Guidance – Drinking Water Quality Standards

Purpose

Section 17(1) of the *Safe Drinking Water Act 2003* requires water suppliers to ensure that drinking water supplied, or to be supplied, meets the water quality standards specified by the Safe Drinking Water Regulations 2015. Part 4 of the Regulations applies to water suppliers and prescribes the drinking water quality standards, the frequency of sampling and analysis, and the reporting requirements for compliance purposes. The following guidance, when read in conjunction with the Regulations, provides information to assist with the implementation of these regulatory requirements.

Introduction

Part 4 of the Regulations refers to the collection, analysis and reporting of samples of drinking water in a water sampling locality.

A water supplier must collect samples of drinking water in accordance with the water sampling program in their risk management plan. In developing their water sampling program, r.8(1)(d)(vi) requires a water supplier to consider the water quality standards.

Water suppliers must ensure drinking water samples are collected in accordance with the Regulations, and are given to an accredited laboratory to be analysed. A written summary of the results must be provided to the department by water suppliers when any analysis undertaken does not comply with the relevant sample standard.

Guidance

Water quality standards: r.12

The compliance requirements for r.12(a), Schedule 2, are:

- Three parameters must be monitored in every sampling locality,

- At a frequency of sampling not less than the frequency defined in the Schedule, and

- Must meet the standard defined in the Schedule.

The compliance requirements for r.12(b) relate to:

- An algal toxin, any other pathogen, any substance or chemical not specified in Schedule 2 in such amounts that may pose a risk to human health. These are the health based parameters that a water supplier identifies and monitors in accordance with their water sampling program.

- The Australian Drinking Water Guidelines (ADWG) is the authoritative reference for health-based guideline values and should be used to determine compliance with r.12(b). If there is insufficient information on health-based guideline values in ADWG, a water supplier should contact the department for advice.

In addition to the reporting requirements detailed in r.15, an exceedance of an identified parameter requires a notification in accordance with Section 18 of the Act. Also, where the level is such that it may pose a risk to human health, a notification in accordance with Section 22 of the Act must also be lodged with the department.

> Section 18: Notification required if non-complying water supplied
>
> A water supplier must notify the department if it becomes aware that the drinking water it is supplying does not, or is not likely to comply, with any relevant water quality standard.

Department of Health & Human Services

Schedule 2 Standards

Escherichia coli (E. coli) is an indicator of faecal contamination and any detection indicates there may be a risk to human health.

Section 22: Officer to report known or suspected contamination

It is a requirement under the *Safe Drinking Water Act 2003* that any known or suspected contamination is reported. Therefore all *E. coli* detections in drinking water must be reported in accordance with Section 22 of the Act.

The drinking water quality standard for E.coli in Schedule 2 of the Regulations requires *"all samples of drinking water collected to contain no E. coli per 100mL of drinking water with the exception of any false positive sample."*

Following an *E.coli* detection in drinking water, an investigation of the drinking water supply system must be undertaken by the water supplier and a report of the investigation submitted to the department. The standard requires both functions follow the guidelines issued by the Secretary.

The guidelines for the investigation and reporting of *E.coli* detections are provided in **Appendix 1**.

An *E.coli* detection process map is provided in **Appendix 2.**

Investigation

The overarching principle of the *E. coli* standard is to investigate the potential for contamination of the drinking water system. Consistent with risk management principles, the investigation approach involves inspection of various elements that could identify any contributing factors to a contamination event. The investigation must consider the criteria specified in paragraph c of Schedule 2.

- c(i) *"all other factors that would indicate the presence of E.coli in that water are not present in the water in the water sampling locality at the time of the investigation"*

This relates to water sampling results in response to the initial detection. Relevant parameters include but are not limited to, disinfection residual, turbidity, electrical conductivity or TDS and other *E. coli* samples or bacterial indicators such as total coliforms or heterotrophic plate counts.

- c(ii) *"the drinking water treatment process applied or other specified actions taken by the water supplier, are such as would be*

reasonably expected to have eliminated the presence of E.coli in the water sampling locality at the relevant time"

This refers to the treatment processes and actions taken to manage microbial hazards as identified in the water supplier's risk management plan. Processes to be reviewed should include primary and secondary treatment. Specified actions should include network practices in the distribution system or tank inspections.

- c(iii) *"all plant and infrastructure associated with the water treatment processes were operating to specification at all relevant times"*

This relates to the operation of the plant and refers to the performance of critical control points in the time period that the sampled water would have been produced. Critical control point measures would include whether critical limits have been exceeded.

- c(iv) *"there were no issues arising from degradation of plant or infrastructure in or around the relevant water sampling locality that could reasonably be suspected to have contributed to the presence of E.coli in the drinking water in that water sampling locality"*

This applies to the condition of any of the infrastructure in place in the water supply system and any degradation which may have contributed to the water quality results. Consideration should be given to equipment in or around the water sampling locality that supplies drinking water to customers. This could include storages that are physically outside the locality or pipes that link treatment plants to the water sampling locality where the detection occurred. Degradation may be evidenced by damaged or compromised tanks, pipe cross connections or the unintentional operation of out of service assets.

Conclusion

Schedule 2 requires that the outcomes of the investigation must consider paragraphs (c)(i)(ii)(iii) and (iv) to determine whether the initial detection of *E.coli* is representative of the water being supplied. If the investigation can conclude that there were no contributing factors in accordance with the criteria, then the initial detection can be determined a false positive sample, and the *E. coli* standard has been met.

If the outcome from the investigation is that one or more criteria have not been met, then the initial *E. coli* detection cannot be a false positive sample and a Section 18 notification will be required.

Total Trihalomethanes (total THM) is the total concentration of bromodichloromethane, bromoform, chloroform and dibromochloromethane in drinking water. Total THM may be a useful indicator of other disinfection by-products.

The total THM standard in the Regulations is consistent with the ADWG health-based guideline value. The ADWG also suggests the health risk is likely to only arise from long-term exposure to elevated concentrations of THM and that the possibility of such health risks are uncertain in comparison to the risk from inadequate disinfection.

One exceedance of the standard will require a Section 18 notification. More than one exceedance or concentrations at levels that pose an acute health risk will require a Section 22 notification as well. ADWG indicates that concentrations greater than 1mg/L are likely to pose a health risk.

The presence of any elevated level of THM should be investigated with a view to reducing the total THM concentrations. Water suppliers should aim to keep disinfection by-products as low as possible, but efforts to achieve this should not compromise effective disinfection.

Turbidity is a measure of the cloudiness of water and can be used as an indicator of issues in the distribution system. The turbidity standard aims to assess the aesthetic variability of water supplied.

Following treatment of surface water, turbidity trend data can become significantly skewed with the majority of observations being very low. Occasional high readings do occur and can be an indication of filtration or treatment problems, high flows in pipework, pipe failures, new works, or flushing and maintenance activities. Statistical measures, such as percentiles, provide a good basis for the assessment of infrequent events.

There are many methods for the calculation of percentiles from a set of observations. The method recommended by the department is described as the Weibull method and is the method adopted by the National Institute of Standards and Technology (NIST). This method provides a conservative approach to the percentile calculation; is supported by texts addressing water quality monitoring data and reflects the typical nature of observed turbidity data in drinking water systems.

For ease of calculation, Microsoft Excel 2010 and later versions contain calculation functions consistent with the Weibull method (figure 1). Other Microsoft Excel functions, including those in prior software versions, are not consistent with this approach and should not be used for calculation of percentiles.

Figure 1: Weibull percentile calculation method

Calculation of the rank of the required sample percentile of a sorted data set:

$r = p(n+1)$, where:

r = rank of the required percentile
p = proportion corresponding to the required percentile
n = number of data points (minimum of 19)

(McBride G, Using Statistical Methods for Water Quality Management, 2005, pg180)

Excel 2010 function consistent with NIST method:

=PERCENTILE.EXC (array,k), where:

Array = the set of turbidity observations
k = proportion corresponding to the required percentile (use 0.95 for the 95th%ile)

Limit of detection and Rounding

Information related to limit of detection and rounding rules are provided to assist with water quality standard compliance.

For results less than the limit of detection, it is recommended that detection limit values be replaced by L/2 as a conservative approach (ADWG 2011, p. 231). Other more conservative methods, such as adopting the detection limit without the less than qualifier, are also permissible. The method adopted by the water supplier should be detailed.

For rounding rules, rounding of calculated values can lead to confusion if the extent of rounding increases or decreases the significance of the values. Calculations (such as arithmetic averages) should be completed with the original data values prior to any rounding. The calculated value should ideally not have more than the lowest number of significant figure from the data set. Under no circumstances should a calculated value be afforded more than 1 order of significance greater than that of the original result. Rounding is not a valid method to determine compliance with Water Quality Standards or other health guideline values (ISO8000-1:2009). Where greater accuracy in sample results is required, this should be addressed with the analysing

laboratory to increase the accuracy or improve the level of detection. (ADWG 2011, p231)

Frequency of sampling for drinking water: r. 13

A water sampling program describes the parameters to be tested and the frequency of sampling for each parameter. Those parameters specified in Schedule 2 must not be sampled at a frequency less than the requirements in the Schedule.

However, a water supplier may apply to decrease the frequency at which samples are collected in respect to a parameter specified in Schedule 2 of the Regulations. If a water supplier is considering decreasing the frequency of sampling, this should be discussed with the department to determine if a proposal is appropriate.

Regulation 13(2) outlines the process for applying for a variation to the sampling frequency. The application form is provided at **Appendix 3.**

Please note variations that were approved under the 2005 Regulations, no longer apply. A new application with supporting justification will be required.

Where the frequency of sampling for Schedule 2 parameters has not met the required frequency, the water supplier must notify the department as soon as they become aware of the missed sample.

Samples of drinking water must be analysed: r. 14

Regulation 14 requires all samples of drinking water to be analysed at a laboratory that is NATA accredited for the parameters (and the matrix) that are being investigated. The key intent is to provide confidence in the results of analysis of drinking water for compliance purposes.

ADWG recommends that NATA accredited methods are utilised where possible however there are situations where novel methods are undertaken (ADWG 2011, p.141). Novel and developing analysis techniques, non-accredited laboratories and analysis may be used but not where the results of the analysis will be used to determine compliance with the water quality standards set out in regulation 12.

Results of analysis of drinking water samples must be given to the Secretary in specified circumstances: r. 15

If any drinking water samples exceed a parameter in accordance with regulation 12, a written summary of the results of analysis must be submitted within 10 days. This must include:

- The relevant sample standard and the recorded results.

- The performance history of the sample analysis parameter which should include data trends. The amount of performance data is dependent on providing enough information to demonstrate normal conditions and where variations occurred, and should be discussed with the department.

- The results of related water quality analysis. For example, parameters related to THM would include chlorine residuals and total organic carbons (TOC) or dissolved organic carbons (DOC).

> Section 23 of the Act requires a water supplier to make available, to the public within 7 days after they are compiled, results of any water quality monitoring program that it conducts on any drinking water supplied. This relates to drinking water parameters identified in the water sampling program in their risk management plan.

Appendix

Appendix 1: Guidelines for the investigation and reporting of *E.coli* detections

Appendix 2: *E. coli d*etection process map

Appendix 3: Variation to sampling frequency application form r. 13(2)

Related information

Guidance: Water sampling program: r. 8(1)(d)

Guidance: Annual reports: rr. 16, 17

NHMRC, NRMMC (2011) *Australian Drinking Water Guidelines* Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra