

## 1 Summary

- Water utilities must immediately notify the local Public Health Unit of any incident affecting the ability to provide safe drinking water.
- This response protocol outlines the actions that should be taken by water utilities and public health units in responding to critical limit exceedances, raw water quality problems, reservoir contamination and test results indicating possible contamination.
- The water utility is responsible to investigate and carry out corrective actions to restore control of treatment processes.
- The PHU can support and advise the water utility on its investigation and response.
- Prompt action will help prevent illness.
- A boil water alert may be necessary when there is an ongoing risk.

## 2 Introduction

This protocol provides processes that water utilities should follow in working with Local Health District Public Health Units (PHUs) in responding to risks to drinking water safety including where:

- a critical limit has been exceeded at a critical control point (CCP) for pathogen risk
- there is a raw water quality problem likely to affect water treatment
- there is evidence of vermin (birds, possums or other animals) found in a reservoir
- *Escherichia coli* (*E. coli*) is detected in drinking water

### Responsibilities

The water utility is responsible for all necessary investigation and sampling as specified in this response protocol. The water utility should plan, carry out and document the investigation, response and corrective actions and communicate these to the PHU. Water utilities must immediately notify and consult the local PHU of any incident affecting the ability to provide safe drinking water. Prompt action at these times will help prevent illness.

The PHU can support and advise the water utility on its investigation and response.

The PHU will advise the Department of Industry – Water (DoI Water) Regional Officer when a drinking water risk is notified or when a boil water alert is considered or lifted. DoI Water can provide technical assistance to water utilities when responding to drinking water incidents.

### 3 Incident scenarios

**A boil water alert should be considered where there is a risk that cannot immediately be rectified and consumers will be exposed to contaminated water.**

#### 3.1 A critical limit has been exceeded and/or there is a raw water quality problem likely to affect water treatment

##### Notification

The water utility must immediately notify and consult the PHU when:

- A. A critical limit at a CCP for pathogen risk is exceeded (e.g. filtered water turbidity is above the critical limit or chlorination contact time (C.t) below critical limit) (see NSW Health critical control point guidance), or where there is
- B. Raw water quality problems (e.g. high or rapidly changing turbidity) mean that treatment processes may not be effective.

The water utility must still notify critical limit exceptions, even when the treatment or disinfection failure is corrected before inadequately treated water enters the supply system.

##### Response and investigation

The water utility should follow its CCP standard operating procedures (SOPs). SOPs (including CCP limits) should be displayed in the treatment plant. SOPs provide guidance on responding to critical limits, adjustment limits and target criteria exceptions and dealing with changes in raw water quality. Water utilities must respond promptly to adverse signals (including operational monitoring results, alarms, weather warnings).

The water utility should estimate how long demand will be met by the remaining safe drinking water in the distribution system. This will determine the time available to rectify the situation and/or consider a boil water alert.

The response may include:

- changing to an alternative source or changing the off-take depth to improve raw water quality
- Assessing whether there have been recent inflows of water from contaminated sources in the catchment, (even if raw water turbidity is stable). Sources could include sewer overflows, sewage treatment plant discharges or storm runoff from intensive agriculture (See Sanitary survey guidance, section 4)
- Investigating whether a temporary shutdown of the treatment plant is feasible if adequate storage is available
- Optimising all processes at the treatment plant
- Diverting filtered water to waste (when above target turbidity)
- Investigate whether contaminated water can be isolated or removed from the system, e.g., by emptying or taking the reservoir offline. (Note that this will not be effective for consumers who receive water before the reservoirs.)

- Confirming whether adequate disinfection residual is being maintained throughout the distribution system (free chlorine residual of at least 0.2 mg/L or total chlorine of at least 0.6 mg/L in chloraminated systems). Where there is a risk of *Naegleria fowleri* (see NSW Health Naegleria fact sheet <http://www.health.nsw.gov.au/environment/water/Pages/naegleria-utilities.aspx>), free chlorine residuals must be at least 0.5 mg/L.
- Where possible, monitoring turbidity in the distribution system.
- Boosting chlorine, if inadequate, at points in the distribution system (e.g., by dosing at mains and/or reservoirs)

#### **Next step**

Contact the PHU regarding the outcome of the response and investigation and the need for a boil water alert (See Boil water alert guidance, section 5).

### **3.2 There is evidence of vermin (birds, possums or other animals) found in a reservoir**

#### **Notification**

The water utility must immediately notify and consult with the PHU when evidence of vermin is found.

#### **Response and investigation**

The response may include:

- Assessing whether potentially contaminated water could be isolated or removed from the system (e.g. by emptying or taking the reservoir offline)
- Confirming whether adequate disinfection residual is being maintained throughout the distribution system (free chlorine residual of at least 0.2 mg/L or total chlorine of at least 0.6 mg/L in chloraminated systems). Where there is a risk of *Naegleria fowleri* (see NSW Health Naegleria fact sheet <http://www.health.nsw.gov.au/environment/water/Pages/naegleria-utilities.aspx>), free chlorine residuals must be at least 0.5 mg/L.
- Collect microbiology samples (for *E. coli*)
- Boosting chlorine, if inadequate, at points in the distribution system (e.g. by dosing at mains and/or reservoirs)
- Remove vermin and repair the reservoir to prevent recontamination

#### **Next step**

Contact the PHU regarding the outcome of the response and investigation and the need for a boil water alert (See Boil water alert guidance, section 5).

### 3.3 *E. coli* is detected in drinking water

#### Notification

The testing laboratory must immediately call the water utility and the PHU when *E. coli* is detected in drinking water (*E. coli* indicates recent faecal contamination) and email or fax the result to the water utility and PHU.

The water utility should ask the laboratory for the chlorine concentration and any other field results (e.g. pH, turbidity) for the sample, if the utility does not have a record.

#### Response and investigation

The water utility and PHU should discuss the response to the detection.

**The PHU will consider the need for a boil water alert if the water utility cannot provide prompt confirmation of normal operation, including an adequate disinfectant concentration at the sample site and throughout the system (See Boil water alert guidance, section 5).**

The response may include:

- Checking, correcting and/or adjusting treatment plant CCP performance particularly filtration (i.e. filtered water turbidity) and disinfection (i.e. chlorination C.t).<sup>1</sup>
- Confirming whether adequate disinfection residual is being maintained throughout the distribution system (free chlorine residual of at least 0.2 mg/L or total chlorine of at least 0.6 mg/L in chloraminated systems). Where there is a risk of *Naegleria fowleri* (see NSW Health *Naegleria* fact sheet <http://www.health.nsw.gov.au/environment/water/Pages/naegleria-utilities.aspx>), free chlorine residuals must be at least 0.5 mg/L
- Boosting chlorine, if inadequate, at points in the distribution system (e.g., by dosing at mains and/or reservoirs)
- Confirming the integrity of the distribution system, especially reservoir integrity. Identify any recent main break repairs and investigate whether they could be the source of contamination. (Note: before flushing mains, consider the risk that flushing may distribute contamination throughout the system if the source of contamination is unknown.)
- Collecting repeat microbiology samples for *E. coli* (see below)
- Investigating catchment conditions and raw water quality. (See Sanitary survey guidance, section 4)
- Correcting any faults that are found.

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<sup>1</sup> Depending on the scale and source of contamination, an increase in disinfection at the treatment plant or reservoir may be sufficient to rectify the situation. If repeat testing again indicates contamination, further control measures including a boil water alert may be required.

## Repeat microbiology testing

The water utility should:

- Immediately re-sample at the same site and at least two other locations in the distribution system using NSW Health Drinking Water Monitoring Program 'Repeat' labels and record field results (free and total chlorine, pH, temperature and turbidity).
- Collect samples from upstream and downstream of the original sample site to investigate whether the problem is localised or system-wide (and that there is adequate chlorine residual throughout the distribution system).
- Submit the samples to a NSW Health laboratory or other NATA accredited laboratory for analysis. Advise the laboratory that these are urgent repeat samples to investigate possible contamination. Request that the laboratory urgently notify both positive and negative results.
- Note that the PHU can request that the NSW Health laboratory conduct the analysis out of hours using the Urgent Water Analysis Request form ([www.health.nsw.gov.au/environment/water/Documents/FASS-request-urgent-testing.pdf](http://www.health.nsw.gov.au/environment/water/Documents/FASS-request-urgent-testing.pdf)).

Where immediate resampling is not possible (e.g. sampling officer is not available or it is not possible to meet departure time of a flight or courier), the water utility and PHU should assess the situation and agree on the necessary actions, and take a repeat sample as soon as practicable.

### **If *E. coli* is detected in the repeat samples, the response should include:**

- Checking, correcting and/or adjusting treatment plant CCP performance particularly filtration (i.e. filtered water turbidity) and disinfection (i.e. chlorination C.t).<sup>2</sup>
- Immediately contact PHU regarding the need for a boil water alert (See Boil water alert guidance, section 5).
- Confirming whether adequate disinfection residual is being maintained throughout the distribution system (free chlorine residual of at least 0.2 mg/L or total chlorine of at least 0.6 mg/L in chloraminated systems). Where there is a risk of *Naegleria fowleri* (see NSW Health Naegleria fact sheet <http://www.health.nsw.gov.au/environment/water/Pages/naegleria-utilities.aspx>), free chlorine residuals must be at least 0.5 mg/L
- Boosting chlorine, if inadequate, at points in the distribution system (e.g., by dosing at mains and/or reservoirs)
- Confirming integrity of the distribution system, especially reservoir integrity.
- Conducting a sanitary survey (See Sanitary survey guidance, section 4)

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<sup>2</sup> Depending on the scale and source of contamination, an increase in disinfection at the treatment plant or reservoir may be sufficient to rectify the situation. If repeat testing again indicates contamination, further control measures including a boil water alert may be required.

If *E. coli* is not detected in the repeat samples and the supply system is operating normally resume normal water quality monitoring. The next scheduled sample would normally be sufficient as follow-up testing.

### 3.4 Total coliforms are detected in drinking water

#### Notification

The testing laboratory will email or fax the water utility and the PHU when total coliforms are detected in drinking water. Standard NSW Health laboratory microbiology testing includes both total coliform bacteria and *E. coli*.

#### Response and investigation

Coliforms, when used in operational monitoring, may indicate inadequate treatment, breakdowns in system integrity, or the presence of biofilms. (see Appendix 1 Indicator organisms).

Note that where water utilities use total coliforms as an indicator of system cleanliness, organism numbers should be established on a system-specific basis, taking into consideration relevant historical data and an understanding of the characteristics of the system (such as maintenance of chlorine residual, long sections of mains).

The response may include:

- Checking, correcting and/or adjusting treatment plant CCP performance particularly filtration (i.e. filtered water turbidity) and disinfection (i.e. chlorination C.t).
- Confirming whether adequate disinfection residual is being maintained throughout the distribution system (free chlorine residual of at least 0.2 mg/L or total chlorine of at least 0.6 mg/L in chloraminated systems). Where there is a risk of *Naegleria fowleri* (see NSW Health Naegleria fact sheet <http://www.health.nsw.gov.au/environment/water/Pages/naegleria-utilities.aspx>), free chlorine residuals must be at least 0.5 mg/L
- Confirming the integrity of the distribution system, especially reservoir integrity.

#### Next step

Refer to section 3.1 if a critical limit exceedance is identified.

#### Repeat testing

The next scheduled sample would normally be sufficient as follow-up testing.

## 4 Sanitary survey guidance

A sanitary survey includes a review of system integrity, supported by water quality data, particularly microbiology data.

A sanitary survey is defined in the *Australian Drinking Water Guidelines* as a review of the water sources, facilities, equipment, operation and maintenance of a public water system to evaluate its adequacy for producing and distributing safe drinking water.

The sanitary survey should determine whether system barriers are operating normally, particularly at critical control points (CCPs), and investigate and document the following:

### 4.1 Catchment management and source water protection:

- The integrity of critical catchment and storage protection such as fences and locked gates
- Whether there is high or rapidly changing raw water turbidity that cannot be improved (e.g. by changing the level of off-take or source)
- Whether there has been a recent inflow of water from a contaminated source in the catchment (even if raw water turbidity is stable). Sources could include sewer overflows, sewage treatment plant discharges or storm runoff from intensive agriculture.
- Whether there has been a recent natural event that may impact raw water quality e.g. storm event, flooding, fire.
- Condition of extraction points for surface water sources (e.g. pumping station subject to flooding, inlet screen condition)
- Integrity of bore head structures and bore casing (consider whether contamination from the surface could enter the bore)
- Integrity of raw water transfer infrastructure e.g. pump stations and pipelines.

#### 4.2 Water treatment plant performance:

- Integrity and sources of contamination at treatment structures (e.g. coagulation, settling, clear water tanks, filters)
- CCPs are meeting operational targets, particularly filtration (i.e. filtered water turbidity) and disinfection (i.e. disinfection contact time, *C.t* and residual)
- Power surges or loss of power supply
- The water treatment plant(s) operational and CCP data from the preceding 24-48 hours.

#### 4.3 Distribution system performance and integrity:

- Maintenance of adequate disinfection residual (free chlorine residual of at least 0.2 mg/L or total chlorine of at least 0.6 mg/L in chloraminated systems). Where there is a risk of *Naegleria fowleri* (see NSW Health Naegleria fact sheet <http://www.health.nsw.gov.au/environment/water/Pages/naegleria-utilities.aspx>), free chlorine residuals must be at least 0.5 mg/L.
- Integrity of the distribution system, especially reservoir integrity
- Any recent main breaks, repairs or interruptions to supply
- Sudden changes in flow direction or surges in water supplied
- Potential for deliberate or accidental contamination
- Power surges or loss of power supply
- Continuing sample collection for operational monitoring (chlorine, turbidity and pH) and laboratory verification

Note: Before flushing mains, consider the risk that flushing may distribute contamination throughout the system if the source of contamination is unknown.



## 5 Boil water alert guidance

### 5.1 Considering the need for a boil water alert

**A boil water alert should be considered where there is a risk that cannot immediately be rectified and consumers will be exposed to contaminated water.**

Under Section 22 of the *Public Health Act 2010*, the Chief Health Officer has the power to issue advice, for the benefit of the public, concerning the safety of drinking water and any possible risks to health. This advice may include a boil water alert. The supplier of drinking water concerned must issue the advice to the public in such form and manner directed by the Chief Health Officer. The power to provide this advice is delegated to PHU Directors.

The PHU should consult with the Water Unit, Environmental Health Branch, Health Protection NSW when considering a boil water alert.

A local water utility may issue a boil water alert of its own accord. However, before issuing a boil water alert, the utility should consult with their PHU.

The water utility, PHU, Water Unit and/or Chief Health Officer will consider the following when determining the need for a boil water alert:

- The findings of the water supply system investigation
- Results of available water quality data (operational monitoring, field measurements and laboratory testing results)
- Whether proper sample collection and analysis techniques were used
- Whether samples are representative of water that is actually consumed
- The effectiveness of current treatment (including filtration and disinfection) to respond to the range of potential pathogens.
- For a critical control point exception, consider the catchment condition, raw water quality and the likelihood of pathogens entering the drinking water supply.
- Any complaints about water quality (including taste, odour and appearance) or health. Evidence of illness associated with this water supply.
- The community impact of a boil water alert (including adverse consequences such as scalds) where the cause can be resolved promptly.

### 5.2 Issuing a boil water alert

Once a decision is made to issue a boil water alert, the water utility must notify consumers urgently. The investigation should have confirmed where consumers are already exposed to the contamination, or when they will be exposed.

The conditions for lifting the boil water alert should be discussed with the PHU at the time that the alert is placed. These should include evidence of a sanitary survey, rectification of any problems, evidence that reservoir openings have been sealed and contamination removed, evidence that the supply system is operating normally (e.g.

adequate filtration turbidity, adequate disinfection residual in distribution system), and clear microbiology sampling results.

Standard words for a boil water alert due to detection of *E. coli* can be found on the NSW Health website at:

[www.health.nsw.gov.au/environment/water/Documents/bwa-e-coli.doc](http://www.health.nsw.gov.au/environment/water/Documents/bwa-e-coli.doc)

Standard words for a boil water alert due to poor raw water quality or when treatment or disinfection critical limits are exceeded can be found on the NSW Health website at:

[www.health.nsw.gov.au/environment/water/Documents/bwa-flood-treatment-failure.doc](http://www.health.nsw.gov.au/environment/water/Documents/bwa-flood-treatment-failure.doc)

In issuing a boil water alert the water utility should use the best means to communicate the information, possibly including:

- Letterbox drops
- Radio and television announcements
- Door knocking
- Signs on public taps and bubblers
- Social media
- Electronic roadside signs
- Regional SMS services
- Notify water carters and consumers who receive carted water.

Include the time and date in all updates, as messages are often repeated by others at a later time, especially across social media.

The water utility must:

- Ensure vulnerable people and those with special needs receive the information they need to make themselves safe (e.g. direct communication with schools, hospitals etc.). Translated information should be available for culturally and linguistically diverse communities. Accommodation facilities should be reminded to provide the boil water advice to all consumers.
- Notify consumers that may have received carted water drawn from the affected system.

The water utility, PHU and DoI Water should maintain close communication during the boil water alert to ensure all parties are kept up to date with findings and corrective actions.

The PHU should consider the need for enhanced surveillance for illness in communities where boil water alerts have been issued.

### **5.3 Lifting a boil water alert**

The water utility must consult the PHU before lifting a boil water alert.

In lifting a boil water alert, the water utility should communicate the information in the same way the alert was issued. The water utility should also:

- Include time and date in all updates, as messages are often repeated by others at a later time
- Include information regarding the nature of the problem, how it has been fixed and assurance that the water is now safe
- Notify consumers that may have received carted water from the affected system

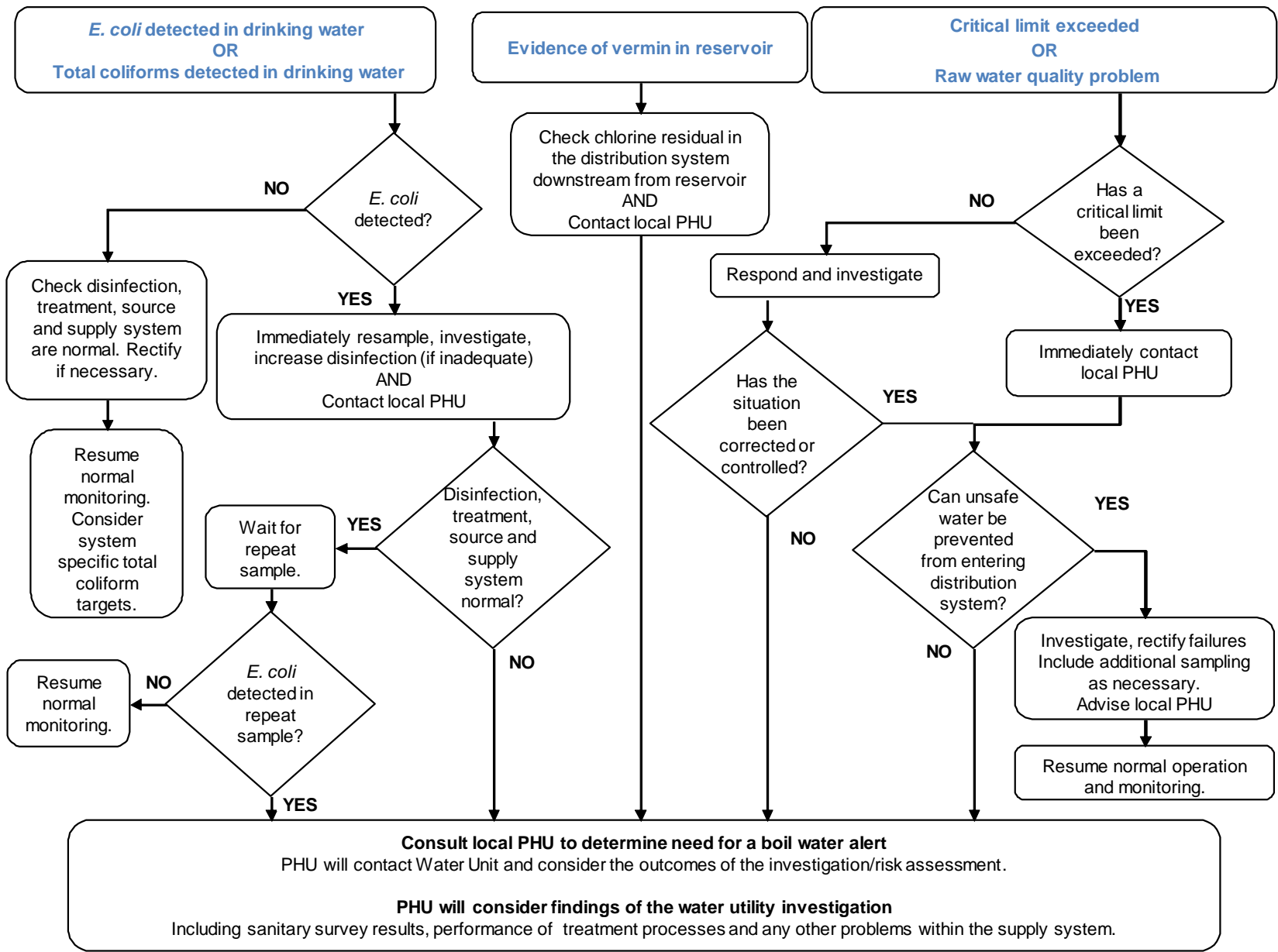
## 6 Incident debrief and reporting guidance

Directly following completion of the incident response, arrange a debrief discussion with relevant stakeholders, including all staff involved, NSW Health and DoI Water. The debrief should allow stakeholders to discuss the incident and address any issues or concerns. The aim of the debrief is to allow the utility, NSW Health and DoI Water to learn from the incident and improve operations and responses.

The debrief discussion should be followed up with a written summary report on the incident considering factors such as:

- The cause of the problem
- How the problem was first identified
- The most critical actions and pieces of information required to respond
- Challenges in communication and how were they addressed
- How well the protocol was followed
- Any necessary improvements to equipment, processes, SOPs or the incident management plan
- Documentation of relevant information during the incident
- Any actions to improve preparedness and planning for future incidents

Utilities should consider the need to support staff who may feel a significant burden of responsibility for an incident (e.g. through counselling or an employee assistance program).



**Decision making process for NSW Health Response Protocol - Managing Pathogen Risks in Drinking Water**

## 7 Appendix 1: Indicator bacteria

Testing drinking water for specific pathogens is impractical and can be unreliable. It is neither physically nor economically feasible to test for all pathogens that may be present in drinking water. For this reason tests are carried out for bacteria, which are present in faeces and indicate contamination of drinking water. The *Australian Drinking Water Guidelines* recommend that *Escherichia coli* (*E. coli*) is the most reliable and specific indicator of recent faecal contamination in drinking water. Refer to the *E. coli* factsheet in the Guidelines ([www.nhmrc.gov.au/guidelines-publications/eh52](http://www.nhmrc.gov.au/guidelines-publications/eh52)) and the *NHMRC Review of Coliforms* ([www.nhmrc.gov.au/files\\_nhmrc/file/publications/synopses/eh32.pdf](http://www.nhmrc.gov.au/files_nhmrc/file/publications/synopses/eh32.pdf)) for further information.

Additionally, the turnaround time for microbiology test results is typically at least 24 hours after sample collection and may be delayed for remote utilities. By the time a test result is available, the tested water has already entered the distribution system and been consumed.

Thermotolerant (or faecal) coliform and total coliform bacteria are no longer recommended by the Guidelines as primary indicators of faecal contamination. Although some members of these bacteria families are present in faeces, other members occur naturally in soil and water in the absence of faecal contamination. Coliform bacteria other than *E. coli* can multiply in treated drinking water under the right conditions. Even *E. coli* can multiply in raw water under some conditions but generally not in drinking water systems.

Total coliforms should generally not be detected in water sampled immediately after disinfection. While total coliforms are not a reliable indicator of faecal contamination, their presence may suggest regrowth or possible ingress of foreign material. In some cases, *E. coli* may lodge in biofilm and be released at a later time. Flushing and resampling may be necessary to confirm whether contamination is persistent.

Testing for *E. coli* can help verify the adequacy of preventive measures. However, water utilities should not rely solely on end point testing. The implementation of a comprehensive risk-based drinking water management plan is the most reliable way to protect drinking water quality.