

# **New Zealand Drinking-water Safety Plan Framework**

Citation: Ministry of Health. 2018. *New Zealand Drinking-water Safety Plan Framework*. Wellington: Ministry of Health.

Published in December 2018 by the Ministry of Health  
PO Box 5013, Wellington 6140, New Zealand

ISBN 978-1-98-856840-9 (online)  
HP 7014



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# Introduction

A water safety plan (WSP) is essential to the good management of a drinking-water supply. It articulates the six fundamental principles of drinking-water safety in New Zealand.<sup>1</sup>

## **Principle 1: A high standard of care must be embraced**

Unsafe drinking-water can cause illness, injury or death on a large scale. All those involved in supplying drinking-water must therefore embrace a high standard of care. Vigilance, diligence and competence are minimum requirements, and complacency has no place.

## **Principle 2: Protection of source water is of paramount importance**

Protection of the source of drinking-water provides the first, and most significant, barrier against drinking-water contamination and illness. It is of paramount importance that risks to sources of drinking-water are understood, managed and addressed appropriately. ...

## **Principle 3: Maintain multiple barriers against contamination**

Any drinking-water system must have, and continue to maintain, robust multiple barriers against contamination appropriate to the level of potential contamination. No single barrier is effective against all sources of contamination, and any barrier can fail at any time. ...

## **Principle 4: Change precedes contamination**

Contamination is almost always preceded by some kind of change, and change must never be ignored. Change of any kind should be monitored for and responded to with due diligence.

## **Principle 5: Suppliers must own the safety of drinking-water**

Drinking-water suppliers must maintain a personal sense of responsibility and dedication to providing consumers with safe drinking-water. Knowledgeable, experienced, committed and responsive personnel provide the best assurance of safe drinking-water.

## **Principle 6: Apply a preventive risk management approach**

A preventive risk management approach provides the best protection against waterborne illness. Once contamination is detected, illness may already have occurred. This requires systematic assessment of risks throughout a drinking-water supply from source to tap; identification of the ways these risks can be managed; and control measures implemented to ensure that management is occurring properly. Adequate monitoring of performance of each barrier is essential. ...

<sup>1</sup> Government Inquiry into Havelock North Drinking Water. 2017. *Report of the Havelock North Drinking Water Inquiry: Stage 2*. December. Auckland: Department of Internal Affairs. URL: [www.dia.govt.nz/Government-Inquiry-into-Havelock-North-Drinking-Water](http://www.dia.govt.nz/Government-Inquiry-into-Havelock-North-Drinking-Water) (accessed 12 November 2018).

A WSP documents a public health risk-based assessment and management process that aims to ensure a safe and secure supply of drinking-water for consumers, protecting public health. Water safety planning strengthens the focus on preventive measures across the whole drinking-water supply system, moving away from a reliance on after-the-event end-point water quality testing. It promotes a multi-barrier approach to managing risks, which safeguards against the failure of any one barrier. Water safety planning supports continuous improvement and guides day-to-day activities now and into the future. A WSP is supply-specific, ie, every water supply must have an individualised plan.

A WSP is an essential tool for providing safe drinking-water. The Health Act 1956 (the Act) requires certain drinking-water suppliers to have and implement a WSP. Whilst the Act describes the statutory requirements for a WSP and incorporates the principles of public health risk management in those requirements, new guidance around planning water safety and managing health risks will align WSPs more closely with international best practice.

This *New Zealand Water Safety Plan Framework* (the framework) outlines what the Ministry of Health (the Ministry) expects water suppliers to include in their WSPs. This framework should be read in conjunction with the Act, *Drinking-water Standards for New Zealand*,<sup>2</sup> *Guidelines for Drinking-Water Quality Management for New Zealand*<sup>3</sup> and WSP guides.<sup>4</sup>

<sup>2</sup> Ministry of Health. 2008. *Drinking-water Standards for New Zealand 2005*. (Revised 2008). Wellington: Ministry of Health. URL: [www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008](http://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008) (accessed 12 November 2018).

<sup>3</sup> Ministry of Health. 2017. *Guidelines for Drinking-water Quality Management for New Zealand*. (3<sup>rd</sup> edition). Wellington: Ministry of Health. URL: [www.health.govt.nz/publication/guidelines-drinking-water-quality-management-new-zealand](http://www.health.govt.nz/publication/guidelines-drinking-water-quality-management-new-zealand) (accessed 12 November 2018).

<sup>4</sup> See Ministry of Health. Water safety plan guides for drinking-water supplies. URL: [www.health.govt.nz/publication/water-safety-plan-guides-drinking-water-supplies](http://www.health.govt.nz/publication/water-safety-plan-guides-drinking-water-supplies) (accessed 12 November 2018).

# Water Safety Planning in New Zealand

Water safety planning as a concept was first developed in the late 1990s and gradually rolled out globally over the early 2000s, led by the World Health Organization (WHO). New Zealand was one of the early adopters of water safety planning, formally introducing it into its drinking-water standards in 2005,<sup>5</sup> then into legislation in 2007.

Water safety planning is now widely accepted and adopted worldwide, and New Zealand has over a decade of experience in this approach to drinking-water quality management. This framework reflects the lessons learned about water safety planning, presenting an international best practice structure that remains consistent with the WHO guideline.

At its heart, water safety planning seeks to respond to the following fundamental questions about providing safe and secure drinking-water.

- **Commitment:** Who is responsible for, and knows about, managing and operating the drinking-water supply to ensure safe and secure water continues to be provided?
- **Assessment of the drinking-water supply system:** What could happen to threaten the supply of safe and secure drinking-water? How likely is it that such events will occur and how severe might they be?
- **Existing preventive measures:** What good practices are already happening to stop things going wrong and how do we make sure such practices continue?
- **Operational procedures:** What needs to be done to make sure the water supply system is maintained?
- **Verification monitoring and inspection programme:** What needs to be checked regularly to make sure everything is OK?
- **Improvement plan:** What more should be done to prevent things going wrong or reduce their severity if they do go wrong?
- **Management of incidents and emergencies:** What will be done if things go wrong?
- **Documentation and reporting:** Have we recorded events appropriately to inform future efforts?
- **Investigation:** Are the appropriate equipment, processes and practices being used and followed?
- **Review and continual improvement:** How well is the WSP working?

<sup>5</sup> *Drinking-water Standards for New Zealand 2005 (Revised 2008)*, section 10: Small water supplies, alternative compliance criteria, see URL: [www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008](http://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008)

# Layout of this document

This framework encourages drinking-water suppliers to follow a structured approach when formulating a WSP. The framework consists of 10 components and a number of sub-components. A list of criteria (specific requirements) accompanies each of the sub-components. These criteria should be addressed in every WSP.

The structure, detail and complexity of individual WSPs may vary due to the differences in water supply complexity, size and risks. The drinking-water supplier must demonstrate that sufficient relevant information has been used to meet the criteria.

Components	Sub-components
Commitment to drinking-water quality management	<ul style="list-style-type: none"> <li>Relationship of WSP to organisational policy and strategy</li> <li>Engaging stakeholders</li> <li>Engaging community</li> </ul>
Assessment of the drinking-water supply system	<ul style="list-style-type: none"> <li>Water supply system description and analysis</li> <li>Assessment of water quality data</li> <li>Hazard and hazardous event identification and risk assessment</li> </ul>
Existing preventive measures for drinking-water quality management	<ul style="list-style-type: none"> <li>Assessment of existing preventive measures and multiple barriers</li> <li>Identification of additional preventive measures</li> </ul>
Operational procedures	<ul style="list-style-type: none"> <li>Operational procedures</li> <li>Operational monitoring and inspection</li> <li>Critical control points</li> <li>Corrective actions</li> </ul>
Verification monitoring programme	<ul style="list-style-type: none"> <li>Drinking-water quality monitoring</li> <li>Consumer satisfaction</li> <li>Short-term evaluation of results</li> </ul>
Improvement plan	<ul style="list-style-type: none"> <li>Drinking-water quality management improvement plan</li> </ul>
Management of incidents and emergencies	<ul style="list-style-type: none"> <li>Incident and emergency response plans</li> </ul>
Documentation and reporting	<ul style="list-style-type: none"> <li>Management of documentation and records</li> <li>Reporting</li> </ul>
Investigations	<ul style="list-style-type: none"> <li>Investigative studies</li> <li>Validation of equipment, processes and practices</li> </ul>
Oversight, review and continual improvement	<ul style="list-style-type: none"> <li>Long-term evaluation of results</li> <li>Audit of drinking-water quality management</li> <li>Review by senior leadership</li> </ul>

# Component 1: Commitment to drinking-water quality management

The provision of safe and secure drinking-water requires commitment not only from within the water supplier organisation and other agencies but also from the community receiving that water. That commitment relates to leadership, awareness, engagement, communication, information and a clear path to equally clear goals.

## Sub-components

- Relationship of WSP to organisational policy and strategy
- Engaging stakeholders
- Engaging community

## Relationship of WSP to organisational policy and strategy

The water supplier is legally accountable for providing safe drinking-water. Organisational support and long-term commitment by senior leadership is the foundation to implementing an effective system for providing safe and secure drinking-water. Organisational policies and strategies, reflected in plans and budgets, need to support the effective management of drinking-water supply.

## Criteria

- The provision of safe and secure drinking-water is visible in the organisational policy and strategy.
- Water safety planning is identified in the organisational strategy, plans and budget.
- Where the drinking-water supply management spans multiple organisations, the various roles of each party are recognised in appropriate policies and strategies across each organisation.

## Engaging stakeholders

Engaging stakeholders early and throughout the development of the WSP will smooth the way for implementing the WSP, giving the public greater confidence in the water supply and supplier.

### Criteria

- All stakeholders who could affect, or be affected by, decisions or activities to do with the drinking-water supply are identified.
- A core team is formed to lead the WSP's development, led by the water supplier and involving operational staff. The core team must understand the operation and management requirements for the drinking-water supply, have the ability and authority to make decisions and enact changes, know about legal requirements and be prepared to bring in additional expertise where required.
- Appropriate mechanisms and documentation are developed to ensure stakeholder commitment and involvement in developing and implementing the WSP.
- A long-term employee engagement plan (management and operational) on awareness and involvement in safe and secure drinking-water is identified.

## Engaging community

Effective communication is vital in managing incidents and emergencies. However, the foundation of consumer confidence is built during non-emergency times.

### Criteria

- A long-term consumer engagement plan (including participation of any elected officials) on awareness and involvement in safe and secure drinking-water is identified.
- An active two-way communication programme exists to receive consumers' suggestions, complaints and concerns (also see component 5) and promote community awareness of drinking-water quality status, issues and actions.
- A contact list and communication plan for incidents and emergencies exists (also see component 7).

# Component 2:

## Assessment of the drinking-water supply system

A holistic assessment of the drinking-water supply system is an essential prerequisite for subsequent steps to planning and implementing effective strategies for hazard prevention and control. This assessment includes understanding the characteristics of the drinking-water supply system, what hazards may arise, how these hazards arise and create risks, and the processes and practices that affect drinking-water quality.

### Sub-components

- Water supply system description and analysis
- Assessment of water quality data and catchment characteristics
- Hazard and hazardous event identification and risk assessment

## Water supply system description and analysis

The water supply system description is useful when preparing a WSP as it helps ensure that every element of the water supply has been identified and carefully considered with respect to factors that affect drinking-water quality.

The drinking-water supply system is defined as everything from the catchment where the water is sourced down to the consumer. It covers the physical environment, infrastructure (source, treatment, storage and distribution) and organisations/people and their processes and practices.

## Criteria

- An accurate schematic or flow diagram from catchment to consumer is provided.
- A detailed description of the drinking-water supply system is provided, including:
  - the catchment characteristics:
    - catchment area or groundwater recharge zone, including any designated catchment protection zones
    - topography
    - main geological features
    - land use (both current and past) and likely land use changes
  - climatic features, including significant climate variability and expected changes
  - source (abstraction) infrastructure
  - treatment process description, including process control, target microbiological log reduction values and chemical reduction values for treatment components
  - the reticulation network, including storage
  - supply and demand characteristics, including projections and quality requirements
  - drinking-water supply management systems
  - any planned improvements to the drinking-water supply system.
- Any sources that do not undergo treatment are identified and an explanation is included clarifying why there is no treatment.
- Key stakeholders and staff who are actively involved in the operation and management of the drinking-water supply are identified, with their roles.

## Assessment of water quality data

Water quality information for source (characteristics and variability), treated and reticulated water, both recent and historic, add to the understanding of treatability, water quality hazards and the events that have triggered the presence of these in the past. Information should be assessed both over time and following specific extreme events for trends, exceedances, major variations, abnormal results and absence of results.

Sources of information include routine monitoring and inspection records, health agency records, regional council monitoring, local knowledge, consumer complaints and reports on previous water quality problems or investigations.

### Criteria

- The WSP includes a summary of the available water quality information and an analysis and interpretation of this information, which identifies actual and potential water quality issues.
- A review of previous water quality incidents is provided.

## Hazard and hazardous event identification and risk assessment

Effective risk management requires the identification of all potential hazards, their sources, hazardous events and an assessment of the level of risk presented by each event. A structured approach is important to ensure that significant issues are not overlooked and that areas of greatest risk are identified. Measures to reduce hazard concentrations in the source water or prevent hazardous events in the catchment are arguably the most important steps in protecting water safety. Controlling the hazards at these points reduces the potential consequences of any failure in subsequent preventive measures.

A **hazard** is a biological, chemical, physical or radiological agent that has the potential to cause harm.

A **hazardous event** is an incident or situation that can lead to the presence of a hazard in the water supply.

**Risk** is the likelihood of the hazardous event occurring (in a specified timeframe), combined with the severity of the consequences the hazard may cause.

**Consequences** can be a combination of harm to people in the exposed population and disruption to systems.

The level of risk (likelihood of occurrence and severity of consequence) associated with each hazardous event needs to be estimated so that priorities for risk management can be established. It is rare to have enough knowledge or data available to complete a detailed quantitative risk assessment, and thus, risk assessments will often include subjective judgements and uncertainties.

### Criteria

- The approaches used for hazard identification and the methodology used for risk assessment are defined. Methodological limitations and uncertainties are documented, as is the rationale for an acceptable level of risk. Those involved in

the hazard identification and risk assessment, along with their rationale for involvement, are documented.

- Hazards and hazardous events for each element of the drinking-water supply are identified and documented, including hazards and events that are considered to be well managed currently.
- The **maximum** level of risk (ie, in the absence of preventive measures and under conditions when the system would be most challenged) and the **residual** level of risk (ie, after considering existing preventive measures, see component 3) for each identified hazard or hazardous event are estimated.
- A prioritised list of risks requiring improvements to their management are made.
- The WSP recognises any uncertainties surrounding the risk assessment and factors these into the preventive measures adopted. Any actions taken to reduce the uncertainty have been documented.
- Adequate consideration has been given to plausible combinations of hazards or hazardous events (eg, calving season AND a heavy rain event AND treatment plant failure).

# Component 3:

## Existing preventive measures for drinking-water quality management

Preventive measures are those actions, tasks and processes used to prevent hazards from reaching the consumer or used to reduce the hazards to acceptable levels. Preventive measures may address more than one risk. The water supplier needs to demonstrate how they intend to manage the priority risks posed by the identified hazards and hazardous events (see component 2). They need to assess the effectiveness of existing preventive measures and respond to unacceptable residual risk. They may respond by enhancing existing measures or introducing new measures.

Treatment is an important contribution to preventive measures, and so too are measures that protect raw water quality before treatment and measures that protect treated water quality. The minimum level of treatment required in each water supply system is determined by the quality of the source water and the hazards associated with the catchment and source water. Treatment elements targeting microbiological hazards must be assessed for removal of these hazards in the form of log reduction values and those targeting chemical hazards must look to remove these hazards.

### Sub-components

- Assessment of existing preventive measures and multiple barriers
- Identification of additional preventive measures

## Assessment of existing preventive measures, and presence or absence of multiple barriers, and identification of additional preventive measures (enhanced existing or new)

Identifying and implementing preventive measures should always be done within the context of a multiple barrier approach so that failure of one barrier will be

compensated for by effective operation of the remaining barriers. Water suppliers should consider the following four types of barriers.

- Preventing hazards entering the raw water
- Removing particles and hazardous chemicals from the water by physical treatment
- Killing or inactivating pathogens in the water by disinfection
- Maintaining the quality of the water in the distribution system.

### **Criteria**

- The WSP identifies existing preventive measures for each of the priority risks posed by the hazards and hazardous events and provides an estimate of the residual risk for each targeted hazard and hazardous event (see component 2).
- The WSP comments on the extent to which existing preventive measures cover the four types of barriers. If any type of barrier is not present, additional preventive measures are identified and added to the improvement plan (see component 6), or an explanation is provided as to why the barrier is not required.
- Where the residual risk is deemed unacceptable, additional preventive measures are identified and added to the improvement plan (see component 6). These may be in the form of enhancements to the existing measures or new measures. The WSP includes evidence of the appropriateness of the additional preventive measures.
- Where additional preventive measures have been identified but cannot be implemented immediately, the WSP includes a short-term alternative to manage the risk.

# Component 4:

## Operational procedures

Operational and maintenance procedures formalise the day-to-day activities that help to ensure the entire water supply system remains functional and all preventive measures are effective in managing the identified risks. These procedures must be identified, documented and implemented. Instructions need to be written in a way that makes sense to the person who is expected to use them, so operations staff should be involved in their development, and the instructions should be displayed at the places where they are expected to be used.

### Sub-components

- Operational procedures
- Operational monitoring and inspection
- Critical control points
- Corrective actions

## Operational procedures

Detailed procedures are required for operating all processes and activities (both ongoing and periodic) from catchment to consumer and should be compiled into an operations manual. There will be procedures for system operations, maintenance and repairs, back-up equipment, equipment validation and calibration, approved materials, and chemicals.

### Criteria

- The WSP includes a list of all operational procedures required for processes and activities and refers the user to an operations manual covering the actual procedures if that manual is not appended to the WSP.
- Where operational procedures are found to be missing, these are added to the improvement plan (see component 6).
- There is a schedule of operations and maintenance duties and a way to record evidence of schedule implementation.
- Operational procedures include details of: what needs to be done, by whom, how frequently, where procedures should take place, and what needs to be recorded for each procedure. There is document/version control of operational procedures.
- There is evidence that the operations staff have been trained in the procedures.

## Operational monitoring and inspection

Operational monitoring and inspection covers a planned sequence of measurements and observations to assess and confirm the performance of the preventive measures. Operational monitoring and inspection needs to be carried out at frequencies that allow enough time for taking action to bring the system back under control before health-based targets<sup>6</sup> are reached. Target criteria (performance goals) should be established for each preventive measure. Any deviation of performance from these established targets should be regarded as a trend towards losing control of the process, and appropriate action should be taken to resolve the potential problems.

### Criteria

- The WSP includes a list of monitoring and inspection plans for the drinking-water supply system's operational performance and refers the user to an operational monitoring and inspection plan and schedule if one is not appended to the WSP.
- Where monitoring and inspection plans are found to be missing, these are added to the improvement plan (see component 6).
- Formal records of operational monitoring and inspection are required, and include a record of actions taken in response to the monitoring/inspection results.
- Monitoring and inspection plans include details of parameters to monitor/inspect, the purpose of each parameter, methods, location, timing and frequency, by whom, and what needs to be recorded. There is document/version control of monitoring and inspection plans.
- There is evidence that the operations staff have been trained in following the plans.

## Critical control points

A few preventive measures – one or more measures that can be operated as process controls – will be designated **critical control points**. These must be able to control the water supply system, have defined limits (target, action, critical) and be able to be monitored (if not continuously then frequently enough to detect a failure in the preventive measure in good time to take action).

A **critical limit** is a prescribed tolerance that distinguishes acceptable from unacceptable performance at the critical control point. Predefined corrective actions are required for critical control points.

<sup>6</sup> The health-based target will often be the maximum acceptable value (MAV) but may also be a treatment performance target or a reduction in the level of disease.

The critical control points are especially important in managing microbiological hazards and being able to supply water (ie, quantity).

### **Criteria**

- The WSP identifies an appropriate set of critical control points and has critical control point process control summaries for each control point.
- Critical control point process control summaries include a monitoring procedure; defined target, action and critical limits; and predefined corrective actions for these limits.

## **Corrective actions**

Corrective actions are taken in response to routine monitoring and inspections that indicate a preventive measure is deviating from expected performance. They quickly re-establish control of the system, usually by making adjustments to the system. Incident and emergency plans (see component 7) are activated when normal corrective actions cannot re-establish operational performance quickly enough to prevent drinking-water of an unacceptable quality from reaching consumers.

### **Criteria**

- The WSP includes a list of procedures for corrective actions that are triggered by exceeding target criteria or critical limits. The WSP refers the user to a corrective actions manual covering the actual procedures if that manual is not appended to the WSP.
- Where corrective action procedures are found to be missing, these are added to the improvement plan (see component 6).
- Corrective action procedures include details of instructions on required adjustments or process control change, communication and notification requirements, and additional monitoring or inspection required to verify that the corrective action has been effective. There is document/version control of corrective action procedures.
- A process exists for reviewing why the corrective action was needed (the underlying cause), how effective the monitoring and inspection plan and corrective action were, and whether the WSP needs to be updated as a result.
- There is evidence that the operations staff have been trained in the corrective action procedures.

# Component 5:

## Verification monitoring programme

Verification of drinking-water quality is an assessment at one point in time that the overall performance of the drinking-water supply system is capable of providing water of acceptable quality at the point of supply. It is a quality control check in the drinking-water safety planning quality assurance approach.

### Sub-components

- Drinking-water quality monitoring
- Consumer satisfaction
- Short-term evaluation of results

## Drinking-water quality monitoring

The benchmark for verification monitoring is compliance with the *Drinking-water Standards for New Zealand*.<sup>7</sup>

### Criteria

- The WSP references a drinking-water quality compliance monitoring plan that meets the requirements of its supply-specific compliance monitoring as set out in the *Drinking-water Standards for New Zealand*.
- The WSP references procedures (see component 7) for responding to transgressions and non-compliances with the *Drinking-water Standards for New Zealand*.

<sup>7</sup> Ministry of Health. 2008. *Drinking-water Standards for New Zealand 2005*. (Revised 2008). Wellington: Ministry of Health. URL: [www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008](http://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008) (accessed 12 November 2018).

## Consumer satisfaction

Monitoring consumer comments and complaints can provide valuable information on water quality problems that may not have been picked up by operational or verification monitoring. In particular, the aesthetic qualities of taste, colour and odour can be indicative of other problems that may be intermittent or newly introduced to the system.

### Criteria

- The WSP references a consumer complaint and response process and explains how the information from such complaints/responses will be reviewed and used to help with making improvements.

## Short-term evaluation of results

The benefit of operational and verification monitoring and inspection is only realised if the results are regularly reviewed and acted on.

### Criteria

- A process exists to review operational and verification monitoring and inspection results regularly, and actions are taken in response to the review, including:
  - communicating messages to the appropriate people in a timely manner and in a suitable way
  - updating the WSP where necessary.

# Component 6:

## Improvement plan

The improvement plan for the drinking-water supply draws from the assessment of preventive measures, operational procedures, the verification monitoring programme and management of incidents and emergencies. The improvement plan captures what needs to happen, by when and by whom to address missing barriers to contamination, additional preventive measures to reduce residual risk, and omissions in plans and procedures.

### Sub-components

- Drinking-water quality management improvement plan

## Drinking-water quality management improvement plan

Improvements can encompass a wide range of actions, ranging from immediate to long term and from no/low cost to having significant budgetary implications. In general, priority should be given to those improvements that will reduce the risk most significantly, but it is also important to consider improvements that take very little time or cost.

### Criteria

- The WSP describes the additional measures proposed for each unacceptable risk and includes:
  - priorities for implementation
  - a timeframe for implementation
  - details about who has responsibility for implementing each improvement
  - confirmation that, after the improvement is implemented, the residual risk is acceptable.
- The improvement plan has been endorsed by senior management/decision makers.

# Component 7:

## Management of incidents and emergencies

Although preventive measures are intended to prevent incidents and emergencies that threaten safe and secure drinking-water, some events cannot be anticipated or controlled, or the probability of their occurrence is so low that including a preventive measure would be too costly. Nonetheless, the drinking-water supplier still needs to be prepared to instigate a controlled response to the situation.

### Sub-components

- Incident and emergency response plans

## Incident and emergency response plans

The development of appropriate incident and emergency response plans needs to involve all stakeholders who have a role in the response so that responses are well coordinated. Sufficiently knowledgeable, experienced and senior people need to lead emergency responses because often such responses will be emerging situations that require adaptive capability.

Effective communication is vital in managing incidents and emergencies. Clearly defined plans for both internal and external communications should be established in advance.

### Criteria

- The WSP includes:
  - a review of any previous incidents and emergencies, and identifies potential incidents and emergencies
  - emergency-level categories for events and clear triggers for activating the incident and emergency response plan, for example, when a critical control point critical level has been reached
  - accessible response plans to each event, shared with and agreed by all stakeholders who need to be involved in the response, so that it is clear who has responsibility for taking what actions
  - staff training in emergency situations and testing of response plans.
- A process exists for reviewing why any incident and emergency response is needed, how effective the response plan is, and whether the WSP or response

plan needs to be updated to prevent a recurrence of the event or to improve the response.

# Component 8:

## Documenting and reporting

Documentation provides a basis for effective communication within the organisation as well as with the consumer and various stakeholders. A system of regular reporting, both internal and external, is important to ensure that the relevant people receive the information they need to make informed decisions about the management or regulation of drinking-water quality.

### Sub-components

- Management of documentation and records
- Reporting

## Management of documentation and records

Appropriate documentation provides the foundation for establishing and maintaining effective drinking-water quality management systems. Documentation should:

- demonstrate that a systematic approach has been established and is being implemented effectively
- develop and protect the organisation's knowledge base
- provide an accountability mechanism
- provide written evidence of the water quality system to help with reviews and audits
- establish due diligence and credibility.

The operation of systems and processes leads to the generation of large amounts of data that need to be recorded. Efficient record keeping is an essential tool for indicating and forewarning of potential problems and providing evidence that the system is operating effectively. Documents and records can be stored in a variety of forms, such as written documents, electronic files and databases, video and audiotapes, and visual specifications (flow charts, posters, etc). Drinking-water suppliers should consider using computer-based documentation that is faster and easier to access and update.

## Criteria

- The WSP describes the information management system, record keeping and reporting processes. It includes:
  - details on how documentation pertinent to all aspects of drinking-water quality management is developed, maintained and made available to all employees. Mechanisms are in place to ensure employees read, understand and adhere to documentation procedures
  - a document control system to ensure documents are reviewed regularly and updated where necessary to reflect changing circumstances and to ensure that current versions are being used and obsolete documents are discarded
  - instructions for how records of all activities pertaining to the performance of drinking-water quality management are stored so that they can be easily accessed and reviewed. Storage should protect against damage, deterioration or loss
  - a system to ensure that employees are properly trained to fill out records and records are regularly reviewed by a supervisor (signed and dated).

## Reporting

Reporting encompasses both internal and external reporting of activities and results pertinent to drinking-water quality management. Internal reporting supports effective decision making at the various levels of the organisation, including operations staff and management, senior leadership and the board of directors or elected officials. It also provides a way to communicate information on decisions to employees throughout the organisation. External reporting ensures that drinking-water quality management is open and transparent. It includes reporting to regulatory bodies, consumers and other stakeholders in accordance with requirements.

## Criteria

- The WSP references internal reporting requirements, purposes and procedures for communicating between the various levels and functions of the organisation. This includes results from audit and management reviews.
- The WSP references external reporting requirements, purposes and procedures. This includes regulatory reporting and sharing information with other agencies and consumers.

# Component 9:

## Investigations

Investigations enable continuous improvement, helping to increase the drinking-water supplier's understanding of hazards, hazardous events and risks, as well as the appropriateness of preventive measures in controlling these risks. The level of investigation will differ significantly depending on the size and complexity of the water supply system.

### Sub-components

- Investigative studies
- Validation of equipment, processes and practices

## Investigative studies

Investigations may be reactive or proactive. **Reactive investigations** are problem-solving and aim to help the investigator understand why something has not gone to plan and what can be done to rectify the issue effectively. **Proactive investigations** are strategic and aim to stay ahead of emerging issues, for example, predictive modelling helps develop our understanding of the potential impacts of climate or land-use change.

Investigations should be an integral part of design and selection of new equipment, processes or practices. Literature reviews and bench- and pilot-scale evaluations before full-scale may be useful. Attending conferences and visiting other drinking-water supplies can provide valuable ideas for suitable designs and selections – enabling the visitor to hear about and witness best practice in action.

### Criteria

- The WSP summarises planned investigation activities.
- The WSP refers to a procedure for activating and implementing investigations.

## Validation of equipment, processes and practices

Robustly designed studies are important in demonstrating that a new system improvement is working. Where the performance of equipment, processes or practices is susceptible to variation (eg, seasonal source water quality change or filter media replacement), revalidation of its effectiveness needs to be planned to take place at intervals that account for such expected variation.

### Criteria

- The WSP refers to documented processes for first-time validation and routine revalidation of equipment, processes or practices.

# Component 10: Oversight, review and continual improvement

Components 1–9 of this framework focus on providing safe and secure drinking-water. Component 10 considers higher-level oversight, performance assessment against organisational goals and objectives and lessons or opportunities for continual improvement.

## Sub-components

- Long-term evaluation of results
- Audit of drinking-water quality management
- Review by senior leadership

## Long-term evaluation of results

The systematic review of operational and verification monitoring and inspection results over an extended period (typically looking back 12 months or longer) is needed to:

- assess overall performance against numerical guideline values, regulatory requirements or agreed levels of service
- identify emerging problems and trends
- assist in determining priorities for improving drinking-water quality.

Each event will have been assessed and responded to in the short term, but there is also value in looking across events longer term for patterns or trends. Inevitably, there will be occasions when the review reveals that an event did not conform with operational criteria or numerical guideline values.

## Criteria

- The WSP identifies mechanisms for evaluating performance results, with defined responsibilities, accountabilities and reporting requirements.
- There is evidence that the current WSP has taken into account previous long-term evaluations.

# Audit of drinking-water quality management

Auditing is the systematic evaluation of activities and processes to confirm that defined objectives are being met. It seeks to determine whether the WSP has been implemented as planned and, coupled with long-term evaluation results, whether the WSP is adequate. An audit is broader than the specifics of the WSP itself; it is an assessment of the wider organisational management systems that the WSP is expected to operate across.

Auditing provides valuable information on those aspects of the system that are effective, as well as identifying opportunities to improve poor operational and management practices.

Internal audits are important for maintaining a functional drinking-water quality management system and for identifying areas for improvement. External audits can be useful in establishing credibility and maintaining consumer confidence. External audits should focus on confirming implementation and results of internal audits.

## Criteria

- The WSP refers to a process for internal audits, including:
  - who should carry out the audits
  - how frequently those audits should be scheduled
  - what should be covered in an audit, for example, management systems, operational and emergency procedures, monitoring and inspection programmes and records, etc
  - what should be documented and communicated to operations staff, management and senior leadership.
- The WSP refers to a process for external audits, documenting and communicating results.

## Review by senior leadership

This sub-component brings us full circle to component 1 and a commitment to drinking-water quality management. Senior leadership support, commitment and ongoing involvement are essential to the continual improvement of the organisation's activities around providing safe and secure drinking-water. The senior leadership team needs to receive and review consolidated information about overall system performance so it can evaluate the need for change and commit resources to effect

this change. The results of regulatory compliance, system audits and the improvement plan should be included in the consolidated information.

### **Criteria**

- The WSP identifies the consolidated information about overall system performance required by senior leadership and the mechanism for providing this information and receiving feedback.