Environmental quality criteria for toxic algae in marine recreational water

Background

As part of the Office of the Environmental Protection Authority (OEPA) review of the Cockburn Sound State Environmental Policy 2005, the Department of Health, Western Australia (DOHWA) has developed in collaboration with the OEPA, and other stakeholders, Environmental Quality Criteria (EQC) for toxic algae in marine recreational water.

Understanding the Water Quality Management Framework

The Water Quality Management Framework adopted by the OEPA for protecting environmental values in marine waters is based on the table opposite. This table highlights **Environmental Values (EV)** i.e. core principle areas, and then details **Environmental Quality Objectives (EQO)** i.e. what specifically is trying to be achieved or maintained within the marine environment. The assigning of the **Level of ecological protection** follows, high, medium or low.

Most important from this factsheet perspective is the **Environmental Quality Criteria (EQC)**, which provides levels to ensure the **EQO's** and **EV's**.

Water Quality Management Framework

Understanding Environmental Quality Criteria, Guidelines and Standards

Environmental Quality Criteria (EQC) Defined

EQC are established to provide environmental quality benchmarks against which environmental quality and the performance of environmental management can be measured. EQC are generally quantitative and are usually described numerically.

Environmental Quality Guidelines (EQG) Defined

EQG are threshold numerical values or narrative statements which if met, indicate that there is a high degree of certainty that the associated EQO has been achieved. If the EQG is not met, then there is uncertainty as to whether the associated EQO has been achieved, and a more detailed assessment against an 'Environmental Quality Standard' (EQS) is triggered. This assessment is risk-based and investigative in nature.

Environmental Quality Standards (EQS) Defined

EQS are threshold numerical values or narrative statements that indicate a level beyond which, there is a significant risk that the associated EQO has not been achieved and a management response is triggered. The response would normally focus on identifying the cause/source of the exceedance and eradicating or reducing the contaminant of concern.

Environmental Quality Criteria Guidance Notes

Environmental Quality Guidelines (EQG)

Toxic algae

Historical numerical environmental quality guidelines for toxic algae have primarily been developed for inland/fresh waters. In the absence of any known numerical guideline for marine waters, the numerical guidelines referred to in this document are generally indicative and conservative, and thus designed to protect public health.

These numerical guidelines are based upon an understanding, that recreational contact and exposure to potentially toxic algae may pose a low level public health risk; whereby some people could experience mild health effects which cause temporary discomfort or difficulty e.g. skin or respiratory irritation.

A watching brief will also be maintained to consider any reports of human health illness/disease that may be attributable to potentially toxic algae.

Monitoring

If phytoplankton water sampling results identify 'DOHWA watch list' (**Table 1**) species or exceed their trigger levels, re-sampling (within 48 hours of trigger level exceedance identification), and a visual assessment for algal scum (refer also to **Table 2**) within the defined recreational area shall be undertaken.

A detection or exceedance of 'DOHWA watch list' (**Table 1**) species will increase monitoring frequency to, weekly sampling and visual assessment for algal scum. Weekly monitoring will continue until, two consecutive all-clear results are achieved i.e. samples and visual assessment do not trigger EQG or EQS criteria.

Note: Visual assessment shall be undertaken at that time of the day, which in general experiences calmer water conditions for that season. For example, when known prevailing winds are not blowing or are as strong as what typically maybe experienced. In general morning conditions may tend to provide calmer wind and weather conditions.

The resample shall be analysed to determine algal groups and cell counts and results of the analysis shall be reported to DOHWA. This information will enable DOHWA, to communicate any potential impacts that detection or exceedance may pose to primary contact recreational water activities.

Environmental Quality Standards (EQS)

Toxic algae

Historical numerical EQS for toxic algae have primarily been developed for inland/fresh waters. In the absence of any known numerical guideline for marine waters, the numerical EQS referred to in this document, is indicative, and designed to indicate when recreational exposure to potentially toxic algae is likely to pose a medium-high level risk to public health.

A medium to high level risk to public health may be considered to represent an incidence when, an increased proportion of people, who undertake primary contact water recreation

experience some health compromising effects e.g. more severe intense skin and respiratory reactions, gastrointestinal or other illness.

If an EQS is exceeded, the exceedance should be referred to DOHWA for advice as to the appropriate management actions required to be implemented.

If the exceedance involves:

- a potentially toxic algal species at an elevated level, or;
- if algal scums are present at moderate to high risk levels (refer to **Table 2**), as determined/confirmed by DOHWA,

The relevant management action will likely include:

- The erection of warning signs;
- The issue of a press release, and;
- Ongoing monitoring at increased frequency, including;
    - Weekly to fortnightly sampling, and;
    - Daily visual assessment of algal bloom location, movement, density and total area of coverage.

Upon exceedance of an EQS, sampling shall be undertaken at regular durations (fortnightly at a minimum and more frequently for more apparently significant events).

Note: Weekly sampling at a minimum is recommended in the event of a press release.

Sampling shall be undertaken for the duration of the exceedance/detection event, to determine whether toxic species are present at potentially harmful concentrations.

Phytoplankton cell counts should be performed for each potentially toxic species present.

Phytoplankton Sampling Methodology

The water sampling methodology for phytoplankton shall include the following:

1. Select a suitable access point e.g. open water, shoreline, bridge or weir.
2. Collect a minimum of 3 x 1.5-2m depth tube/hosepipe samples over the representative recreational area.

   Note: Sampling on different sides of a stationary boat is acceptable. When sampling, ensure that the 5-20cm benthic (bottom) layer is avoided.
3. Mix the collected samples into a large container (at least 25-50L of sample is required).
4. Collect 2 composite samples from bucket (1 fixed sample and 1 fresh sample).
5. Submit composite samples for analysis.

Environmental Quality Guideline (EQG) for toxic algae in marine recreational water

A. The phytoplankton cell count* from a single site, should not:

- Exceed 10, 000 cells/mL, or;
- Detect 'DOHWA watch list' (**Table 1**) species or exceed their trigger levels. #

B. There should be no reports of skin, eye or respiratory irritation or potential algal poisoning in swimmers *considered by a medical practitioner as potentially resulting from toxic algae*.

Environmental Quality Standard (EQS) for toxic algae in marine recreational water

A. The phytoplankton cell count* from a single site should not:

- Exceed 50, 000 cells/mL, or;
- Exceed 'DOHWA watch list' (**Table 1**) action levels.

C. The presence of algal scums+ (NHMRC 2008) - Refer also to 'DOHWA watch list' (**Table 1**) action levels for algal filaments or scums.

D. There should be no confirmed incidences by report from a medical practitioner, of skin, eye or respiratory irritation, caused by toxic algae or of algal poisoning in swimmers.

---

* Phytoplankton cell counts include cyanobacteria and eukaryotic organisms.

\# Exceedance of 'DOHWA watch list' (**Table 1**) trigger levels, should trigger re-sampling of the site within 48 hours of identification of the exceedance for assessment against EQS A.

\+ **Algal Scum:** dense accumulation of algal cells at or near the surface of the water forming a layer of distinct discolouration (green, blue, brown or red) (Government 2002).

Glossary

Algae	Comparatively simple chlorophyll-bearing plants, most of which are aquatic and microscopic in size
Cyanobacteria	A division of photosynthetic bacteria, formerly known as blue-green algae that can produce strong toxins.
Eukararyotic organisms	Organisms characterised by the presence of membrane-bound organelles. Opposite to Prokaryotes.
Phytoplankton	Small often microscopic plants suspended in water.

(Australian and New Zealand Environment and Conservation Council and and Agriculture and Resource Management Council of Australia and New Zealand 2000)

Table 1: DOHWA Watch list for potentially toxic algae in marine recreational waters

Algal Group	Algal Genus/ Complex	Key Species	DOHWA Watch List Trigger Levels (cells/L)	DOHWA Watch List Action Levels (cells/L)
Cyanobacteria	*Lyngbya*	*majuscula*	Detected	relatively widespread visible presence of algal filaments (NHMRC 2008)
	Trichodesmium			presence of algal scums (NHMRC 2008)
	Other		≥5,000	≥15,000
Dinoflagellates	*Karenia*	*brevis*	≥5,000	≥10,000**
	Karenia	*Sp.*	≥50,000	≥100,000**
	Pfiesteria		Detected	presence of algal scums (NHMRC 2008)

** This is a temporarily assigned action level for which the DOHWA may consider it appropriate to issue a public health warning and/or provide information/advice, having consideration for the specific monitoring event and result in the overall situation/context.

Table 2: DOHWA risk assessment for algal scum in marine waters

Algal Scum/Filaments Distribution/Characteristic	Algal Scum Location	~ Total Area of Scum = 1 to 25m2	~ Total Area of Scum = 25 to 100m2	~ Total Area of Scum > 100m2	Risk Level
patchy/sporadic in nature	1. along shoreline at recreational beach/area	Moderate	High	High	
	2. within swimming zone at recreational beach (< 500m from shoreline)	Low	Moderate	High	
	3. > 500m offshore	Low	Low	Moderate	
	4. along shoreline (non-recreational area) e.g. rocky outcrop, boat harbour/marina.	Low	Low	Moderate	
	5. < 500m from shoreline (non-recreational area) e.g. rocky outcrop, boat harbour/marina.	Low	Low	Moderate	
continuous aggregated	1. along shoreline at recreational beach/area	Moderate	High	High	
	2. within swimming zone at recreational beach (< 500m from shoreline)	Moderate	High	High	
	3. > 500m offshore	Low	Low	Moderate	
	4. along shoreline (non-recreational area) e.g. rocky outcrop, boat harbour/marina.	Low	Low	Moderate	
	5. < 500m from shoreline (non-recreational area) e.g. rocky outcrop, boat harbour/marina.	Low	Low	Moderate	

References

Australian and New Zealand Environment and Conservation Council and and Agriculture and Resource Management Council of Australia and New Zealand (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality Canberra, ACT. **1**.

Government, Q. (2002). Queensland Harmful Algal Bloom Response Plan. D. o. H. Qld. Queensland, Queensland Government - Department of Health**:** 13.

NHMRC (2008). Guidelines for Managing Risks in Recreational Water. Canberra**:** 215.

More Information:

Water Unit
Environmental Health Directorate
Department of Health
PO Box 8172
PERTH BUSINESS CENTRE WA 6849

Telephone: 08 9388 4999
Email: ehinfo@health.wa.gov.au

Or

Environmental Protection Authority
Locked Bag 10
EAST PERTH WA 6892

Telephone: 08 6145 0800
Email: info@epa.wa.gov.au

Printed on: 27 October 2017

Version 2

Produced by Environmental Health Directorate

W:\Public Health\EHD\Water Unit\PUBLICATIONS\Environmental\Section\Fact Sheet\Algae\Environmental Quality Criteria for toxic algae in marine recreational water_V2.docx