public health. Operators need to understand the characteristics of microbiological risks such as bacteria, viruses, protozoa, cyanobacteria and cyanotoxins, how these microbiological risks are detected and what treatment processes are used to reduce microbiological risks to the drinking water supply.

Element of Competence:	Technical Standards Related to Water Treatment
Context	There is a wide range of technical standards available that can be used to help operate and maintain a Water Treatment Plant.
Outcome	Water Treatment Plants are operated and maintained following best practice that has been documented within Technical Standards and Guidelines.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the appropriate technical standards that relate to the operation and maintenance of the Water Treatment Plant. This might include a mix of:
  - Internal standards developed by the Water Supplier
  - The Drinking Water standards, guidelines and publications produced by the Ministry of Health relating to drinking water.
  - Technical documents, guidelines and publications developed by industry groups like Water New Zealand.
  - New Zealand Standards and Guidelines published by NZ Standards, or by government organisations like Worksafe.
  - International standards and guidelines e.g. those published by International Organisation for Standardization (ISO) or the American Water Works Association (AWWA).

To do this, Drinking Water Treatment Operators ***need to know***

- Which technical standards relate to the work that they are responsible for. These should be identified on applicable operational and maintenance procedure documentation.
- Where to find the technical standards, e.g. through a subscription to NZ Standards.

Element of Competence:	Safe Isolation of Plant and Equipment
Context	In order to undertake maintenance on plant and equipment Water Treatment Operators need to be able to safely isolate and "lock out" the equipment that they are to work on. This would usually form part of a Permit-to-work system.
Outcome	Plant and equipment are safely isolated before undertaking any maintenance in a manner that: ▪ Avoids the possibility of injury to workers ▪ Maintains the safety of water being supplied to the community

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Identify the equipment that is to be worked on, including the point of isolation. There are occasions where this is not clear, e.g. a switchboard may not isolate all equipment in the vicinity, and some plant, e.g. actuators, may require isolating elsewhere.
- Identify the hazards that might need to be controlled in order to isolate the plant or equipment. This might include hazards from the likes of:
  - Confined Spaces
  - Falling from heights
  - Mechanical equipment with moving parts
  - Electricity
  - Pressure
  - Chemical hazards
- Identify any other areas of the plant that might be affected by the isolation. The Water Treatment Operator must be able to clearly understand and communicate the effects of the isolation.
- Be able to select and use the correct equipment to safely isolate the plant to be worked on e.g. valves, isolating locks and tags, locking pins etc
- Safely remove any hazardous substances from the system by draining, venting, purging or flushing.
- Follow approved procedures to confirm that the isolation has been successful to ensure that the isolated equipment is safe to work on.
- Undertake the safe removal of isolation equipment to return the plant into service.

To do this, Drinking Water Treatment Operators ***need to know***

- The permit-to-work system in use
- The procedures for installing isolations including:
  - Electrical isolation and tagging/locking out.
  - Proving electrical equipment is dead to ensure the correct piece of equipment has been isolated.
  - Immobilisation techniques such as valves, chains, locking pin etc.
  - Bleeding off pressure, isolating and bypassing process equipment.
  - Cooling requirements, e.g. the time electric motors take to cool.

  - Neutralisation of chemicals (e.g. chlorine and caustic soda).
- How to adequately identify, test and confirm that the isolation has made the plant or equipment safe.
- The procedures for draining, venting, purging and flushing.
- The procedures for removing isolations and returning plant and equipment.
- The risks associated with isolating a piece of plant or equipment and how to minimise the impacts associated with these and as documented within the Implementing the Water Safety Plan.
- Communication, reporting and record keeping requirements associated with isolating a piece of plant and equipment. This includes ensuring the work meets the requirements of the Health and Safety at Work Act.

Element of Competence:	Drinking Water Hygiene Requirements
Context	Water Treatment Operators need to understand potential sources of contamination and the steps that they are required to take to ensure that the water supply does not become contaminated.
Outcome	Contamination of the water supply is prevented by requiring hygienic work practices for workers and materials that come into contact with water.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Prevent the pollution or contamination of drinking water by following hygiene procedures.
- Disinfect tools, equipment, fittings and materials used in maintenance with chlorine and correctly dispose of the chlorine solution.
- Keep Personal Protective Equipment (PPE) and boots clean.
- Keep all fittings carried in vehicles or stored at site boxed, capped or sealed with plastic wrapping. These items should not be uncovered until immediately before use.
- Have current inoculations and pass health screening requirements for waterborne illnesses.
- Follow the Incident and Emergency Response Plan associated with the water treatment plant after any contamination incidents.

To do this, Drinking Water Treatment Operators ***need to know:***

- How to identify potential sources of contamination.
- The importance of personal hygiene.
- About the potential for contamination from workers Personal Protective Equipment (PPE) and the need for clean equipment and boots.
- Chlorine/disinfection procedures, both for the water itself and other hygiene purposes i.e. how chlorine is used to wash boots, clean tools and in repairs, and the correct disposal of chlorine solution.
- The risks of multi-functional working between water and wastewater assets, including the need to have separate tools and equipment for water and wastewater works. Separate vehicles must be used for water and wastewater maintenance works. Water Treatment Operators must be mindful of where their vehicle has been e.g. wastewater treatment plants.
- The potential for, and implications of, contamination of the water supply from items such as fuel and chemical contamination. What Treatment Operators need to know what procedures to follow after a contamination incident.
- The potential for, and implications of, contamination of the water supply from waterborne microorganisms.
- Sampling and audit processes for the work that they are undertaking.
- That the Water New Zealand Good Practice Guide – Hygiene Practices to Prevent Water Supply Contamination provides best practice guidance.

Element of Competence:	Maintenance and Repairs of Water Treatment Equipment
Context	The equipment used at the Water Treatment Plant needs to be maintained so that it continues to work efficiently and reliably. Not maintaining, or replacing, assets at the right time might result in an unexpected failure, which could mean the community isn't being supplied with safe drinking water. Maintenance can either be planned (routine or scheduled) or unplanned (reactive).
Outcome	Maintenance of the equipment at the Water Treatment Plant is safely completed, at the correct frequency, in accordance with the Maintenance procedures that are identified in the Implementing the Water Safety Plan for the work in question. Maintenance tasks and costs are recorded so that better decisions can be made about maintaining each item and identifying when they need to be replaced

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Respond to water treatment plant maintenance / repair emergencies.
- Perform planned and unplanned maintenance on the equipment at the Water Treatment Plant in accordance with job instructions detailed in operations and maintenance procedures that are identified in the Implementing the Water Safety Plan. This will require Drinking Water Treatment Operators to:
  - Complete the instructions/organisational procedures for the maintenance task in question e.g. as recorded in maintenance procedures.
  - Identify any environmental, safety and water quality hazards and how they are to be mitigated. Obtain a permit to work, where this is required for the procedure.
  - Identify any distribution network impacts on the work and inform the appropriate people e.g. if there is to be a supply interruption.
  - Safely isolate the plant and equipment
  - Ensure materials, pipes and fittings are clear of any contaminants before installing.
  - Sterilise fittings and repair materials.
  - Check that the completed maintenance and repairs meets the specification detailed in the maintenance procedure before returning the equipment to service.
  - Document what work has been undertaken, including identifying any costs (including time) and spare parts used.

To do this, Drinking Water Treatment Operators ***need to know***

- The required planned, scheduled and reactive maintenance tasks and procedures for each piece of equipment used at the Water Treatment Plant.
- How the equipment typically operates. Drinking Water Treatment Operators need to observe the equipment while it is in use so that they can recognize unusual sounds, vibrations or leaks that indicate that reactive maintenance is necessary.
- What maintenance frequency is required for each task. This will be based on the suggestions of the equipment manufacturer but may also be a factor of the reliability and criticality of the equipment.
- How to identify any environmental, safety and water quality hazards, and appropriate mitigation methods.
- How to safely shut down and isolate equipment before performing maintenance.
- The hygiene requirements and procedures.
- The requirements for documenting what work has been completed.
- The maintenance and asset replacement strategies for the Water Treatment assets that are recorded in the Asset Management Plan, so that Operators are aware of what should be maintained and what should be replaced.
- That differentiating between planned and unplanned maintenance is important because an increasing incidence of unplanned maintenance might indicate that the assets at the treatment plant are deteriorating and becoming unreliable.
- That routine (planned) maintenance comprises the periodic inspections and tests performed on equipment at regular intervals. Included are daily, weekly, monthly, quarterly etc., inspections during which minor routine maintenance tasks are carried out, e.g. cleaning, lubrication, vibration tests, adjustments replacements and calibrations.
- That scheduled (planned) maintenance is also carried out on a time basis but is based on wear and the expected life cycle of the equipment's individual components. It involves the systematic and periodic removal from service of a piece of equipment for the replacement of parts, reconditioning or overhaul
- That reactive (unplanned) maintenance amounts to repairing equipment that has broken down or abandoning it and replacing it with new equipment.

Element of Competence:	Validation and Calibration of Monitoring Equipment
Context	Water Treatment processes must be monitored to ensure that barriers against contamination are sustained. The instruments used to monitor the water treatment processes must be validated and calibrated to ensure that the water supply system remains functional and all preventive measures are effective in managing identified risks to water quality.
Outcome	The instruments used to monitor the water treatment processes are validated and calibrated to ensure that the water supply system remains functional and all preventive measures are effective in managing identified risks to water quality.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Carry out key calibration or instrument checks of online equipment and identify issues with their performance.
- Understand the operation of control systems and how to operate each instrument in various control states.
- Carry out the practice of maintaining online instruments in line with supplier recommendations, standard operating procedures and record keeping as detailed in the Implementing the Water Safety Plan for the Water Treatment Plant.
- Review and analyse the performance of the water instruments by reviewing site and telemetry data to ensure the results are correct and accurate.

To do this, Drinking Water Treatment Operators ***need to know***

- The validation and calibration procedures documented within the Implementing the Water Safety Plan for the supply.
- What the critical control points for the Water Treatment Plant are.
- The correct type and use of various analytical equipment for water quality measurement, including the levels at which the instruments operate, and their limitations are understood e.g. the accuracy and sensitivity of the equipment.
- The requirement and need for online monitoring of water processes, including the key performance criteria for the water treatment works.
- The use and care of online equipment, including record keeping.
- The equipment required to maintain the instrument and its use.
- The calibration of the instruments including understanding the expected results.
- Communications, reporting and record keeping requirements, associated with maintenance of monitoring equipment. These will be detailed in the Implementing the Water Safety Plan.

- Monitoring, the identification of instrument performance, including troubleshooting, such as flat lining.
- The need for accurate and precise analysis and risks associated with incomplete or inaccurate analysis or results.
- Contingency plans associated with the water treatment works when monitoring equipment is unavailable or incorrect.
- The requirements for validation and monitoring in the New Zealand Drinking Water Standards.
- The Guidelines for Drinking-water Quality Management for New Zealand particularly for online water quality reporting, and control systems.

Element of Competence:	Inventory Management
Context	Water treatment systems can fail if there are no spare parts available to undertake required maintenance or repair of equipment used in the process. Holding spare parts for items that fail frequently has the benefit of allowing repairs to be undertaken immediately, instead of time being spent going to the market to search for the appropriate part. Water Treatment plants also require sufficient levels of chemicals (consumables) to be available for treatment processes. These need to be delivered to the site at the right time, and consumed on a "first in, first out" basis.
Outcome	The spare parts required to maintain, and repair equipment is known, along with where to source these parts. The quantity of parts stock held in storage is monitored, with replacement stock ordered in time. The quantity and quality of chemicals used on site is monitored, with chemicals used before they degrade in quality. Both chemicals and spare parts are used on a "first in, first out" basis.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Proactively identify what spare parts are needed to maintain and repair equipment.
- Monitor the level of parts that are held in stock.
- Identify which parts are to be used first (i.e. the oldest)
- Proactively order adequate quantities of parts and consumables from the supplier, in accordance with the Procurement policies of the water supplier.
- Follow the Water New Zealand Good Practice guides when ordering chemical supplies, paying regard to the chemical specification, quality control, and certification requirements. Drinking Water Operators need to be able to reject any chemicals supplied which do not meet the specified standard.

To do this, Drinking Water Treatment Operators ***need to know***

- What spares are held in storage at the Water Treatment Plant.
- How to store parts correctly.
- That spares should be used on a "first in, first out" basis.
- What supplier provides spare parts and how to follow the organisations procurement procedures to obtain them.
- That standardisation of equipment and parts reduces the level of risk of equipment failure, because fewer types of each part need to be stocked which makes stock management easier and because it reduces the number of skills which need to be learnt to correctly install each part by the operators

- The correct specification of the chemicals they need to order and the quality control, testing, certification requirements that they need to meet in accordance with the following:
  - Water New Zealand Good Practice Guide for the supply of polyelectrolytes for use in drinking-water treatment. [2]
  - Water New Zealand Good Practice Guide for the supply of chlorine for use in drinking-water treatment. [3]
  - Water New Zealand Good Practice Guide for the supply of hydrated lime for use in drinking-water treatment. [4]
  - Water New Zealand Good Practice Guide for the supply of aluminium sulphate for use in drinking-water treatment. [5]
  - Water New Zealand Good Practice Guide for the supply of fluoride for use in drinking-water treatment. [6]
  - Water New Zealand Good Practice Guide for the supply of polyaluminium chloride for use in drinking-water treatment. [7]

Element of Competence:	Cranes and Lifting Equipment
Context	Cranes are often installed at Water Treatment Plants to lift heavy equipment. Unsafe use of crane equipment presents significant risk potential for people and property. Crane collapse or falling loads can cause serious injuries, fatalities as well as damage to property on and off site. The controller of the crane is responsible for the safe testing, operation, inspection, repair and maintenance of that crane.
Outcome	Cranes are operated within their loading limits and are maintained in a safe condition with a current certificate of inspection.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Understand and comply with the written instructions relating to the safe operation of the crane.
- Calculate the load to be lifted and confirm that this is within the safe loading limit of the crane.
- Use, and understand, hand signals for the operation of the crane.
- Exercise the required level of care when operating the crane, including wearing the correct Personal Protective Equipment (PPE).
- Notify the controller of any unsafe equipment or process as soon as practicable.
- Readily locate all documentation and information related to the crane.
- Engage an Inspector to certify that the crane is safe.

To do this, Drinking Water Treatment Operators ***need to know***

- That they cannot operate the crane until they have been trained in its safe use.
- That the crane cannot be used unless it has a certification of inspection.
- The design loading limits of the crane.
- That the Approved Code of Practice for Cranes [8] covers the operation, maintenance and inspection requirements of any cranes located at the Water Treatment Plant.
- That a general guide to the health and safety in employment (pressure equipment, cranes and passenger ropeways) Regulations 1999 provides guidance on regulations around the duties of equipment controllers, designers, manufacturers and suppliers, as well as workers.

Element of Competence:	Maintaining Specified Building Systems
Context	Under the Building Act [9], buildings that contain safety and essential systems, known as specified system, need a compliance schedule. Water Treatment Plants often include buildings which require a compliance schedule. This means that they require an ongoing inspection and maintenance to ensure that the specified systems function as required.
Outcome	The buildings warrant of fitness (BWoF) is renewed every 12 months, and is signed, issued and publicly displayed to prove the building's specified systems have been maintained and inspected.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Obtain a compliance schedule where one is required under the Building Act [9].
- Publicly display a compliance schedule statement in their building for the first 12-month period from the issue of the compliance schedule.
- Ensure all the inspection, maintenance and reporting procedures for the specified systems stated in the compliance schedule for their building have been carried out and that those systems are performing, and will continue to perform, to the performance standards.
- Engage an Independent Qualified Person (IQP) to undertake the inspection, maintenance and reporting procedures listed on the compliance schedule and obtain a Certificate of Compliance with Inspection, Maintenance and Reporting Procedures (Form 12A).
- Provide the BWoF annually to the building team of the council (ensuring the Form 12A certificates from the IQP(s) are attached) and publicly display a copy of this for the next 12 months.
- Obtain and keep reports detailing inspections, maintenance and repairs from the people who have carried out the work. These need to be kept with the compliance schedule for at least two years after they have been issued.

To do this, Drinking Water Treatment Operators ***need to know***

- That the Ministry of Building, Innovation and Employment has published a Compliance Schedule Handbook to provide guidance on the requirements of Compliance Schedules and Building Warrants of Fitness.

Element of Competence:	Root Cause Analysis
Context	When something goes wrong at the Water Treatment Plant, Water Treatment Operators help to answer the question of why the problem occurred in the first place by helping to: ▪ Determine what happened ▪ Determine why it happened ▪ Figure out what to do to reduce the likelihood that it will happen again.
Outcome	The root cause of a problem is identified, and steps are put in place to prevent it happening again.

To do this, Drinking Water Treatment Operators *need to be able to*:

Be involved, with others where appropriate, in the Root Cause Analysis processes. This involves helping to:

- Define the problem:
  - what is happening?
  - what are the specific symptoms?
- Collect data:
  - how long has it been happening?
  - what is the impact of the problem?
- Identify possible causal factors:
  - what sequence of events led to the problem?
  - what conditions allows it to occur?
- Identify the Root Cause:
  - Why does the causal factor exist?
  - What is the real reason the problem occurred?
- Recommend and Implement Solutions
  - What can you do to prevent this happening again?
  - How do we implement the solution?
  - Who will be responsible for this?
  - What are the risks of implementing the solution?
- Update the Development of Water Safety Plans

To do this, Drinking Water Treatment Operators *need to know*

The basic cause of the problem (there can be more than one). Usually either a:

1. Physical cause – a physical item failed in some way (for example a dose pump stopped working).
2. Human cause – somebody did something wrong or did not do something that was needed. Human causes typically lead to physical causes (for example nobody filled a dose tank, which led to the pump failing).

3. Organisational cause - a system, process, or policy that people use to make decisions or do their work is faulty (for example, no one person was responsible for maintaining the dose tank, and everyone assumed someone else had done this).

Element of Competence:	Water Demand and Hydraulics
Context	An understanding of current and forecast demand for water along with an understanding of hydraulics and design flows is needed by Water Treatment Operators.
Outcome	The Water Treatment Plant operates in accordance to its design and can supply sufficient water.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Monitor the flow through the Water Treatment Plant and use knowledge of daily and seasonal demand variations to forecast what the future demand for water will be.
- Perform calculations to determine changing chemical requirements in response to changes in plant flow.
- Perform simple calculations using process flow to calculate residence times and velocities within filters.
- Calculate chlorine contact time within the treatment process, demonstrating an awareness of the effect of flow and contact tank design on the disinfection process
- Review and analyse the performance of flow instruments.
- Carry out procedures for maintaining flow instruments in line with supplier recommendations, operational procedures including paperwork and records keeping requirements

To do this, Drinking Water Treatment Operators ***need to know***

- Hydraulic principles and understanding of how flow and hydraulic conditions can influence the water treatment plant throughput and quality.
- Flow calculations and understand their significance for the treatment process.
- The requirements of flow monitoring and reporting requirements to meet Resource Consent conditions.
- The monitoring of hydraulic loading and control limitations.
- The effects of the measurements on control systems such as dosing control.
- The effect of flow or hydraulic changes on key process streams or equipment and the significance of these for water quality and plant performance.
- The significance of design capacity of processes for plant performance.
- Understand flow pacing and the effects this has on chemical dosing or pump operation.
- Key flow control systems and operation of these in automatic or manual.
- The risks associated with incomplete or inaccurate flow measurement.

- Contingency plans associated with the water treatment plant when monitoring equipment is unavailable or incorrect.

Element of Competence:	Use Automated Systems to control the Process Plant and Collect Data
Context	Remote automation systems, such as SCADA (Supervisory, Control and Data Acquisition) systems are used to monitor and control processes at Water Treatment Plants.
Outcome	The Water Treatment Plant is controlled using remote automation. Data collected by the SCADA system is analysed and used to comply with the Drinking-water Standards of New Zealand.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Use the SCADA system, including:
  - Logging into and navigating around the SCADA system
  - Adjusting control set points and alarm levels for the different types of equipment used to control process operations.
  - Interpreting alarms
  - Accepting, or overriding, alarms
  - Viewing and understanding trend data and reporting any unusual trends
  - Setting up ad-hoc records
  - Interpreting mimic pages
  - Undertaking basic maintenance of the SCADA system i.e. shutting down and restarting nodes
- Interrogate the SCADA system to:
  - Identify and control items of mechanical, electrical and instrumentation equipment.
  - Evaluate trend data differentiating normal operational cycles from developing fault conditions or emerging risks

To do this, Drinking Water Treatment Operators ***need to know***

- The control philosophy for the Water Treatment Plant.
- What SCADA systems are, and what functions they are used for, at Water Treatment Plants.
- How data acquisition is done from Remote Terminal Units (RTUs) or Programmable Logic Controllers (PLCs) which connect to sensors in the process and convert sensor signals to digital data, and which is then compiled and formatted so that Drinking Water Operators can make supervisory decisions to adjust or override normal automatic controls.
- What the limitations of the SCADA system are, including an understanding of how the frequency of signals impacts the data.
- What to do if the SCADA system fails.
- The different types of equipment for process control and compliance monitoring.
- How the radio/telemetry system at the plant works.

Element of Competence:	Operate the Source Water Abstraction Process
Context	Source water abstraction can be affected by the quantity and quality of the available water source.
Outcome	Sufficient water is abstracted to supply the community. Raw water quality is monitored to determine when quality is approaching the limits of the water treatment plant capabilities. Raw water quality indicators are monitored to determine when additional treatment processes (e.g. pre-oxidation, algicide application) are necessary. Abstraction rates are controlled to take account of varying water quality and quantity, whilst considering the water take resource consent, the Implementing the Water Safety Plan and energy efficiency.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures and first line Maintenance tasks that are identified in the Implementing the Water Safety Plan for the source water abstraction process.
- Select the source or blend of sources that will give optimum raw water quality for the treatment works.
- Monitor and control the operation of all assets associated with the raw water source or sources for the treatment works.
- Control water abstraction at rates that meet the quality and quantity requirements for water treatment and the conditions of the Water Take Consent and the Implementing the Water Safety Plan .
- Identify risks to treatment processes arising from raw water abstraction, such as weather events or local conditions.
- Manage water abstraction to balance energy efficiency targets.
- Maintain and repair source water abstraction assets.

To do this, Drinking Water Treatment Operators ***need to know***

- The factors that influence raw water quality and the risks identified in Implementing the Water Safety Plan and the risks to Water Treatment processes from changes in raw water quality.
- The importance of catchment management and source protection.
- The objectives of abstraction processes and consequences of sub-optimal performance.
- How to interrogate the SCADA system to identify:
  a) Normal trends or cycles for the works, and
  b) Atypical trends or changes and the underlying or root causes for the change.

- How to identify the root cause of raw water abstraction problems and the sequence of actions required to restore the process to steady-state conditions, taking account of all process variables and knock-on effects.
- The types and qualities of raw water available to the water treatment plant.
- The strategies utilized to manage raw water quality and maximize yields from the sources available.
- How water abstraction is regulated and consented with water take consents, implications of infringements and the role of the consenting authority.
- The design specification for the treatment processes in relation to raw water quality.
- The range, operation and maintenance of mechanical, electrical and instrumentation equipment utilized in raw water abstraction.
- Alarms, action levels, authorization levels and consequences associated with the process of raw water abstraction.
- How to confirm the configuration, operation and performance of the raw water abstraction equipment corresponds to the information shown in SCADA.
- Key process parameters and variables associated with raw water abstraction.
- That excessive starting and stopping of pumps should be avoided as this shortens the equipment's life and consumes more energy.
- Reactive and preventative Maintenance procedures and frequencies.

Element of Competence:	Operate Pre-treatment Processes
Context	Pre-treatment of water is used to reduce, and/or to stabilise variations in the microbial, natural organic matter and particulate load. It can also be used to control algae in the raw water. Pre-treatment of surface water includes processes such as bankside filtration, infiltration galleries, pre-sedimentation, off-river storage, roughing filters, screens and micro-strainers.
Outcome	Pre-treatment processes at the Water Treatment Plant are controlled and optimized based on test results and analysis of trends. They are restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures and first line Maintenance and Repairs of Water Treatment Equipment that are identified in the Implementing the Water Safety Plan for to the pre-treatment processes.
- Identify all mechanical, electrical and instrumentation assets associated with the pre-treatment process on SCADA and at the Water Treatment Plant.
- Monitor and control the pre-treatment process.
- Calibrate equipment and instrumentation associated with the pre-treatment process.
- Optimize the pre-treatment process based on test results and trend data.
- Respond to alarms currently and instigate corrective actions to return the pre-treatment process to optimal conditions.
- Manage the safe disposal of any treatment residuals.

To do this, Drinking Water Treatment Operators ***need to know***

- The objectives of the pre-treatment processes and consequences of sub-optimal performance. Refer to Chapter 12 of the Guidelines for Drinking Water Quality Management for New Zealand.
- Key process parameters and variables associated with pretreatment, including the influence of variable water quality, pH, temperature, and the design limitations of the plant.
- How to interrogate the SCADA system to identify:
    a) Normal trends or cycles for the works, and
    b) Atypical trends or changes and the underlying or root causes for the change.
- The range of mechanical, electrical and instrumentation plant used to monitor and control the pre-treatment process and their calibration requirements.

- Alarms, action levels, authorization levels and consequences associated with the process or processes
- The safe storage, handling and use of chemicals associated with pre-treatment including personal protective equipment (PPE) requirements.
- How to manage residuals from the water treatment process. Refer to the Management of Water Treatment Plant Residuals in New Zealand Handbook. [10]
- Reactive and preventative Maintenance procedures and frequencies.

Element of Competence:	Operate Coagulation and Clarification Processes
Context	The combined processes of coagulation and clarification followed by rapid granular media filtration is used to remove dissolved and colloidal colour (natural organic matter), turbidity (suspended solids), algae (phytoplankton), bacteria, viruses and protozoa (e.g., Giardia and Cryptosporidium) from drinking water. This treatment combination is often referred to as 'conventional treatment'.
Outcome	Coagulation processes at the Water Treatment Plant: ▪ Comply with the New Zealand Drinking Water Standards. ▪ Are controlled and optimized based on test results and analysis of trends.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures that are identified in the Implementing the Water Safety Plan.
- Identify all mechanical, electrical and instrumentation assets associated with coagulation and clarification processes on SCADA and at the Water Treatment Plant.
- Control the coagulation and clarification processes. Depending on the quality of the source water, pH adjustment and / or alkalinity adjustment prior to coagulant addition may be required.
- Calibrate, monitor and check coagulation and clarification performance.
- Evaluate trend data from SCADA and test results to identify:
- Normal trends or cycles for the works, and
- Atypical trends or changes and the underlying or root causes for the change
- Optimize the coagulation and clarification processes based on test results and trend data e.g. for filtrate turbidity.
- Instigate corrective action to return the disinfection process to compliant condition.
- Safely carry out operational and first line maintenance tasks relating to the coagulation and clarification processes.
- Manage the safe disposal of any treatment residuals.

To do this, Drinking Water Treatment Operators ***need to know***

- The objectives of the coagulation and clarification processes and consequences of sub-optimal performance. Refer to Chapter 13 of the Guidelines for Drinking Water Quality Management for New Zealand for coagulation guidance and Chapter 8 for the associated guidance on Protozoal compliance.

- Key process parameters and variables associated with coagulation and flocculation, including:
    a) the influence of variable water quality,
    b) chemical dose rates,
    c) mixing conditions,
    d) flocculation times,
    e) the selection of chemicals and their order of addition,
    f) pH,
    g) temperature,
    h) desludging and flow rates, and
    i) the design limitations of the plant.
- The procedures governing the utilization of returning wash water to the head of the plant and its impact or influence on the operation of the plant.
- Key compliance criterion from the New Zealand Drinking Water Standards relating to the coagulation and process including Maximum Acceptable Values (MAV).
- How to interrogate the SCADA system to identify:
    a) normal trends or cycles for the works, and
    b) atypical trends or changes and the underlying or root causes for the change.
- The types of coagulants and coagulant aids used and the factors that influence their selection, to include:
    a) use
    b) interaction
    c) sequence of addition
    d) cost
- The range of mechanical, electrical and instrumentation plant used to monitor and control the coagulation and clarification control processes and their calibration requirements.
- The range of plant used to store, mix and pump chemicals and the methods of operation available.
- The safe storage, handling and use of chemicals associated with coagulation and clarification including PPE requirements.
- Alarms, action levels, authorization levels and consequences associated with the process or processes.
- How the de-sludging process relates to the operation of the wash water recovery system.
- How to complete jar tests to specification and any limitations, including analysis of results.
- How to identify the root cause of coagulation and clarification process problems and the sequence of actions required to restore the process to compliant conditions, taking account of all process variables and process lag times. Chapter 13 of the Guidelines for Drinking Water Quality Management for New Zealand provides troubleshooting and optimization guidance for coagulation and clarification processes.
- Reactive and preventative Maintenance requirements and frequencies for the coagulation and clarification system.

- How to manage residuals from the water treatment process. Refer to the Management of Water Treatment Plant Residuals in New Zealand Handbook. [10]

Element of Competence:	Operate Filtration and Adsorption Processes
Context	Filtration methods such as rapid sand, diatomaceous earth filtration, slow sand filtration, membrane filtration, cartridge filtration and bag filtration are used to remove particles including *Cryptosporidium* oocysts Adsorption processes that do not need to follow coagulation processes can remove some of the chemical determinants with Maximum Acceptable Values (MAVs). Adsorption processes can also be used for taste and odour control or in the case of Activated Carbon as a means of adsorbing cyanotoxins from water
Outcome	Filtration and adsorption processes at the Water Treatment Plant: ▪ Comply with the New Zealand Drinking Water Standards. ▪ Are controlled and optimized based on test results and analysis of trends.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures and first line maintenance tasks that are identified in the Implementing the Water Safety Plan for filtration and adsorption processes
- Identify all mechanical, electrical and instrumentation assets associated with filtration and adsorption processes on SCADA and at the Water Treatment Plant.
- Calibrate, monitor and check Filtration and adsorption performance, completing associated calculations.
- Evaluate trend data from SCADA and test results to identify:
  - Normal trends or cycles for the works, and
  - Atypical trends or changes and the underlying or root causes for the change
- Optimize the filtration and adsorption processes based on test results and trend data e.g. for filtrate turbidity.
- Instigate corrective action to return the filtration and adsorption processes to compliant condition.
- Safely dispose of any treatment residuals.

To do this, Drinking Water Treatment Operators ***need to know***

- The objectives of the filtration and adsorption processes and consequences of sub-optimal performance. Refer to Chapter 14 of the Guidelines for Drinking Water Quality Management for New Zealand for filtration and adsorption guidance, chapter 8 of the Guidelines for Drinking Water Quality Management for New Zealand for protozoal compliance and Chapter 10 of the Guidelines for Drinking Water Quality Management for New Zealand for the associated guidance on Chemical compliance.

- Key process parameters and variables associated with filtration and absorption, including the influence of variable water quality, design limitations of the plant, operating cycles, filter washing and return to service.
- Types of media used and the factors that influence their selection, use and performance.
- Key compliance criterion from the New Zealand Drinking Water Standards relating to the filtration and absorption including Maximum Acceptable Values (MAV).
- How to interrogate the SCADA system to identify:
    c) Normal trends or cycles for the works, and
    d) Atypical trends or changes and the underlying or root causes for the change.
- The range of mechanical, electrical and instrumentation plant used to wash filters and the methods of operation available.
- How the filter wash cycle relates to the operation of the wash recovery system where this exists.
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of filtration and absorption process problems and the sequence of actions required to restore the process to compliant conditions, taking account of all process variables and process lag times. Chapter 14 of the Guidelines for Drinking Water Quality Management for New Zealand provides troubleshooting and optimization guidance for filtration and absorption processes.
- Reactive and preventative maintenance requirements and frequencies for the filtration and absorption systems
- How to manage residuals from the water treatment process. Refer to the Management of Water Treatment Plant Residuals in New Zealand Handbook. [10]

Element of Competence:	Operate Sludge Dewatering and Disposal Processes
Context	Sludge is a by-product of treating water. It is made up of both organic and inorganic materials and pathogens. Dewatering and disposal of solids and sludges can include: ▪ A thickening process to increase the solids percentage and to reduce its volume and make it easier to handle. ▪ Dewatering to reduce the moisture content and produce a solid mass. ▪ Storage of sludge until it can be safely disposed of, usually to landfill due to its chemical composition. ▪ Transportation of sludges for disposal.
Outcome	Sludge handling, storage, dewatering and transportation processes are maintained and operated in accordance with their design specification, to allow for safe disposal. The processes are: ▪ Monitored to identify abnormal operation ▪ Controlled to ensure contaminants are being reduced. ▪ Optimized on the basis of the analysis of trends ▪ Restored to normal operation through the identification of the root cause of any faults,

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures that are identified in the Implementing the Water Safety Plan for sludge dewatering and disposal.
- Identify all mechanical, electrical and instrumentation assets associated with sludge dewatering and disposal processes on SCADA and at the Water Treatment Plant.
- Identify and locate any chemical, storage, mixing and pumping equipment used in the sludge dewatering and disposal processes.
- Identify critical control points applicable to the sludge dewatering and disposal operations, control the sludge dewatering and disposal processes.
- Calibrate, monitor and check the sludge dewatering and disposal process performance, completing associated calculations.
- Evaluate trend data from SCADA and test results to identify:
  - Normal trends or cycles for the works, and
  - Atypical trends or changes and the underlying or root causes for the change
- Optimize the sludge dewatering processes based on test results and trend data to efficiently achieve the required parameters.
- Respond to alarms and instigate corrective action to return the sludge dewatering and disposal processes to compliant condition.

- Deal with spillages or pollution events in accordance with the incident and emergency plan for the site.
- Safely carry out operational and first line maintenance tasks relating to the sludge dewatering and disposal processes including the safe isolation of equipment when required.
- Identify the root cause of sludge dewatering and disposal problems.
- Record equipment condition and performance data to the appropriate people to assist in asset management decision making.
- Safely transfer dewatered solids for disposal at the landfill (or approved equivalent) paying attention to health and safety requirements.

To do this, Drinking Water Treatment Operators ***need to know***

- How to manage residuals from the water treatment process. Refer to the Management of Water Treatment Plant Residuals in New Zealand Handbook. [10]
- The objectives of the sludge dewatering and disposal process, including an understanding of the design considerations and consequences of sub-optimal performance.
- Key process parameters and variables associated with sludge dewatering and disposal, including the flow rate for liquor return.
- How to interrogate the SCADA system to:
    - Identify and control items of mechanical, electrical and instrumentation equipment
    - Normal trends or cycles for the works, and
    - Atypical trends or changes and the underlying or root causes for the change.
- The range of mechanical, electrical and instrumentation plant used to monitor and control sludge dewatering and disposal assets and their calibration requirements. This may include:
    - Centrifuges
    - Belt Presses
    - Picket-fence thickeners
    - Mono pumps
    - Plate Presses
- Where the sludge dewatering process is enhanced by the use of chemicals, the Water Treatment Operator would also need to know the types of chemicals used in the process, the reason why, and the factors that influence their selection, use and sequence of addition. How these potentially hazardous substances are to be safely stored, handled and managed.
- Factors that can affect the sludge quality and supernatant liquor quality including operational, mechanical, chemical and weather-related factors.
- The critical control points, alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of sludge dewatering and disposal process problems and the sequence of actions required to restore the process to compliant conditions, taking account of all process variables and process lag times.

- The operational and maintenance tasks for the sludge dewatering and disposal processes that will be outlined in the Implementing the Water Safety Plan. Including the reactive and preventive maintenance procedures and frequencies.
- The health and safety hazards associated with the sludge dewatering and disposal processes and how these should be mitigated.
- How to optimise the sludge dewatering and disposal processes to minimise downstream treatment problems, on the basis of process performance management, test results and analysis of trends.
- How to safely take the sludge dewatering and disposal equipment out of service.
- What procedures to follow in an emergency situation.

Element of Competence:	Operate Disinfection Processes
Context	Disinfection processes are used at Water Treatment Plants to remove, deactivate or kill pathogenic microorganisms. Disinfectants used can include: ▪ Ozone ▪ Chlorine dioxide ▪ Chlorine ▪ Chloramines ▪ UV
Outcome	Disinfection processes at the Water Treatment Plant: ▪ Comply with the New Zealand Drinking Water Standards. ▪ Are controlled and optimized based on test results and analysis of trends. ▪ Are restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures that are identified in the Implementing the Water Safety Plan.
- Identify all mechanical, electrical and instrumentation assets associated with the disinfection process on SCADA and at the Water Treatment Plant.
- Control the disinfection process.
- Calibrate, monitor and check disinfection performance, completing associated calculations, or utilizing look-up tables in DWSNZ.
- Evaluate trend data from SCADA and test results to identify:
- Normal trends or cycles for the works, and
- Atypical trends or changes and the underlying or root causes for the change
- Optimize the disinfection process based on test results and trend data.
- Instigate corrective action to return the disinfection process to compliant condition
- Safely carry out operational and first line maintenance tasks relating to the disinfection processes.

To do this, Drinking Water Treatment Operators ***need to know***

- The objectives of the disinfection processes and consequences of sub-optimal performance. Refer to Chapter 15 of the Guidelines for Drinking Water Quality Management for New Zealand.
- Key process parameters and variables associated with disinfection, including the influence of variable water quality, pH, temperature, disinfection by-product formation,

disinfectant residuals, contact time, FACe (Free Available Chlorine equivalent) and the design limitations of the plant.

- Key compliance criterion from the New Zealand Drinking Water Standards relating to the disinfection process including Maximum Acceptable Values (MAV).
- How to interrogate the information system to:
    a) Identify and control items of mechanical, electrical and instrumentation equipment.
    b) Evaluate trend data differentiating normal operational cycles from developing fault conditions.
    c) How to confirm the configuration, operation and performance of the actual disinfection plant corresponds to SCADA.
- The range of mechanical, electrical and instrumentation plant used to monitor and control the disinfection process and their calibration requirements
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- The safe storage, handling and use of chemicals associated with disinfection including PPE requirements.
- How to identify the root cause of disinfection process problems and the sequence of actions required to restore the process to compliant conditions, taking account of all process variables and process lag times
- Reactive and preventative Maintenance requirements and frequencies for the disinfection system

Element of Competence:	Operate Treatment Processes for Aesthetic Considerations
Context	Water supplies with aesthetic issues can be treated to improve the aesthetic qualities of the water. Common Aesthetic treatment processes include those for: ▪ pH adjustment ▪ Iron and Manganese Removal ▪ Softening ▪ Trace Organics Removal ▪ Taste and Odour improvement Note that aesthetic processes are not necessarily discrete e.g. activated carbon also removes cyanotoxins and coagulation can remove colour.
Outcome	Treatment for aesthetic concerns at the Water Treatment Plant: ▪ Satisfies the Guideline Values (GVs) within the New Zealand Drinking Water Standards. ▪ Is controlled and optimized based on test results and analysis of trends. ▪ Is restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures that are identified in the Implementing the Water Safety Plan
- Identify all mechanical, electrical and instrumentation assets associated with treatment processes put in place for aesthetic determinants on SCADA and at the Water Treatment Plant.
- Control the Aesthetic treatment processes.
- Calibrate, monitor and check the processes that provide aesthetic treatment performance, completing associated calculations.
- Evaluate trend data from SCADA and test results to identify:
- Normal trends or cycles for the works, and
- Atypical trends or changes and the underlying or root causes for the change
- Optimize the treatment processes based on test results and trend data.
- Respond to alarms and instigate corrective action to return the treatment processes to compliant condition.
- Safely carry out operational and first line maintenance tasks relating to the aesthetic treatment processes.
- Safely dispose of any treatment residuals.

To do this, Drinking Water Treatment Operators ***need to know***

- The objectives of the aesthetic treatment processes and consequences of sub-optimal performance. Refer to Chapter 18 of the Guidelines for Drinking Water Quality Management for New Zealand for guidelines on aesthetic considerations.
- Key process parameters and variables associated with the aesthetic treatment processes, including the influence of variable water quality and design limitations of the plant.
- The Guideline Values (GVs) from the New Zealand Drinking Water Standards relating to aesthetic determinants and how analysis is carried out to identify taste and odour problems.
- How to interrogate SCADA to:
    a) Identify and control items of mechanical, electrical and instrumentation equipment.
    b) Evaluate trend data differentiating normal operational cycles from developing fault conditions.
    c) How to confirm the configuration, operation and performance of the actual disinfection plant corresponds to the information system
- The range of mechanical, electrical and instrumentation plant used to treat for aesthetic considerations, their calibration requirements and the methods of operation available.
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of process problems and the sequence of actions required to restore the process to compliant conditions, taking account of all process variables and process lag times.
- Reactive and preventative Maintenance requirements and frequencies.
- How to manage residuals from the water treatment process. Refer to the Management of Water Treatment Plant Residuals in New Zealand Handbook. [10]

Element of Competence:	Operate Fluoridation Processes
Context	Fluoridation of drinking water supplies in New Zealand is undertaken to adjust the natural content of fluoride in the water supply to a level that helps protect against tooth decay and improves the health outcomes for the community.
Outcome	Fluoridation at the Water Treatment Plant: ▪ Maintains a fluoride content in the drinking supply in the range of 0.7 to 1.0 mg/L in accordance with the Drinking-water Standards for New Zealand. ▪ Is controlled and optimized based on test results and analysis of trends. ▪ Is restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures that are identified in the Water Safety Plan.
- Identify all mechanical, electrical and instrumentation assets associated with the fluoridation process on SCADA and at the Water Treatment Plant.
- Oversee the delivery of chemicals to site and ensure that they are correctly labelled and stored.
- Control the fluoridation process including checking correct dosing rate. Note that fluoride can be dosed as a powder.
- Calibrate, monitor and check the fluoridation processes and instrumentation including fluoride sensors.
- Complete calculations.to ensure that the fluoride has been prepared at the right concentration using the right chemical.
- Take samples of the treated water to manually check on the fluoride concentration in the treated water.
- Evaluate trend data from SCADA and test results to identify:
  - Normal trends or cycles for the works, and
  - Atypical trends or changes and the underlying or root causes for the change
- Optimise the treatment processes based on test results and trend data.
- Respond to alarms (e.g. for low / high fluoride levels) and instigate corrective action to return the treatment processes to compliant condition.
- Safely carry out operational and first line maintenance tasks relating to the Fluoridation treatment processes.

To do this, Drinking Water Treatment Operators ***need to know***

- That the Water New Zealand Code of Practice for the Fluoridation of Drinking-Water Supplies in New Zealand [11] specifies:
  - Optimum fluoride levels for drinking-water
  - Design of control limits for fluoridation plants
  - Minimum design and operation requirements for the safe and effective addition of fluoride chemicals to drinking-water supplies
  - Monitoring and reporting requirements for fluoridation
- Key process parameters and variables associated with the fluoridation process, including the influence of variable water quality and design limitations of the plant.
- The Maximum Acceptable Value (MAVs) from the New Zealand Drinking Water Standards relating to fluoride.
- How to interrogate SCADA to:
  d) Identify and control items of mechanical, electrical and instrumentation equipment.
  e) Evaluate trend data differentiating normal operational cycles from developing fault conditions.
  f) How to confirm the configuration, operation and performance of the actual disinfection plant corresponds to the information system
- The range of mechanical, electrical and instrumentation plant used in fluoridation, their calibration requirements and the methods of operation available.
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of problems and the sequence of actions required to restore the process to compliant conditions, taking account of all process variables and process lag times.
- Reactive and preventative Maintenance requirements and frequencies.

Element of Competence:	Operate Water Storage Assets
Context	Water storage assets are used to buffer demand between customers and the Water Treatment Plant
Outcome	Water storage assets are: ▪ Controlled to ensure an adequate supply of water ▪ Optimised to ensure that the volume of water meets efficiency and resilience targets based on the analysis of trends. ▪ Are restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures and first line maintenance tasks relating to the water storage asset that are identified in the Water Safety Plan.
- Identify all mechanical, electrical and instrumentation assets associated with the water storage asset on SCADA and on site,
- Monitor and check reservoir storage volumes, completing associated calculations e.g. to determine disinfection contact times, retention and turnover.
- Identify set-points (e.g. pump start and stop levels) applicable to the treated water storage assets
- Identify the range of alarms associated with the treated water storage points (e.g. low level, high level and hatch alarms)
- Control treated water storage assets to meet energy efficiency targets
- Evaluate trend data from SCADA and / or test results to identify:
  a) Normal trends or cycles for the works, and
  b) Atypical trends or changes and the underlying or root causes for the change
- Instigate corrective action to return the treated water storage points to normal operation, taking account of process lag time.

To do this, Drinking Water Treatment Operators ***need to know***

- The objective of the water storage operations and consequence of sub-optimal operation.
- Key process parameters and variables associated with the water storage asset, including the influence of variable water quality and design limitations of the set-up.
- The operating and maintenance cycles for the treated water storage asset including routine inspections.
- The operation and control of associated pumping regimes.
- Water quality and sampling requirements at the water storage asset.

- The need to maintain reservoir integrity and how this can be compromised, including inspection requirements following a seismic event.
- The consequences of sub-optimal treat storage water asset performance on the distribution network and customers.
- How to interrogate SCADA to:
  a) Identify and control items of mechanical, electrical and instrumentation equipment.
  b) Evaluate trend data differentiating normal operational cycles from developing fault conditions.
  c) How to confirm the configuration, operation and performance of the actual water storage asset corresponds to the information system.
- Security requirements for treated water storage assets.
- The range of instrumentation plant used to monitor and control the water storage asset and their calibration requirements.
- How levels and flows are controlled to maximize efficiency.
- Disinfection standards, operations and requirements for using Hypochlorite dosing.
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of problems and the sequence of actions required to restore water storage to optimal volumes, taking account of all demand and process lag times.
- Reactive and preventative Maintenance requirements and frequencies for the water storage asset, including safe entry procedures.

Element of Competence:	Operate Pumping Systems
Context	Pumps are used in several ways at a Water Treatment Plant, the main types in use include: ▪ Bore pumps, which draw water from underground sources and can be located either within the bore or above ground ▪ Process pumps which are used to dose chemicals and to pump water to monitoring equipment ▪ Transmission pumps which move water from the Water Treatment Plant into the supply system.
Outcome	Pumps are maintained and operated in ▪ Controlled to ensure an adequate supply of water ▪ Optimized to ensure that the volume of water meets efficiency and resilience targets based on the analysis of trends. ▪ Are restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures that are identified in the Water Safety Plan.
- Identify all mechanical, electrical and instrumentation assets associated with the pumps on SCADA and on site,
- Monitor and check flows and system pressures.
- Identify and adjust set-points (e.g. pump start and stop levels) applicable to the pumping operations
- Identify the range of alarms associated with the pumps
- Control pumping operations to meet energy efficiency targets
- Evaluate trend data from SCADA and / or test results to identify:
  a) Normal trends or cycles for the works, and
  b) Atypical trends or changes and the underlying or root causes for the change
- Inspect pump components and identify maintenance needs, as per the manufacturer's recommendations e.g. to repair leaks and replace corroded parts.
- Schedule preventive maintenance, particularly lubrication and replacement of seals, diaphragms, tubing etc as per manufacturers recommendation.
- Instigate corrective action to return the pumps to normal operation.
- Safely carry out operational and first line maintenance tasks relating to the pumping system.

To do this, Drinking Water Treatment Operators ***need to know***

- Principle and purpose of the pump operation, the types of pumps and their operational function.
- Key process parameters and variables associated with the pumps and design limitations of the set-up.
- The system hydraulics, including both the Water Treatment Plant and network layout
- The operating and maintenance cycles for the pumps including inspection requirements and how to safely isolate the pumps from both mechanical and electrical hazards.
- How to interrogate SCADA to:
  d) Identify and control items of mechanical, electrical and instrumentation equipment.
  e) Evaluate trend data differentiating normal operational cycles from developing fault conditions.
  f) How to confirm that the configuration, operation and performance of the actual pumping system assets corresponds to the information system.
- The range of instrumentation used to monitor and control the pumps and their calibration requirements.
- How pumps are controlled to maximize energy efficiency.
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of problems and the sequence of actions required to restore water storage to optimal volumes, taking account of all demand and process lag times.
- Reactive and preventive maintenance procedures and frequencies.

Element of Competence:	Operate Emergency Power Systems
Context	In the event of a loss of mains power an alternative power supply, such as an emergency generator and/or an uninterrupted power system (UPS) are used to allow the communities water treatment and supply to continue uninterrupted.
Outcome	The Water Treatment Plant continues to operate during a loss of mains supply power.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the operational procedures relating to the emergency power system that are identified in the Water Safety Plan.
- Identify the voltage, load and phase of all assets associated with the treatment plant.
- Ensure that the generator is regularly serviced by a qualified technician as specified by the supplier.
- Run the generator under full load for extended periods to test for any problems.
- Ensure that the UPS is regularly tested and serviced by a qualified technician as specified by the supplier.
- Arrange for fuel in storage tanks to be tested to ensure that it remains viable. Undertake fuel conditioning, or fuel replacement, on a regular basis to maintain the quality of the fuel in the tank.
- Implement the incident and emergency response plan for loss of power at the site, including informing their lines network provider of the loss of mains electricity supply.
- For sites which rely on portable emergency generators the drinking water operator needs to be able to select a generator which is suitable for the site and be able to safely transfer the load from the mains to the generator.
- Safely carry out operational and first line maintenance tasks relating to the emergency power system.

To do this, Drinking Water Treatment Operators ***need to know***

- The operating and maintenance cycles for the emergency power system components including inspection requirements.
- How much fuel is needed to operate the site, or the time period specified in the incident and emergency response plan and the on-site fuel capacity
- If there isn't a permanently installed generator the Drinking Water Operator needs to know what type of generator is needed and where this is to come from. The following variables will need to be known by the Drinking Water Operator in order to select an appropriate emergency generator:
  - Voltage – the generator must have the appropriate voltage to match the motors it will be powering

- Load - the Full Load Amps of all motors that are to be run off the generator needs to be known.
- Phase (rotation) - Phase is a requirement for a single or multiphase generator based on what the generator will be powering.
- The power rating and load factor of the genset.
- Where the load transfer switch is located.

- Reactive and preventive maintenance procedures and frequencies.

Element of Competence:	Water Treatment Plant Isolation / Shutdown / Re-commissioning of Process Streams
Context	Plant shutdown and the restarting processes can occur in planned, or unplanned, and emergency situations. Shutdowns and restarts might involve: ▪ A complete plant shutdown and purging of all process materials from equipment; or ▪ A short shutdown to allow minor work with retention of some or all of processes; or ▪ A short shutdown in response to a plant upset or trip.
Outcome	▪ Identify early warning signs that equipment/processes need attention. ▪ Identify the range of circumstances in which a treatment plant will shut down automatically, including the range of failsafe criteria, and critical control points. ▪ Identify the range of circumstances treatment plants may be shutdown manually. ▪ Identify the range of possible causes of a shutdown and be able to determine the most likely cause. ▪ Apply the procedures, including required communications, to manage treatment plant shutdowns and re-starts effectively, reducing the impacts as far as practicable.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Carry out the planning and actions required for the following types of shutdowns:
  a) An automatic plant shutdown
  b) A manual plant shutdown
  c) A controlled plant shutdown on discovery of process issues
- Shutdown the treatment plant in line with standard operating procedures
- Identify the work area to be accessed using documentation, systems and work instructions.
- Troubleshoot major components and their problems to identify the cause of an emergency shutdown.
- Re-start the treatment works in line with standard operating procedures, including:
  a) Reporting and recording
  b) Observing, sampling and testing
  c) Information systems and manual checks

To do this, Drinking Water Treatment Operators ***need to know***

- The correct methods of starting, stopping, operating and controlling each process including understanding the impact of plant shutdown on each treatment process and how to respond.

- The architecture of the process/production system including knowing the process control philosophy and process parameters and limits e.g. temperature, pressure, flow, ph.
- How to identify the cause of plant shutdown including relevant alarms and actions.
- Start-up procedures including standard operating procedures and local procedures
- The range of water quality sampling and testing required in the event of a plant shutdown and re-start.
- Communications, reporting and record keeping requirements associated with a plant shutdown. Including ensuring the response meets the requirements of the Drinking Water Standards of New Zealand.
- The risks associated with works shutdown and re-start and how to minimise the impacts associated with these and as documented within the Water Safety Plan.
- Contingency plans associated with the works shutdown.
- How to respond in the event of an emergency situation in the workplace environment e.g. following an Incident and Emergency Response Plan.

Element of Competence:	Incident and Emergency Response Plans
Context	Incidents or emergencies that might threaten the safety of the drinking water supply, can occur. Water Treatment Operators need to be able to provide input into the development of Incident and Emergency Response Plans and be able to implement the operational response to such incidents
Outcome	During incidents or emergencies Water Treatment Operators implement the operational response in accordance with the Incident and Emergency Response Plan.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Provide input into the development of the Incident and Emergency Response Plan.
- Implement the operational corrective actions, which may include process control adjustments or a plant isolation and shutdown to ensure that the supply of non-compliant water is prevented.
- Demonstrate that they have been trained in emergency situations.
- Test response plans prior to an emergency arising.
- Make use of "lessons learned" information by contributing to the implementation and continuous improvement of quality systems in the water industry.

To do this, Drinking Water Treatment Operators ***need to know***

- Where to find the documented Incident and Emergency Response Plan.
- What potential incidents and emergencies will require an operational response.
- The triggers for activating the incident and emergency response plan, for example when a critical control point level has been reached.
- Communications, reporting and record keeping requirements associated with emergencies, including ensuring the response meets the requirements of the Drinking Water Standards of New Zealand.
- What civil defense obligations they have during an emergency.

Element of Competence:	Assisting with the Process to Decommission, Dispose or Abandon Assets
Context	Drinking Water Treatment Operators are involved in the decommissioning and removal of a significant part of an operating plant from service. They also need to manage the ongoing risks from any assets which have been abandoned but remain in place.
Outcome	Assets are safely decommissioned and either disposed of, or if they remain in place the ongoing risk of these assets is understood and managed by the Drinking Water Operator.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Organise a risk assessment, prior to starting the decommissioning process, that is reflective of the scope and complexity of the decommissioning process. The risk assessment may need to include the following items to provide assurance that all hazards are identified, understood and eliminated:
  - An engineering assessment of the structural integrity of any associated building and structure carried out be a Chartered Structural Engineer.
  - A health and safety electrical assessment that identifies and marks out the power supply to, and the distribution of power in the work area, to identify the isolation requirements or protection of the supply to other areas of plant or equipment carried out by an Electrical Engineer or the plants Electrician.
  - A Health and Safety Fire Assessment if changes to fire protection systems might be required carried out by a Fire Engineer.
  - A Health and Safety Asbestos Assessment to establish if any asbestos is present and if so, how to deal with it
  - Undertake the decommissioning process and dispose of water treatment assets at the end of their life once the risks above have been eliminated.

To do this, Drinking Water Treatment Operators ***need to know***

- The Decontamination and Demolition of Plant and Assets Procedure outlined in the Guidelines for Occupational Health & Safety in the New Zealand Water Industry. [12]

Element of Competence:	Provide Data to assist in Asset Management Decision Making
Context	Data that is collected by Drinking Water Operators supports effective decision making at various levels within an organisation, including operation staff and management, senior leadership and elected officials or boards of directors. The operation of the drinking water system leads to the generation of large amounts of data that needs to be recorded. Efficient record keeping is an essential tool for identifying potential problems, or as a means of providing evidence that the system is operating effectively.
Outcome	The relevant people within an organisation receive the information they need to be able to make informed decisions about the management of the drinking water supply. The organisations knowledge base is continuously developed with information provided by Drinking Water Operators.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Undertake a systematic approach to collecting, recording and reporting data.
- Follow the reporting requirements and procedures that are either referenced or documented within the Water Safety Plan.
- Follow reporting requirements and procedures for the performance measures and targets that are either referenced or documented within the Asset Management Plan.

To do this, Drinking Water Treatment Operators ***need to know***

- What mechanisms are in place for recording and reporting data to others within the organisation. This includes what reporting responsibilities and accountabilities the Drinking Water Operator will have.
- What higher level oversight, performance assessment against organisational goals and objectives is expected. This includes needing to know about:
    - The required level of service for the drinking water supply
    - The performance measures and targets that are to be used to assess compliance with the required level of service.
    - How performance is to be assessed and reported.

Element of Competence:	Provide Data to Taumata Arowai - the Water Services Regulator
Context	Data is supplied to Taumata Arowai to ensure that drinking-water quality management is open and transparent. The Water Safety Plan for the supply references regulatory reporting requirements, purposes and procedures.
Outcome	Relevant information is provided to Taumata Arowai which allow them to assess whether the water supply is demonstrably safe.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Undertake a systematic approach to collecting, recording and reporting data.
- Follow the reporting requirements and procedures that are either referenced or documented within the Water Safety Plan.

To do this, Drinking Water Treatment Operators ***need to know***

- The compliance monitoring requirements within the Drinking-water Standards for New Zealand (DWSNZ), including which parameters are =to be continuously monitored.
- That compliance with the DWSNZ requires some determinants not to exceed a certain value for more a few minutes. This requires accuracy in time measurement and recording to ensure no short-term transgressions go unrecorded.
- The reporting requirements and procedures that are either referenced or documented within the Water Safety Plan including what mechanisms are in place for recording and reporting data to Taumata Arowai, and what reporting responsibilities and accountabilities the Drinking Water Operator will have to provide this data.

Element of Competence:	Implementing the Water Safety Plan
Context	Water Safety Plans consider the potential risks to the water supply and identify ways to manage those risks. This essential tool promotes a multi-barrier approach to managing risks and articulates how the supply addresses the principles of drinking water safety in New Zealand. Drinking Water Treatment Operators are instrumental in the implementation of the Water Safety Plan.
Outcome	The publics' health is safeguarded through the implementation of the Water Safety Plan.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Operate the Water Treatment Plant in a manner that aligns with the operational procedures that are identified in the Water Safety Plan.
- Undertake Operational monitoring and inspection of the Water Treatment processes, as documented in the Water Safety Plan. This includes undertaking corrective actions when monitoring and inspections indicate that a measure is deviating from expected performance and communicating this to the appropriate people.
- Monitor the Critical Control Points and undertake the corrective actions for the CCPs when the defined action and critical limits are reached.
- Verify the performance of the Water Treatment Plant performance in accordance with the Drinking-water Quality Compliance Monitoring Plan referenced in the Water Safety Plan.
- Implement the procedures that are documented in the Water Safety Plan that detail how to respond to transgressions and non-compliances with the Drinking-water Standards for New Zealand.
- Assist with reviewing customer complaints to help identify whether operational changes can be made to improve consumer satisfaction.
- Communicate with the appropriate people when updates to the Water Safety Plan are identified.
- Undertake any improvement items identified in the Water Safety Plan for which the Water Treatment Operator has been given responsibility for.

To do this, Drinking Water Treatment Operators ***need to know***

- The principles of drinking water safety in New Zealand
- The characteristics of the drinking-water supply system, what hazards might arise, how these hazards arise and create risks, and the processes and practices that affect drinking-water quality.
- The available water quality information and be able to analyse and interpret this information which identifies actual and potential water quality issues.

- What the barriers to contamination are for the Water Treatment Plant, so that the failure of one barrier will be compensated for by the effective operation of the remaining barriers. Possible barriers might include:
    - Hazards entering the raw water (e.g. source protection)
    - Removing particles and hazardous chemicals from the water by physical treatment
    - Killing, or inactivating pathogens by disinfection
    - Maintaining the quality of the water within the distribution system
- What the Critical Control Points at the Water Treatment Plant are.
- How the The New Zealand Drinking-Water Standards provide requirements for drinking-water safety by specifying the:
    - maximum amounts of substances or organisms or contaminants or residues that may be present in drinking-water
    - criteria for demonstrating compliance with the Standards
    - remedial action to be taken in the event of non-compliance with the different aspects of the Standards.
- About the Guidelines for Drinking-Water Quality Management in New Zealand which complement the Drinking-Water Standards for New Zealand and provides advice for achieving high level of drinking-water quality management. The Guidelines will assist water suppliers to achieve the Standards and are updated on an ongoing basis with new information.
- The commitment to drinking-water quality management from their employer and the relationship of the WSP to organisational policy and strategy.

Element of Competence:	Health and Safety
Context	Water Treatment Plant operators work in an area with several high risks to their health and safety. They need to be able to work in a manner that mitigates the hazards and risks that they, and others, may be exposed to. The Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [12] provides guidance and model procedures for how to mitigate common health and safety risks in the water industry in New Zealand.
Outcome	Water Treatment Operators work in a safe manner that mitigates the hazards and risks that they, and others, may be exposed to.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Identify hazards, risk assessment and control measures.
- Safely undertake their work and look after the health and safety of any other workers that they direct. To do this Water Treatment Operators need to be able to:
  - Conduct a health and safety induction for visitors to the site
  - Safely enter confined spaces
  - Work alone, and in isolated areas
  - Work with hazardous substances
  - Work at heights
  - Work in, and above, water
- Control plant and equipment hazards by:
  - Safely operating machinery
  - Safely operating vehicles
  - Safely operating mobile plant
- Implement Incident and Emergency response plans for the site.

To do this, Drinking Water Treatment Operators ***need to know***

- That the Health and Safety at Work Act 2015 (HSWA) [13] is New Zealand's workplace health and safety legislation. Water Suppliers must look after the health and safety of their Drinking Water Treatment Operators and any other workers that they influence or direct.
- That the Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [12] provides guidance and model procedures for how to comply with
- What "permits to work" and operational procedures are in place at the Water Treatment Plant that control the identified hazards.
- What Personal Protective Equipment (PPE) is required when operating and maintaining processes at the Water Treatment Plant.

Element of Competence:	Hazardous Substances Management
Context	Drinking water operators ensure that chemicals and hazardous substances used at Water Treatment Plant are used and stored in a safe manner. The Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [12] provides guidance and model procedures for how to manage chemical and hazardous substances at Water Treatment Plants.
Outcome	Chemicals and hazardous substances are stored and used in a safe manner.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Manage an inventory of all chemicals and hazardous substances used at the site, including all consumable chemicals, process chemicals and laboratory chemicals. The inventory needs to be kept up-to-date, accurate and easily accessible to emergency workers.
- Ensure that Safety Data Sheets are available for all chemical and hazardous substances used at the site.
- Safely work with chemicals and hazardous substances (both in terms of handling and storage requirements) including for:
  - Asbestos
  - Fuel
  - Chemicals
- Use the correct Personal Protective Equipment (PPE) and other appropriate controls (e.g. ventilation) as indicated on the Safety Data Sheet when handling chemicals and hazardous substances.
- Label containers containing hazardous substances correctly, including when they are decanted or transferred into smaller containers.
- Store hazardous substances safely
- Ensure that correct signage is in place for hazardous substances.
- Follow the procedures detailed in the Incident and Emergency Plan for the Water Treatment Plant site in the event of a spill.

To do this, Drinking Water Treatment Operators ***need to know***

- What hazardous substances (i.e. any product or chemical that has explosive, flammable, oxidising, toxic, corrosive or ecotoxic properties) are stored or used at the Water Treatment Plant and the dangers that these substances pose.
- That they cannot work with or around hazardous substances until they have the knowledge and practical experience to do so safely.
- That the Incident and Emergency Plan for the Water Treatment Plant site details the procedures to follow in the event of a spill at the site.

- That the Health and Safety at Work (Hazardous Substances) Regulations [14] identifies how the chemicals and hazardous substances such as those used in Water Treatment processes need to be managed.
- That the Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [12] provides guidance and model procedures for how to manage chemical and hazardous substances at Water Treatment Plants.
- That health and safety information is available for all chemicals on Safety Data Sheets (SDS) that must be provided at the time of supply.
- That the Water New Zealand National Asbestos Cement Pressure Pipe Manual [15] details the health and safety requirements when working with asbestos material containing pipes, i.e. for work involving cutting into, removal, storage or replacement of AC pipes Refer to the Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [12] for procedures for asbestos material not associated with pipes i.e. asbestos material present in switchboards or building materials.
- That depending on the type and quantity of hazardous substances stored at the site, a Water Treatment Plant might be considered a Major Hazard Facility. Where this is the case there will be additional requirements for the site to comply with the Health and Safety at work (Major Hazard Facilities) Regulations 2016 which the Drinking Water Operators will need to be aware of.

Element of Competence:	Plant Security and Asset Protection
Context	Delivering safe drinking water to the community includes ensuring that there are appropriate security measures in place to protect the security of the Water Treatment Plant.
Outcome	Access to the Water Treatment Plant is restricted to authorised personnel. Contractors and temporary workers and visitors are inducted onto site and supervised.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Induct and supervise visitors to the Water Treatment Plant
- Lock and alarm all points of entry, including doors, windows, hatches, vents and gates.
- Maintain a key register of who holds keys for each site.
- Routinely perform visual examinations of the exterior of the Water Treatment Plant and remove objects that could be used to aid an intruder.
- Respond to security breaches at the Water Treatment Plant in accordance with the requirements of the incident and emergency response plan for the site.

To do this, Drinking Water Treatment Operators ***need to know***

- Who has access to the Water Treatment Plant, and where the keys are kept.
- How to induct and supervise visitors to site.
- How to implement the incident and emergency response measures for security breaches.

Element of Competence:	Source Water Protection and Catchment Management Plans
Context	Protection of source water is of paramount importance to the safety of drinking water. Most groundwater or surface water sources of drinking water supply in New Zealand are in catchments containing land-use activities that can pose a potential risk of contamination. If an adverse event in the supply catchment threatens the safety of the drinking water supply Drinking Water Operators must be able to implement the Incident and Emergency Response Plan for the supply.
Outcome	Risks to drinking water sources are addressed proactively as part of a multi-barrier approach for managing risks to community drinking water supplies from 'source to tap'.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Implement the operational response in accordance with the Incident and Emergency Response Plan.

To do this, Drinking Water Treatment Operators ***need to know***

- That the National Environmental Standards for Sources of Human Drinking Water Regulations [16] (NES) requires Regional Councils to put conditions on consents within the supply catchment if there is the possibility of an event (e.g. spill) leading to a significant adverse effect on the drinking water supply. In this situation conditions of consent must be imposed that require the consent holder to notify the drinking water supplier if an adverse event occurs.
- The spatial extent of the drinking water supply catchment and any associated source protection zone.
- What potential incidents and emergencies within the catchment will require an operational response.
- Where to find the documented Incident and Emergency Response Plan.

Element of Competence:	Verification Monitoring
Context	Verification monitoring is the process of regularly checking the system to make sure everything is ok. It is the quality control check in the Water Safety Plan approach and includes: ▪ Drinking-water quality monitoring ▪ Consumer satisfaction ▪ Short-term evaluation of results
Outcome	The verification monitoring process confirms that the water supply complies with the Drinking-water Standards for New Zealand.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Follow the drinking-water compliance monitoring plan that is referenced in the Water Safety Plan for the supply. This plan will detail the supply-specific requirements for compliance monitoring in order to meet the Drinking-water Standards for New Zealand. This might include being able to:
    - Take representative samples of water from key points within the treatment process, accurately using appropriate sampling equipment.
    - Review and analyse the performance of the water treatment process by using laboratory, site and network quality reports.
- Follow the procedures referenced in the Water Safety Plan for responding to transgressions and non-compliances with the Drinking-water Standards for New Zealand.
- Review customer complaints and use them to make improvements to the treatment process.
- Review the results of both the drinking-water quality monitoring and the operational monitoring and communicate to identify target and action limits when intervention may be required and communicate this to the appropriate people.

To do this, Drinking Water Treatment Operators ***need to know***

- The Drinking-water compliance monitoring plan that is referenced in the Water Safety Plan. This details how the supply meets the compliance monitoring requirements within the Drinking-water Standards for New Zealand.
- The procedures for responding to transgressions and non-compliance with the Drinking-water Standards for New Zealand.
- The customer complaint process and how complaints are to be reviewed and used with helping to make improvements.
- What operational monitoring and inspection requirements are required including knowing how to instigate the updating of the Water Safety Plan where necessary.

Element of Competence:	Contaminants of Emerging Concern
Context	Sometimes chemicals, or contaminants, that had not previously been detected, or were previously found in far smaller concentrations, are discovered in the water supply. These are known as contaminants of emerging concern.
Outcome	Drinking-water quality monitoring results for the supply are reviewed in order to identify contaminants of emerging concern.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Review the results of both the drinking-water quality monitoring and the operational monitoring to identify what is normal, and what is abnormal, for their supply.
- Where contaminants of emerging concern are identified, Drinking Water Operators need to communicate this to the appropriate people.
- Ensure that this new risk, and how it is to be mitigated, is documented within the Water Safety Plan.

To do this, Drinking Water Treatment Operators ***need to know***

- What drinking water quality monitoring results are considered normal for the supply and what results are abnormal.

Element of Competence:	Resource Consent Compliance Monitoring and Reporting
Context	Water Treatment Plants require a resource consent to take water (a water permit), and sometimes to also discharge contaminants onto land or into the air or water (a discharge permit). A resource consent provides permission to take water and discharge wastes that would otherwise contravene the Resource Management Act. When resource consents are issued, they include conditions intended to protect the environment. As a consent holder the water supplier has a legal obligation to comply with any conditions set out in the resource consent. Drinking Water Treatment Operators need to operate the Water Treatment Plant within the confines of the resource consent(s). This may include collecting and providing data to the Consent Authority on the operation of the Treatment Plant (e.g. data on the amount of water taken, or confirmation that maintenance has occurred).
Outcome	All resource consent conditions related to the Water Treatment Plant are met.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Fulfil the resource consent conditions related to the operation and maintenance of the Water Treatment Plant.
- Assist staff from the consent authority when they undertake site inspections, e.g. induct them onto the site.
- Provide operational data to the consent authority in accordance with the conditions of consent.
- Monitor the performance of the Water Treatment Plant, including trending data, and communicate with the appropriate people when conditions of consent are close to being breached so that action can be taken to prevent this before it occurs.
- Notify the appropriate people when the operation of the Water Treatment Plant fails to comply with the resource consent conditions and implement the operational response in accordance with the Incident and Emergency Response Plan

To do this, Drinking Water Treatment Operators ***need to know***

- What resource consent conditions are in place for the Water Treatment Plant and the limitations these apply to the operation of the Water Treatment Plant (e.g. maximum flow rates).
- What data needs to be collected and monitored to meet the conditions of the consent.
- What to do if the operation of the Water Treatment Plant fails to comply with the resource consent conditions, as detailed in the Incident and Emergency Response Plan.

Element of Competence:	Engage with Stakeholders and the Community
Context	Water Treatment Operators will at times need to be involved with proactively communicating to members of the public. They also need to engage with other stakeholders both external to an organisation, like Drinking Water Assessors and Consent Compliance Officers, and internal stakeholders including the Distribution Operators and Asset Managers
Outcome	Effective communication is used by Water Treatment Operators to engage with stakeholders and the community.

To do this, Drinking Water Treatment Operators ***need to be able to***:

- Identify the stakeholders that they are required to engage with. This will include, but not be limited to, those identified in the Water Safety Plan.
- Engage with stakeholders by following the mechanisms and documentation within the Water Safety Plan for stakeholder engagement.
- Provide input into the long-term employee engagement plan (management and operational) on awareness and involvement in safe and secure drinking water.
- Identify the contact list and communication plan for incidents and emergencies.

To do this, Drinking Water Treatment Operators ***need to know***

- That the stakeholders who could affect, or be affected by, decisions or activities to do with drinking water will have been identified either in the Water Safety Plan, or in other communications plans referenced by the WSP.
- That the Water Safety Plan will also have documented the appropriate mechanisms that they should use to obtain input and involvement from the stakeholders.
- The long-term consumer engagement plan on awareness and involvement in safe drinking water.
- The Water Suppliers two-way communication programme to receive consumers' suggestions, complaints and concerns.

References

[1] Department of Internal Affairs, “Report of the Havelock North Drinking Water Inquiry: Stage 2,” 2017.

[2] Water New Zealand, “Good Practice Guide for the supply of polyelectrolytes for use in drinking-water treatment.”.

[3] Water New Zealand, “Good Practice Guide for the supply of chlorine for use in drinking-water treatment.”.

[4] Water New Zealand, “Good Practice Guide for the supply of hydrated lime for use in drinking-water treatment”.

[5] Water New Zealand, “Good Practice Guide for the supply of aluminium sulphate for use in drinking-water treatment”.

[6] Water New Zealand, “Good Practice Guide for the supply of fluoride for use in drinking-water treatment”.

[7] Water New Zealand, “Good Practice Guide for the supply of polyaluminimum for use in drinking-water treatment”.

[8] Department of Labour, “Approved Code of Practice for Cranes”.

[9] New Zealand Legislation, “Building Act,” 2004.

[10] Water New Zealand, “Management of Water Treatment Plant Residuals in New Zealand”.

[11] Water New Zealand, “Code of Practice for the Fluoridation of Drinking Water Supplies in New Zealand,” 2014.

[12] Water New Zealand, “Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry,” 2017.

[13] New Zealand Legislation, “Health and Safety at Work Act,” 2015.

[14] New Zealand Legislation, “Health and Safety at Work (Hazardous Substaneous) Regulations”.

[15] Water New Zealand, “National Asbestos Cement Pressure Pipe Manual”.

[16] New Zealand Legislation, “Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations,” 2007.