

UPDATED TO INCLUDE
BIOVOLUME



Health Protection Service

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ACT Guidelines for the Management of Blue-Green Algae in Recreational Water

Introduction

Water-based recreational activities are popular during the summer–autumn season in the ACT.

The management of blue-green algae in our waterways is necessary to protect human health during recreational activities and to preserve the aesthetic appeal of water bodies.

Although blue-green algae are common and naturally occurring organisms, they are of a public health concern because some species produce toxins. These toxins can be potential hazards in waters used for recreational activities especially if ingested.

The presence of toxic blue-green algae in a water body is not necessarily an environmental or human hazard as long as the cells remain thinly dispersed in the water body. However when algae concentrate they form scums and pose an increased health risk.

In the ACT the main toxic algae of concern are;

- the free floating forms such as *Microcystis* and *Anabaena spp.*
- the benthic (attached) *Tychonema sp.*

Scope

These guidelines are intended to provide a framework for the management of recreational water quality in ACT lakes and rivers. The approach outlined in these guidelines is based on a preventive risk management approach and will provide guidance on the free floating blue-green algae as well as the benthic *Tychonema sp.*

Types of Blue-Green Algae

Blue-green algae are found in all waters, forming part of the phytoplankton. The natural occurrence of low cell numbers in the environment is of benefit due to their nitrogen fixing capabilities. In small numbers they are of no significance, only when excessive numbers (blooms) occur do they cause problems, either by giving rise to odours and taints or producing toxins.

The predominant species of blue-green algae found in the ACT's lakes and rivers are *microcystis spp.* and *anabaena spp.*

During certain times of the year the occurrence of *Tychonema bornetti* is predominant. This species is benthic and will only grow attached to objects such as the sand, rocks and possibly ribbon weed. During the process of photosynthesis oxygen bubbles can become trapped in the benthic mats, which can lift off the bottom, and float to the surface where they die, releasing toxins into the water.

Health Effects

Exposure

There are three potential routes of exposure to the toxins:

- direct contact of exposed parts of the body, including sensitive areas such as the ears, eyes, mouth and throat;
- accidental swallowing; and
- inhalation of water.

Intake of toxins through swallowing, contact with nasal mucosa or by inhalation are important routes of exposure to toxins during water contact sports. There have been reported cases of people becoming sick after exposure via inhalation and resorption through nasal and pharyngeal mucous membranes in water sports involving submersion of the head (jumping from diving boards, sailboarding, canoe capsizing, swimming) and inhalation of aerosols (water skiing).

Risks of ingestion are particularly high for children playing in shallow near-shore water where scums tend to accumulate.

Toxins

Blue-green algae can produce three different types of toxins with different modes of action.

Hepatotoxins

They are the most common of the blue-green 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 species as *Anabaena*, *Cylindrospermopsis*, *microcystis*, *Nodularia*, and *Oscillatoria*.

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* and *Oscillatoria*.

Endotoxins

The outer walls of all blue-green algae 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 showering. They may also cause stomach cramps, nausea, fever and headaches and if swallowed may also cause irritation to airways and breathing difficulties.

Lipopolysaccharides from blue-green algae can produce irritant and allergic responses in humans and animals that come into contact with the compounds.

There have been reported cases of adverse health consequences for swimmers exposed to blue-green algal blooms. The symptoms include itchy contact dermatitis, hay fever like symptoms, conjunctivitis and asthma. Gastroenteritis may result from accidentally ingesting the water.

Biovolume

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

The size of cells can vary within and between species and toxin concentration relates more closely to the amount of dry matter in a sample rather than to the number of cells.

The use of biovolume for determining compliance has been included to account for mixed species or small algae.

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

Potential Toxicity of Blue-Green Algae Species

This list below is to provide an **indication** of potential toxicity of certain genera. This list is not complete and is to provide an **indication only** of the potential toxicity and hence potential risk to recreational users of the 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>	

Guidelines

The guidelines are based on the National Health and Medical Research Council's *Guidelines for Managing Risks in Recreational Waters* (June 2005).

If visual inspections detect changes, cell counts and species identification should be undertaken to determine the suitability of the water for recreational activities.

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.

Blue-Green Algae Action Plan

Alert level	Blue-green algae cells/mL	Biovolume equivalent	Monitoring requirements	Typical actions
Low	>500 to <5,000	>0.04 to <0.4 mm ³ /L.	Weekly visual inspections.	Maintain routine monitoring.
Medium	≥5,000 to <50,000	≥0.4 to <4 mm ³ /L	Increase to twice weekly visual inspections & sample weekly.	Increase visual inspections and sampling for algal counts. If > 20,000 cells/mL, advise ACT Health & post on-site warning signs for skin irritations, gastrointestinal illness.
High	≥50,000 or scums are consistently present	≥4 mm ³ /L	Maintain twice weekly visual inspections and take water samples.	Maintain increased visual inspections. Regular algal counts. Toxicity testing if necessary. Advise ACT Health. Advise public, water is unsuitable for primary & secondary contact use. Post lake closed signs.

Decreasing 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 and anticipated environmental conditions (ie temperature and rain) are not conducive to facilitating a rapid increase in blue-green algae populations.

Tychonema sp. Action Plan

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

Alert level	Inspection	Monitoring requirements	Typical actions
Low	No obvious benthic growth	Weekly visual inspections.	Maintain routine monitoring.
Medium	Benthic growth observed	Twice weekly visual inspections.	Maintain visual inspections and post 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.	After advice from ACT Health, close affected area of the lake.

Management

Environment Protection Officers perform inspections of ACT Lakes. The inspection results are updated and made available on the Environment ACT website. If algae are assessed at significant levels in any of the lakes, water samples are taken to determine the blue green algal count.

The Health Protection Service (HPS) of ACT Health assesses information provided by the National Capital Authority (for Lake Burley Griffin) and/or Environment ACT (for Lake Tuggeranong and Ginninderra and Molonglo River) and provides comments and advice on the course of action i.e. posting of warning signs and lake closures.

HPS also provides advice on the health effects of algae including, routes of exposure, toxicity of the various species and exposure symptoms.

Advice from ACT Health

The collection of samples and availability of results is critical when providing advice on health risks` and possible closures to recreational users of the water body.

To provide timely advice to event organisers for weekend events, ACT Health requires the results from two consecutive samples by 10.00 am Thursday.

Reductions in alert levels from a higher to a lower level require two consecutive samples to have recorded lower counts. For example, samples should be taken on Monday and Wednesday to provide information by 10.00 am Thursday.

Action

The following action is to be taken if the blue green algal counts/observation indicates a:

Low Level Alert

- Maintain routine monitoring.

Medium Level Alert

- Increase to twice weekly visual inspections & sample weekly.
- If > 20,000 cells/mL or benthic growth observed, an Environment Protection Officer contacts the Health Protection Service with the sample results and assessment of the lake conditions. Based on the information provided, the Health Protection Service may advise the Environment Protection Authority to post warning signs.
- A media release is prepared by the Arts, Heritage and Environment Senior Media Advisor in consultation with the Senior Media Advisor ACT Health. When approved, by each of the organisations the Senior Media advisors notify the relevant media. In addition, an Environment Protection Officer faxes the media release to the Canberra Connect Call Centre; Chief Executive, Urban Service; Health Protection Services; Environmental Management, Parks and Places; ACT Water Police; Director, Sports and Recreation ACT; CRC for Freshwater Ecology; National Capital Authority; ACT Water ski Association; Burley Griffin Canoe Club; Lake Tuggeranong Rowing Club.
- Warning signs are displayed around the lake.
- The lake affected by algae is checked twice weekly. When there is a visible improvement in the lake, water samples are taken.
- When algae levels are below the alert level, an Environment Protection Officer contacts the Health Protection Service with the sample results and assessment of the lake conditions. Based on the information provided, the Health Protection Service may advise the Environment Protection Authority to take down warning signs.
- A media release is prepared by the Arts, Heritage and Environment Senior Media Advisor. When approved, by each of the organisations the Senior Media Advisors notify the relevant media. In addition, an Environment Protection Officer faxes the media release to all previously listed organisations and government departments.
- Warning signs around the lake are taken down.

High Level Alert

- An Environment Protection Officer contacts the Health Protection Service with the sample results and assessment of the lake conditions. Based on the information provided, the Health Protection Service may advise the Environment Protection Authority to close the lake.
- A Declaration of Closure is prepared and signed by a Delegate of the Minister for the Environment pursuant to Section 21(1) and 22 of the *Lakes Act 1976*. The Declaration is advertised in the Public Notices of The Canberra Times.
- A media release is prepared by the Arts, Heritage and Environment Senior Media Advisor in consultation with the Senior Media Advisor ACT Health. When approved, by each of the organisations the Senior Media Advisors notify the relevant media. In addition, an Environment Protection Officer faxes the media release to the Canberra Connect Call Centre; Chief Executive, Urban Services; Health Protection Services, ACT Health; Environmental Management, Parks and Places; ACT Water Police; Director, Sports and Recreation ACT; CRC for Freshwater Ecology; National Capital Authority; ACT Water ski Association; Burley Griffin Canoe Club; Lake Tuggeranong Rowing Club.
- Lake closed signs are displayed around the lake. (For the Molonglo Water ski Reach, bookings are cancelled and persons with bookings are notified)
- The lake affected by algae is checked twice weekly. When there is a visible improvement in the lake, water samples are taken.
- When algae levels are below the alert level, an Environment Protection Officer contacts the Health Protection Service with the sample results and assessment of the lake conditions. Based on the information provided, the Health Protection Service may advise the Environment Protection Authority to re-open the lake
- A media release is prepared by the Arts, Heritage and Environment Senior Media Advisor in consultation with the Senior Media Advisor ACT Health. When approved, by each of the organisations the Senior Media Advisors notify the relevant media. In addition, an Environment Protection Officer faxes the media release to all previously listed organisations and government departments.
- Lake closed signs around the lake are taken down. If reduced to a medium alert level, warning signs are displayed. If reduced to a low or no alert level, no signs are displayed.

Contacts

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