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ACT Guidelines for Recreational Water Quality

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ACT Guidelines for Recreational Water Quality

1.1 Introduction

The ACT Guidelines for Recreational Water Quality provide a framework for the management of recreational water sites within the ACT. It addresses risks from blue-green algae (cyanobacteria) as well as microbial pathogens.

There are a number of different types of water bodies in the ACT and they support various recreational activities, depending on the characteristic of the water. However there are only three lakes in the ACT that primary contact recreational activities are allowed. They are Lake Burley Griffin, Lake Tuggeranong and Lake Ginninderra.

The ACT Government, Environment Protection Authority (EPA) and Territory and Municipal Services (TAMS), is responsible for the management of Lake Ginninderra, Lake Tuggeranong, Molonglo Reach and the Murrumbidgee River Corridor and the National Capital Authority (NCA) is responsible for the management of Lake Burley Griffin (LBG).

The guidelines only apply to the lakes and river sites where primary contact recreational activities are permitted.

The activities that are suitable for the various water bodies are listed in the Territory Plan and detailed in the "Canberra's Urban Lakes and Ponds Plan of Management" and the "Murrumbidgee River Corridor Plan of Management".

1.2 Scope

This guideline is based on the National Health and Medical Research Council's *Guidelines for Managing Risks in Recreational Waters* published in February 2008 and adapted for local conditions.

The assessment of the water quality is based on a preventative risk management approach.

1.3 Definitions

Primary contact recreation

This involves whole-body contact in which the entire body or the face and trunk are frequently immersed or the face is frequently wet by spray, and where it is likely that some water will be swallowed, inhaled, or come into contact with ears, nasal passages, mucous membranes or cuts in the skin (e.g. swimming, diving, waterskiing, windsurfing, white-water canoeing).

Secondary contact recreation

This may involve incidental contact in which only the limbs are regularly wet and in which greater contact is unusual (e.g. boating, fishing, canoeing, and rowing). There may be occasional and inadvertent immersion through accidents (e.g. slipping into the water).

2 Blue-Green Algae

2.1 Exposure

There are three potential routes of exposure to blue-green algal toxins:

- direct contact with exposed parts of the body, including sensitive areas such as the ears, eyes, mouth, nose and throat;

- accidental swallowing; and
- inhalation of water droplets and aerosols.

Important toxin exposure routes during water contact sports include accidental swallowing, contact with nasal mucosa and inhalation. There have been reported cases of people becoming ill after exposure via inhalation and absorption through nasal and pharyngeal mucous membranes in water sports involving submersion of the head (jumping from diving boards, sail boarding and canoe capsizing, and swimming) and inhalation of aerosols (water skiing). For example, the death of a teenager was attributed to the accidental swallowing of neurotoxic *Anabaena* when diving and playing in a pond in the USA.

The greatest risk to recreational users is posed by algal surface scums. These are concentrated accumulations of blue-green algae which tend to settle along shorelines, where recreational users are likely to come in contact with them as they enter the water.

2.2 Toxins

Blue-green algae can produce three types of toxins, each with different modes of action. Australian studies indicate that about 12% of the population are sensitive to blue-green algal endotoxins.

Reactions are unpredictable as certain individuals are more sensitive to cyanobacterial exposure or may have underlying medical conditions that increase their reaction. The risks associated with blue-green algae also vary depending on length and type of contact.

2.2.1 Hepatotoxins

These are the most common of the blue-green algal toxins. They attack the liver and other internal organs. They may also cause visual disturbances, gastroenteritis, nausea, vomiting and muscle weakness. They are slower acting than neurotoxins. They can be produced by such genera as *Anabaena*, *Cylindrospermopsis*, *Microcystis*, *Nodularia*, and *Oscillatoria*.

2.2.2 Neurotoxins

These act as neuromuscular blocking agents. They produce death by paralysis of peripheral skeletal muscles, then respiratory muscles, leading to respiratory arrest. Neurotoxins are produced by species of *Anabaena*, *Aphanizomenon*, *Nostoc*, *Oscillatoria* and possibly *microcystis aeruginosa*.

2.2.3 Endotoxins

The outer walls of all blue-green algae, like other Gram Negative bacteria, contain lipopolysaccharides. These are mainly contact irritants and can cause severe dermatitis and conjunctivitis in people coming into contact with the algae through swimming or water spray. If ingested they may cause stomach cramps, nausea, fever and headaches. If inhaled they may also cause irritation to airways and breathing difficulties.

2.3 Potential Toxicity of Blue-Green Algae Species

The list below provides an **indication** of potential toxicity of certain genera. The list is not complete and provides an **indication only** of the potential toxicity, and hence potential risk, to recreational users of contaminated water.

High Risk	Potential Risk	Lower Risk
<i>Microcystis sp</i>	<i>Aphanizomenon sp.</i>	<i>Cyanodictyon sp.</i>
<i>Anabaena sp.</i>	<i>Planktothrix sp.</i>	<i>Aphanocapsa sp.</i>
	<i>Pseudoanabaena sp.</i>	<i>Chroococcus sp.</i>
	<i>Phormidium sp.</i>	
	<i>Tychonema sp.</i>	

2.4 Biovolume

Biovolume is the measure of space occupied by the algae. It is used as a quantitative measure of the volume of algal cell material in the sample.

The size of cells can vary within and between algae species. Toxin concentration relates more closely to the amount of dry matter in a sample than the number of algal cells. Therefore, biovolume has been included in the assessment process to account for mixed species or large numbers of small algal cells in the water sample.

Cell counts should be used as the primary source for determining potential risks from recreational activities. The biovolume should be used for determining the risks associated with mixed species where a known toxin producer is dominant in contrast small cyanobacteria such as *Aphanocapsa spp.*, *Aphanothece spp.*, *Cyanodictyon spp.*, *Chroococcus spp.*, or *Radiocystis spp.* are dominant.

2.5 Inspections and Observations

If visual inspections detect changes (e.g. colour of water, appearance of surface scums, odours), cell counts and species identification should be undertaken to determine the suitability of the water for recreational activities. Water samples are to be taken from the swimming areas of the relevant lake or river.

If identification reveals that the blue-green algae are dominated by small species, biovolume should be determined to provide additional data in assessing the suitability of the water body for recreational use.

2.6 Toxicity Testing

Research has shown that toxin production varies during a bloom and that a bloom may be toxic one week and not toxic the next. There are a large number of toxins produced and current toxicity testing only identifies a few. In addition, there is no way to accurately forecast what level of toxins will be produced in coming days or weeks. Based on the uncertainty from the testing and delay in receiving results, there is very little benefit of toxicity testing of recreational water from a public health perspective.

2.7 Blue-Green Algae Action Plan

Alert level	Indicative <i>Microcystis aeruginosa</i> algae cells/ml*	Biovolume equivalent*	Monitoring requirements	Typical actions (NCA or EPA)
Low	<5,000	<0.4 mm ³ /L.	Weekly visual inspections.	<u>NCA/EPA</u> Maintain routine monitoring.
Medium	≥5, 000 to <50,000 >20,000	≥0.4 to < 4 mm ³ /L	Increase to twice weekly visual inspections & take water samples as required.	<u>NCA/EPA</u> † Increase visual inspections and sampling for algal counts. If > 20,000 <i>Microcystis</i> spp. cells/mL, advise the Health Directorate, and change warning signs to indicate increased risks for skin irritations, gastrointestinal illness. Issue Media release to public and lake users.
High	≥50,000 to ≤125, 000	≥4 mm ³ /L to <10 mm ³ /L	Maintain twice weekly visual inspections and take water samples as required.	<u>NCA/EPA</u> † Maintain increased visual inspections. Regular algal counts. Advise the Health Directorate. Advise the public that water, or part thereof, is closed for primary contact use, turn off Memorial Jet. Issue media release to public and lake users to indicate site closed from primary contact use. Change warning signs to indicate site closed for primary contact use.
Extreme	≥125,000 or scums are consistently present** (40,000 cells/mL <i>Anabaena</i> sp.)	≥10 mm ³ /L	Maintain twice weekly visual inspections and take water samples as required.	<u>NCA/EPA</u> † Advise the Health Directorate. Advise public that contact with water, or part thereof, poses an increased level of risk for secondary contact users. Issue media release to public and recreational users.

* Indicative numbers for *Microcystis aeruginosa*. If other types of blue-green are dominant the biovolume should be considered.

** Persistent scums are scums that are seen each day at the recreational site.

† The Health Directorate may be contacted for advice on the cell numbers/biovolume and alert levels.

2.8 Decreasing Algal Alert Levels over Time

Reductions in alert levels from a higher to a lower level should not occur until the results from two consecutive samples have recorded lower counts for the alert level and anticipated environmental conditions (e.g. temperature etc) are not conducive to facilitating a rapid increase in blue-green algal populations.

2.9 Public Health Information

If any individual has health issues after coming into contact with cyanobacteria they should see their health care practitioner for advice.

Health information for the public when blue-green alga counts reach $\geq 20,000$ cells/ml include:

- susceptible individuals may experience skin irritations, hay fever-like symptoms or flu-like symptoms after contact with affected water;
- water users should avoid submersion of the head and shower after contact with the water;

Health information for the public when blue-green algae counts reach the High alert level (cell counts are $\geq 50,000$ cells/ml or biovolume is ≥ 4 mm³/L) include:

- there is an increased risk of adverse health events from water exposure;
- symptoms of exposure may include skin/mucosa irritation, flu-like symptoms, and gastrointestinal illness;
- the affected water is closed to primary contact recreation (including swimming, diving, water skiing and windsurfing);
- persons engaged in secondary contact recreation should be careful to limit any water exposure;
- water users should shower after contact with the water;
- event organisers should ensure that participants are aware of the blue-green algal alert level, associated exposure risks and provide adequate showering facilities after events;

Health information for the public when blue-green algal counts reach the Extreme alert level (cell counts are $\geq 125,000$ cells/ml, scums are persistent, or biovolume is ≥ 10 mm³/L) include:

- reiteration that waters, or part thereof, are closed to primary contact recreation (including swimming, diving, water skiing and windsurfing);
- there is an increased risk of adverse health events from water exposure for secondary contact recreation;
- symptoms of exposure may include skin/mucosa irritation, flu-like symptoms, and gastrointestinal illness;
- people should not engage in secondary contact recreation unless:
 - they are experienced;
 - they are informed of the algal risks and what to do if contact occurs;
 - they do not engage in primary-contact during the recreation; and
 - showering facilities, with suitable water, are available for washing after the activity;
- event organisers should ensure that participants are aware of the blue-green algae alert level, associated exposure risks and provide adequate showering facilities after events;

2.10 *Tychonema* sp. Action Plan

The advice to the public on the blue-green alga *Tychonema* sp. is based on visual site inspections and the detection of benthic growth or in worst-case situations floating clumps of *Tychonema*.

Health information for the public for closures due to *Tychonema* algae include:

- Children must not paddle in the water
- Dogs should not enter the water at all as they are very susceptible to the toxic alga when ingested.

Alert level	Inspection	Monitoring requirements	Typical actions
Low	No obvious benthic growth	Weekly visual inspections.	<u>EPA/NCA</u> Maintain routine monitoring.
Medium	Benthic growth observed	Twice weekly visual inspections.	<u>EPA/NCA</u> Maintain visual inspections and indicate risk on warning signs.
High	Obvious benthic growth and floating mats	Maintain twice weekly visual inspections and take a water sample to confirm the identity of the algae.	<u>EPA/NCA</u> Close affected area of the lake to primary contact recreation. Change warning signs to reflect this closure.

2.11 Captain Cook Memorial Jet Action Plan

The jet fountain shoots water approximately 100 metres above the lake. The wind can carry fine mist considerable distances. This may expose the public to algae or pathogens through direct contact with or inhalation of the mist.

Indicator organism		Action
≥50,000 algal cells/ml <i>Microcystis aeruginosa</i>	≥4 mm ³ /L Biovolume equivalent	<u>NCA</u> Turn off water jet
>200 cfu/100mL intestinal enterococci		

3 Microbial Pathogens

3.1 Health effects associated with faecal pollution

Recreational waters generally contain a mixture of pathogenic and non pathogenic organisms. These pathogens may be derived from other bathers, sewerage effluent overflows, domestic, rural and native animals. The pathogens include viruses, bacteria, protozoa and helminths.

The number of microorganisms that may cause infection or disease depends upon the specific pathogen, the form in which it is encountered, the conditions of exposure and the host's susceptibility and immune status. For viral and protozoal illness, this infective dose may only be a small number of organisms. Some vulnerable population groups, such as children, the elderly or immunocompromised, do require a greater degree of protection.

Microbial water quality is strongly influenced by factors such as rainfall, which generally lead to relatively short periods of elevated faecal pollution. **Swimming in receiving waters should be avoided for several days after heavy rainfall.**

The most common adverse health outcome associated with exposure to contaminated recreational waters is enteric illness, such as self-limiting gastroenteritis, which may often be of short duration and may not be formally recorded in disease surveillance systems.

Other adverse health effects such as respiratory illness, ear infections and skin and eye problems are also associated with recreational activities in contaminated water.

3.2 Indicator organism

The World Health Organisation (WHO) advocates the use of intestinal enterococci as the single preferred faecal indicator. The National Health and Medical Research Council's (2008) *Guidelines for Managing Risks in Recreational Water* follow the WHO trend for using intestinal enterococci/100mL as the preferred indicator of faecal pollution.

3.3 Sanitary inspection

An initial sanitary inspection report should be completed for all the recreational sites. The inspection should fully document the site and identify all sources of potential faecal pollution.

If enterococcal counts are >200 cfu/100mL, a follow up sanitary inspection should be undertaken by the relevant controlling authority to determine the source. The purpose of the sanitary inspection is to check the potential sources of contamination identified in the initial sanitary inspection and determine if there are any new sources of pollution.

If a source of pollution is identified, steps to minimise/eliminate the identified source(s) of contamination must be undertaken. Action such as closing the site and posting warning signs should be undertaken. If the counts are above the guideline value, take appropriate action as defined in the guidelines.

If a point source cannot be identified, appropriate actions to minimise the hazard (pollution) to the public must be undertaken. These actions include closing the site and posting warning signs, such as, swimming should be avoided for several days after a heavy rainfall event and/or providing advice on the web site. See the guidelines for the typical actions.

3.4 Monitoring

Monitoring of the recreational sites should commence just before the main swimming season to determine if any unusual conditions exist. This will allow for remedial action to be undertaken.

The sampling frequency during the recreational season is normally once per week.

Monitoring should finish when the climatic conditions restrict the public from engaging in primary contact recreational water activities.

3.5 Microbial Action Plan

The table below outlines the microbial water quality assessment criteria using intestinal enterococci as the indicator organism.

Alert Level	Count cfu/100mL	Monitoring Requirements	Typical Actions
Open	≤ 200	Continue weekly sampling	<u>Health/NCA/TAMS</u> Maintain routine monitoring - no additional action is required.
Closed	>200	Initial sample	<u>Health/NCA/TAMS</u> Take another sample as soon as practical. The site remains open until the results of the repeat sample is known, unless a contamination event is confirmed, then the site should be closed for primary use.
		Repeat sample	<p>If repeat sample ≤200 cfu/100mL; - The site remains open & maintain routine monitoring.</p> <p>If repeat sample >200 cfu/100mL;</p> <ul style="list-style-type: none"> - Inform TAMS/NCA to advise the public of the health risk. - Advise the public that the recreational site is closed for primary contact use. - Identify source(s) of contamination & undertake a sanitary survey if considered necessary. - Take another sample as soon as practical. - TAMS/NCA to advise public that contact with water must be avoided as high counts of indicator bacteria may lead to severe illness for secondary contact users. - Change warning signs

3.6 Reopening after microbiological closure

Reopening a recreational site after a closure following microbiological contamination requires **two** samples to be <200 cfu/100mL and the source of the contamination has ceased and a sanitary inspection (if undertaken) has not identified additional sources of contamination. Occasionally additional samples may be required to confirm the source of the contamination has ceased.

4 Agency Responsibilities

ACT lakes and rivers are inspected weekly to detect visual changes in water quality. The results are updated and made available on the National Capital Authority, Environment and Sustainable Development Directorate and Territories and Municipal Services Directorate web sites.

The Health Protection Service (HPS) of the Health Directorate assesses information provided by the Managers of the water body and give advice to the Managers on the appropriate action to

take. The HPS also provides advice on the health effects of microbial pathogens including routes of exposure, toxicity of the various cyanobacterial species and exposure symptoms.

The NCA is responsible for all aspects of Lake Burley Griffin.

ACT Government officers in the EPA and TAMS monitor Lake Tuggeranong, Lake Ginninderra, Molonglo Reach and Murrumbidgee River Corridor weekly during the main swimming season for both blue-green algae and microbial pathogens. Lake Tuggeranong, Lake Ginninderra and Molonglo Reach are monitored year round for blue-green algae.

4.1 Advice from the Health Directorate

The CHO may advise to close the water body, or part of, before results from indicator testing has been presented, for primary and secondary contact use if there is a risk to public health.

The Health Protection Service provides advice on matters regarding water quality, faecal contamination, blue-green algal blooms and risks to the public from recreational activities on the waterways.

The collection of samples and availability of results is critical when providing advice to recreational users on the health risks and possible closures of a water body. Water samples should be taken on Monday and Wednesday for cyanobacterial counts or Monday and Tuesdays for bacteriological results. To allow the agencies to provide timely advice to event organisers for weekend events, the Health Directorate requires the results of sampling by 10.00 am on Thursdays.

4.2 Warning signs

When required warning signs are present at high-traffic water entry areas and designated recreational sites. These warning signs are altered to indicate the current risk for recreational activities at the particular site.

4.3 Public relations

The NCA, EPA and TAMS, in consultation with Health Directorate, will issue media releases for Medium, High and Extreme blue-green algal alert levels as well as open or closed for the microbiological parameters. The NCA, EPA and TAMS will also advise key stakeholders of changes in these alert levels.

4.4 Contacts

4.4.1 Health Directorate

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Fax: 5124 5554

Website: www.health.act.gov.au/hps

4.4.2 National Capital Authority

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Website: www.nationalcapital.gov.au

4.4.3 Territory and Municipal Services Directorate

Parks Conservation and Lands
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Canberra ACT 2601

Phone: 13 22 81
Fax: 6207 6080
Website: www.tams.act.gov.au

4.4.4 Environment and Sustainable Development Directorate

Environment Protection
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Canberra City 2601

Phone: 13 22 81
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Website: www.environment.act.gov.au