

Guidance notes for recreational water quality in the Northern Territory

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Contact details	Department of Health – Public Health Directorate publichealthdirectoratedoh@nt.gov.au or (08) 8922 7152
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DoH accepts no liability for costs or damages to any person or property resulting from the application of these Guidance notes.

Contents

Version control	2
Disclaimer	2
1. Introduction	4
1.1. NHMRC Guidelines.....	4
1.2. Microbial quality of recreational water – Guidance Notes.....	4
1.3. Purpose	4
1.4. Target audience	4
1.5. Source.....	4
2. Long-term assessment of how suitable a site is for swimming	5
2.1. Step 1: Sanitary inspection.....	5
2.2. Step 2: Monitoring recreational water quality	5
2.3. Step 3: The preferred faecal indicator	5
2.4. Step 4: Microbial Assessment Categories (95th Percentile).....	6
2.4.1. Enterotester.....	7
2.5. Step 5: Recreational water quality grades.....	7
3. Exceptional circumstances	9
4. Field observation record sheet	9
5. Reporting recreational water quality grades	9
6. Tips to getting started	10
7. Generic trigger levels for action when elevated microbial results are obtained during routine sampling	11
7.1. Generic trigger levels.....	11

1. Introduction

1.1. NHMRC Guidelines

The '[Guidelines for Managing Risks in Recreational Water](#)' (the NHMRC Guidelines) were released by the National Health and Medical Research Council (NHMRC) in 2008. The NHMRC Guidelines seek the adoption of a nationally harmonized approach using risk management to reduce hazards and risks associated with recreational water.

Chapter 5 – 'Microbial Quality of Recreational Water' of the NHMRC Guidelines introduces risk assessment and management based on microbial and sanitary inspection classifications. However, while the NHMRC Guidelines provide the framework on how to apply these principles, there are some areas that need further information on interpretation and application.

1.2. Microbial quality of recreational water – Guidance Notes

The WA Department of Health and the University of Western Australia prepared the '[Microbial quality of recreational water – Guidance Notes](#)' to provide supportive information to the practical application of Chapter 5 of the NHMRC Guidelines.

1.3. Purpose

The purpose of these 'NT Guidance notes' is to provide managers of recreational bodies used for swimming with supportive information to the application of the NHMRC Guidelines. This comprise a two-part approach that provides:

1. Long-term assessment of how suitable a site is for swimming that includes:
 - a. A methodology for assigning sanitary inspection categories (see Section 5.4.1 of the NHMRC Guidelines).
 - b. A methodology for calculating microbial assessment categories using the 95th percentile approach (see Section 5.3.2 of the NHMRC Guidelines).
2. Generic triggers level for action when elevated microbial results are obtained during routine sampling that includes:
 - a. How to deal with 'exceptional circumstances'.

Section 5.3.4 of the NHMRC Guidelines discusses microbial assessment for fresh and estuarine water and states that is not possible to directly derive microbial assessment categories for fresh water because of lack of data. However, the guideline value derived for coastal water can be applied to fresh water until a review of more specific data has been undertaken.

1.4. Target audience

The target audience for these NT Guidance Notes are managers of recreational waters that comprise swimming sites.

1.5. Source

The NT Guidance notes have been adapted from the 'Guidance Notes - Microbial Quality of Recreational Water' prepared by the Department of Health, Western Australia and the University of Western Australia in October 2007. Additional information has been sourced from the [NSW Beachwatch – recreational water quality program](#).

2. Long-term assessment of how suitable a site is for swimming

Recreational waters that comprise swimming sites can be graded as Very Good, Good, Fair, Poor or Very Poor in accordance with the NHMRC Guidelines

These recreational water grades provide a long-term assessment of how suitable a recreational water body is for swimming. **The grades are ideally determined from the most recent 100 water quality results (maximum of up to five years) and a risk assessment of potential faecal contamination sources.**

Rainfall is the major driver of pollution to recreational waters, generating stormwater runoff and triggering untreated discharges from the wastewater treatment and transport systems. Changes in rainfall patterns are reflected in beach water quality over time due to variation in the frequency and extent of stormwater and wastewater inputs.

2.1. Step 1: Sanitary inspection

The aim of a sanitary inspection is to identify all sources of faecal contamination that could affect a swimming location and assess the risk to public health posed by these sources. The sanitary inspection category should, to some degree, correlate with the bacterial water quality results obtained from sampling.

The main sources of faecal contamination considered in the sanitary inspection are: bathers, toilet facilities, wastewater treatment plants, sewage overflows, sewer chokes, on-site wastewater management systems, wastewater recycling, stormwater, river discharge, lagoons, boats and animals.

Rivers, lakes and estuaries themselves can be potential sources of faecal contamination to sites located in these waterbodies, with contaminated water from upstream or surrounding areas impacting water quality at the swimming location. This source is captured in river discharge or lagoon category, and shown as the waterbody in the sanitary inspection charts.

Through the sanitary inspection process, recreational waters are categorised to reflect the overall likelihood of faecal contamination. There are five categories: Very Low, Low, Moderate, High and Very High.

The initial sanitary inspection can take the form of a 'screening approach'. To assist, the NSW Beachwatch ['Sanitary Inspection Report'](#) template has been adopted for use in the NT. This is supported by instructions and a sanitary inspection example. To assist, a generic Sanitary Inspection Report template is available on the NTG webpage for [Recreational water and your health](#).

This 'screening approach' is based on a qualitative assessment of faecal sources based on 'consequence' and 'likelihood' of a public health risk occurring.

Further information about sanitary inspections is available in in Section 5.4.1 and Appendix 4 of the NHMRC Guidelines.

2.2. Step 2: Monitoring recreational water quality

Examples of methods for monitoring recreational water quality including collecting and testing water samples are detailed on NSW Beachwatch – [Monitoring beach water quality](#) and WA Department of Health – [Environmental waters publications – Forms and templates](#).

2.3. Step 3: The preferred faecal indicator

Table 5.9 of the NHMRC guidelines states that intestinal enterococci is considered the most suitable indicator for both marine and freshwater. *Escherichia coli* is intrinsically suitable for fresh water but not

marine water. However, there are currently insufficient data with which to develop guidelines for this microorganism in fresh water. Also refer to Sections 5.3.3 and 5.3.3 of the NHMRC Guidelines.

These bacteria are excreted in faeces and are rarely present in unpolluted waters. Enterococci have shown a clear dose– response relationship to disease outcomes in marine waters in the northern hemisphere. The enterococci density in water samples is analysed in the laboratory using method AS/NZS 4276.9:2007.

AS/NZS 4276.9:2007, Water microbiology Method 9: Enterococci – Membrane filtration method (ISO 7899-2:2000, MOD), Standards Australia International Ltd, Sydney and Standards New Zealand, Wellington. Enterococci are measured in colony forming units per 100mL of sample (cfu/100mL).

Stormwater in urban areas often contains sewage from leakages, overflows or sewer chokes when the sewage system fails. Sewage overflows can occur in wet weather when the network has exceeded capacity due to rainwater entering the system. The mix of sewage and rainwater discharges from designated overflow points and drains to waterways, usually via the stormwater system. Overflows from the sewage system can also occur in dry weather due to mechanical failure or power outage. Sewer chokes occur due to blockages in the pipes usually due to tree roots, oil, grease or debris. This causes sewage to back up and escape via sewer inspection points, designed overflow structures or cracks in the pipes, then drain to waterways, usually via the stormwater system. Where there is a known history or evidence of sewage overflows or sewer chokes in the catchment they are identified as sources of potential faecal contamination, particularly if they are located close to the swimming location. In these instances, the risk posed by stormwater is adjusted accordingly to ensure the overall risk to public health is not overestimated.

2.4. Step 4: Microbial Assessment Categories (95th Percentile)

There are four Microbial Assessment Categories (A to D) and these are determined from the 95th percentile of an enterococci dataset of at least 100 data points. Each MAC is associated with a risk of illness determined from epidemiological studies. The risks of illness shown below are not those associated with a single data point but are the overall risk of illness associated with an enterococci dataset with that 95th percentile.

The 95th percentile is a useful statistic for summarising the distribution of enterococci data at a site. It embodies elements of both the location of the distribution (how high/low the enterococci counts are) and the scale of the distribution (how variable the enterococci counts are).

Table 1: Summary of the MAC and the corresponding 95th percentile value (Table 5.7 of the NHMRC Guidelines)

Category	95 th percentile (enterococci)	Basis of derivation	Estimation of probability
A	≤40/100mL	No illness seen in most epidemiological studies	GII risk: <1% AFRI risk: <0.3%
B	41–200mL	200/100mL is above the illness threshold in most epidemiological studies	GII risk: 1-5% AFRI risk: 0.3-1.9%
C	201–500mL	Substantial ↑ in risk of adverse effects where dose response data available	GII risk: 5-10% AFRI risk: 1.9-3.9%
D	>500mL	Significant risk of high levels of illness transmission	GII risk: >10% AFRI risk: >3.9%

GII: gastrointestinal illness AFRI: acute febrile respiratory illness

2.4.1. Enterotester

Dr Richard Lugg (Department of Health, Western Australia) developed a Microsoft® Excel tool referred to as the [Enterotester](#) (accompanied by user instructions) for calculating a modified 95th percentile that takes into account the distribution of data (i.e. from sampling results). This tool has been adopted for use by other jurisdictions in Australia.






The minimum number of observations or sample results needed for the Enterotester to work is 8 sample results, however, recreational water quality grades are considered provisional where there is limited enterococci data.

2.5. Step 5: Recreational water quality grades

Recreational water grades provide an assessment of the suitability of a swimming location for recreation over time and are based on a combination of a sanitary inspection (identification and rating of potential pollution sources) and microbial assessment (gathered over previous years) There are five grades ranging from Very Good to Very Poor. Figure 5.1 of the NHMRC Guidelines shows the three action levels applicable to these classification grades when considering the monitoring data results.

To provide a further explanation of these terms, very good to very poor, a 'traffic light' approach of green, amber and red is described in Table 2. This approach may be useful when explaining to the public or the media the suitability of recreational water bodies. Green represents the safer areas to swim and red represents the recreational areas of higher risk. The definitions are a guide and can be changed to suit specific recreational water conditions e.g. coastal, river, estuarine and freshwater systems.

Table 2: Definitions for recreational water quality grades using the traffic light approach

	Very Good: Water is considered satisfactory for swimming at all times. Consistently very good microbial water quality and very few potential faecal pollutant sources identified indicate that water quality at this location should be of a high standard.
	Good: Conditions are safe for swimming most of the time. Microbial water quality is generally good on nearly all occasions and there are few potential faecal pollution sources identified. Standard advisories should be followed such as avoiding swimming 1 day after heavy rainfall (e.g. >10mm) in marine waters and up to 3 days after heavy rainfall in river and estuarine systems.
	Fair: Conditions are generally suitable for swimming, although microbial water quality may show times of elevated bacteria due to significant sources of faecal contamination and rainfall. Swimming should be avoided during and for up to three subsequent days following heavy rainfall (e.g. >10mm) or if there are signs of pollution such as discoloured water or odour or debris in the water.
	Poor: Location is susceptible to faecal pollution and microbial water quality is not always suitable for swimming. During dry weather conditions, ensure that the swimming location is free of signs of pollution, such as discoloured water, odour or debris in the water, and avoid swimming at all times during and for up to three days following rainfall
	Very Poor: Location very susceptible to faecal pollution and microbial water quality may often be unsuitable for swimming. It is recommended to avoid swimming at these locations almost all of the time. Permanent signage may be erected at the beach stating that swimming is not recommended.

The recreational water quality grade is determined from the matrix using the sanitary inspection category and the microbial assessment category. This grading is shown in Table 3 below (Table 5.13 of the NHMRC Guidelines) and ranges from very good to very poor.

Note that Table 3 has limitations as sites assigned a moderate Sanitary Inspection Category can only be rated as Good or Poor with no option of Fair grades. This can create the impression of a large change in water quality when in fact there need only be a slight increase in bacterial counts to push it over the threshold, with no significant increase in the risk to public health.

Table 3: Classification matrix for faecal pollution of recreational water environments* (Table 5.13 of the Guidelines)

		Microbiological Assessment Category (95 th percentiles – intestinal enterococci/100mL)				Exceptional circumstances ^c
		A ≤40	B 41-200	C 201-500	D >500	
Sanitary inspection category (Susceptibility to faecal influence)	Very low	Very good	Very good	Follow up ^b	Follow up ^b	ACTION
	Low	Very good	Good	Follow up	Follow up ^b	
	Moderate	Good ^a	Good	Poor	Poor	
	High	Good ^a	Fair ^a	Poor	Very poor	
	Very high	Follow up ^a	Fair ^a	Poor	Very poor	
	Exceptional circumstances ^c	ACTION				

^a Indicates possible discontinuous/sporadic contamination (often driven by results such as rainfall). This is most commonly associated with the presence of combined sewer overflows. These results should be investigated further, and initial follow-up should include verification of the sanitary inspection category and ensuring that samples recorded include 'event' periods. Confirm analytical results, review possible analytical errors.

^b Implies non-sewage sources of faecal indicators (e.g. livestock) which need to be verified.

^c Exceptional circumstances are known periods of higher risk, such as during an outbreak involving a pathogen that may be waterborne (e.g. avian botulism – where outbreaks of avian botulism occur, swimming or other aquatic recreational activities should not be permitted), rupture of a sewer in a recreational water catchment, etc. Under such circumstances, the classification matrix may not fairly represent risk/safety. Also see Section 3.

* In certain circumstances, there may be a risk of transmission of pathogens associated with more severe health effects through recreational water use. The human health risk depends greatly on specific (often local) circumstances. Public health authorities should be engaged in the identification and interpretation of such conditions.

Health risks

Contamination of recreational waters with faecal material from animal and human sources can pose significant health problems to beach users owing to the presence of pathogens (disease-causing micro-organisms) in the faecal material. The most common groups of pathogens found in recreational waters are bacteria, protozoans and viruses.

Exposure to contaminated water can cause gastroenteritis, with symptoms including vomiting, diarrhoea, stomach-ache, nausea, headache and fever. Eye, ear, skin and upper respiratory tract infections can also be contracted when pathogens come into contact with small breaks and tears in the skin or ruptures of the delicate membranes in the ear or nose.

Certain groups of users may be more vulnerable to microbial infection than others. Children, the elderly, people with compromised immune systems, tourists, and people from culturally and linguistically diverse backgrounds are generally most at risk.

3. Exceptional circumstances

Table 5.13 in the NHMRC Guidelines refers to 'exceptional circumstances' and a sub note at the bottom of the Table provides examples of such.

The exceptional circumstances or event that is most likely to occur (from the microbiological aspect) is the rupture of a sewage line which discharges directly or indirectly into recreational water bodies. Agencies may have in place their own risk management plans to deal with such events.

An example of wastewater overflow response flow chart is in Appendix 6 of the WA ['Microbial quality of recreational water – Guidance Notes'](#).

Factors to consider in dealing with an 'exceptional circumstance' may include:

- Identify area of spill – is it in a recreational water body, level of risk to users.
- Estimate volume of spill.
- When did it occur – is it still occurring.
- Inspect water body – note wind direction, tidal movement, colouration, floating material, location of recreational water body to spill area.
- Closure of the area – determine distance and extent of area likely to be impacted, tape off area, and erect warning signs.
- Sampling – daily upstream and downstream of spill area. Sample at shoreline and out in water body.
- Liaison with media, groups and other agencies.
- Debriefing session after clean-up with all agencies involved to assess outcomes and Action Response Plan.

Another example of an 'exceptional event' is where there is an abnormally high level of an infection (hepatitis A, cryptosporidiosis) within a community. If the sewage from such a community should enter a recreational water body then this risk may need specific attention. Liaison with DoH Public Health Directorate will be important to ensure notification of unusual disease risks are made known.

4. Field observation record sheet

On each sampling occasion it is important to record any event or happening that may have occurred which could impact on the water quality and influence the microbiological result on that day. The presence of animals or birds etc could contribute to an elevated result and needs to be recorded.

Where an elevated result is detected, the sampling officer can then refer back to the field observation record sheet to determine if there were any noticeable faecal pollutant sources identified on the day of sampling which may have caused the elevation. This information can assist the sampling officer in determining what response action is necessary.

Examples of field observation forms are available from WA Department of Health – Environmental water publications – [Forms and templates](#).

5. Reporting recreational water quality grades

An example of reporting annual recreation water quality grades is the NSW Beachwatch [Annual State of the beaches reporting](#) which provides an annual assessment of how suitable a site is for swimming.

6. Tips to getting started

If you intend to manage your recreational water bodies in accordance with the NHMRC Guidelines, the following points may assist in starting your program if you have not already started:

1. Read Chapter 5 – Microbial Quality of Recreational Water’ in the NHMRC Guidelines.
2. Read the WA ‘Microbial quality of recreational water – Guidance Notes’ to provide supportive information to the practical application of Chapter 5 of the NHMRC Guidelines.
3. Identify the recreational water bodies which are used by the public for whole of body contact activities.
4. Commence microbiological sampling of the recreational water bodies:
 - Ensure sampling techniques and procedures are in line with best practice. Note: NSW Beachwatch has a [Protocol for Assessment and Management of Microbial Risks in Recreational Water](#) which may be a good reference source.
 - Sampling should occur weekly during high use (e.g. >100 people per day) or monthly during low use (e.g. <10 people per day).
 - Sampling should be undertaken at times when most frequented by the public, e.g. weekends, holiday seasons, etc.
 - Aim to take at least 20 microbiological samples per year at each recreational water body.
5. Undertake a comprehensive sanitary inspection of each catchment area surrounding a recreational water body. Use the ‘Sanitary Inspection Report’ template as a screening approach to classify each site.
6. Review existing microbiological data, if available, for recreational water bodies and apply the 95th percentile using the ‘Enterotester’ to determine the microbial assessment category. If previous monitoring data is not available, build up the data set by weekly (or more frequent) sampling.
7. Based on 5 and 6 above, a ‘Provisional’ classification can be assigned to a recreational water body as described in the NHMRC Guidelines.
8. Maintain a secure data storage base for all microbiological results and sanitary inspection reports.

7. Generic trigger levels for action when elevated microbial results are obtained during routine sampling

The NHMRC Guidelines **do not provide specific guidance as to what level of elevated microbiological counts represents a Trigger level for action**. Rather the NHMRC Guidelines emphasise the risk management approach which relies on sanitary inspections and microbiological monitoring.

Section 5.5.4 of the NHMRC Guidelines provides indication on how to deal with contamination triggered by specific events. Elevated results may occur during routine monitoring over the summer season. These elevated results can signify deterioration in water quality. Therefore, at what elevated level is the 'trigger' requiring a response to investigate what could be the cause for such elevated results?

Appendix 5 of the ['Microbial quality of recreational water – Guidance Notes'](#) provides guidance about a response plan for elevated enterococci results.

7.1. Generic trigger levels

Generic trigger levels utilising a 'traffic light' mode is based upon enterococci data point sampling from the most recent sampling data. These modes are derived from the microbial assessment categories in Table 3. However, they do not reflect real time water quality data due to the time lag for laboratory testing, nor do they take into account factors that could explain high results such as heavy rainfall.

In these circumstances the following generic trigger levels have been determined, which have been colour coded for simplicity as:

- Green mode: **Surveillance/open to swimming** - water quality good;
- Amber mode: **Alert/open to swimming** - a sanitary inspection should be undertaken, and sampling rates increased to determine if a public health problem exists. In the alert mode it is recommended a confirmatory sample be taken within 48 hours to accurately determine whether a potential public health problem exists; and
- Red mode: **Warning/precautionary advice against swimming** - water sample results indicate a high risk exists for illness transmission.

GREEN MODE		
Status	Criteria	Action
Surveillance/Open for swimming	All samples ≤ 40 enterococci/100mL <i>No detections of Naegleria fowleri (freshwater only)</i>	<ul style="list-style-type: none"> Continue routine sampling.
AMBER MODE		
Status	Criteria	Action
Alert/Open for swimming	All samples between 41-200 enterococci/100mL <i>No detections of Naegleria fowleri (freshwater only)</i>	<ul style="list-style-type: none"> Slightly elevated enterococci (41-200 enterococci/100mL) is not unusual following rainfall. Water quality still considered Fair at these levels. May not need to increase sampling rate. Confirm poor water quality with replicate sampling. Review sanitary inspection survey, and identify if any further investigation is needed (if results persistently occur in this range).
RED MODE		
Status	Criteria	Action
Warning/precautionary advice against swimming	Two consecutive samples within 48 hours greater than 200 enterococci/100mL (if in dry weather conditions). <i>Any detections of Naegleria fowleri (freshwater only)</i>	<ul style="list-style-type: none"> Additional sampling is recommended if elevated sample (>200 enterococci/100mL) was collected in dry weather. It is not unusual to have results >200 enterococci/100mL following wet weather. Swimming is already not recommended following rainfall, and so resampling may not be needed. If levels are very high following wet weather, further investigations are recommended. Erect warning signs to inform the public near affected areas and access points. Inform the public through media or websites that a potential public health problem exists. Review sanitary inspection survey and further investigate potential sources of faecal contamination.