



# *The development of practical guidance manuals for the management of cyanobacteria*

Gayle Newcombe

# Management of Cyanobacteria: A Guide for Water Utilities

# The idea

“There is lot of excellent research on all aspects of toxic cyanobacteria, but I don’t have the time to wade through hundreds of reports, books and papers. Why don’t you produce a handy guide that everyone can use?”

**Keith Craig, Veolia Water, 2002**

# The idea

Sounded like a good idea at the time!

# The aim

The development of a guide to be used by water utilities that will consolidate *all available current knowledge* on the management of cyanobacteria. Main source, 20 years of applied and fundamental research and practical management experience of SA Water and the AWQC

# Management of Cyanobacteria: A Guide for Water Utilities

## Co-authors

- Mike Burch
- Jenny House
- Lionel Ho

## Partners

- SA Water
- United Water
- Veolia Water
- CRC WQT
- WQRA

# The structure

- ✚ Source water management
- ✚ Water treatment

# The structure

- ✚ A series of questions, with additional information
- ✚ All you ever wanted to know about management of toxic algae, but didn't know where to go for the *simple* answer

# The structure

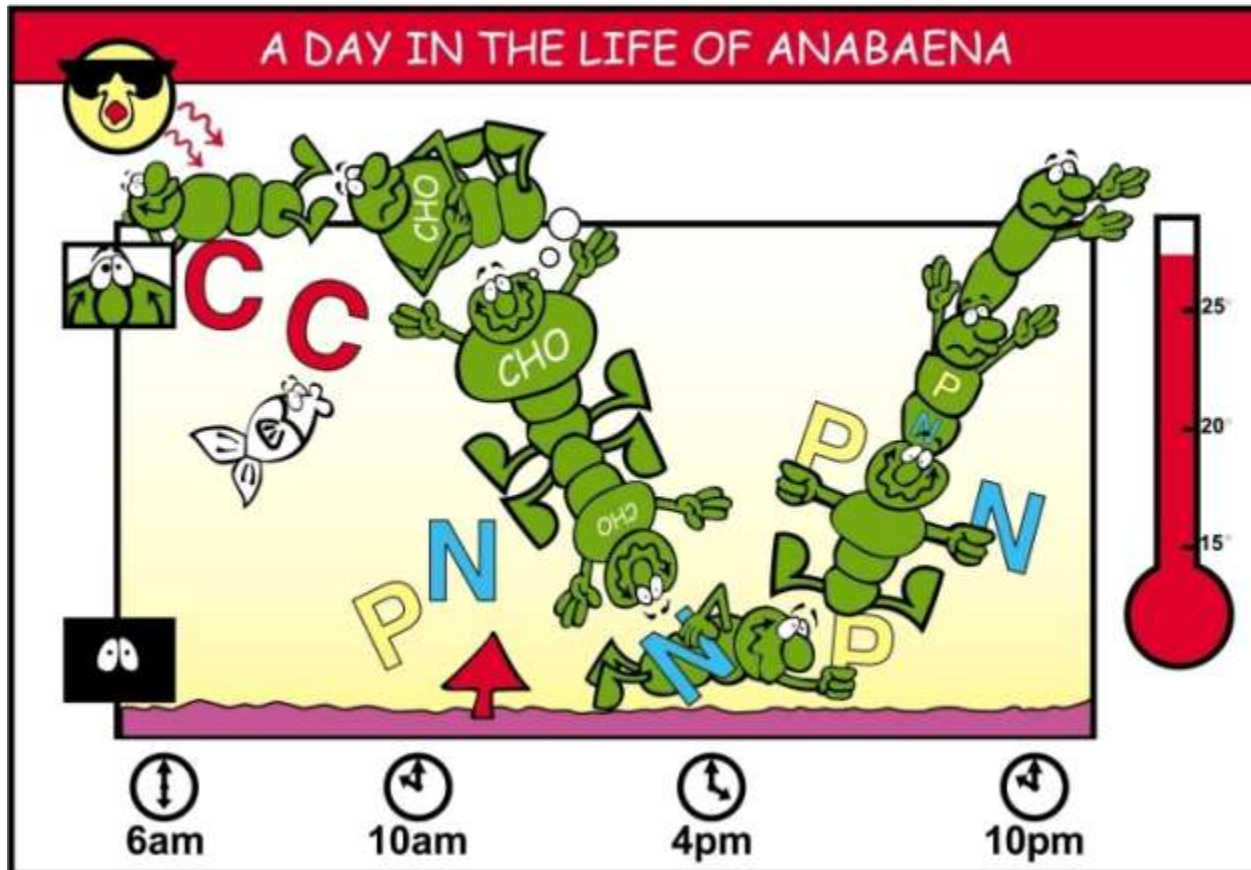
## ✚ Source water

- ✚ Types of cyanobacteria, toxins they produce and health effects
- ✚ Factors controlling growth
- ✚ Risk assessment
- ✚ Alert Levels Framework
- ✚ Monitoring/analysis
- ✚ Management

# The structure

- ***Why do cyanobacteria grow and form blooms?***

# Buoyancy regulation



# The structure

- ***Is it possible to predict the concentrations of toxins and odours that could occur?***

# Risk assessment

Table 3: Combinations of major variables that influence the potential for cyanobacterial growth in lakes.

Potential for Cyanobacterial Growth	Environmental factor			
	History of Cyanobacteria	Water Temperature (°C)	Nutrients Total Phosphorus (µg/L)	Thermal Stratification
Very Low	No	<15	<10	Rare or Never
Low	Yes	<15-20	<10	Infrequent
Moderate	Yes	20-25	10-25	Occasional
High	Yes	>25	25-100	Frequent and persistent
Very High	Yes	>25	>100	Frequent and persistent/strong

# The structure

## Treatment

-  Conventional treatment

-  Activated carbon

-  Oxidants

-  Membranes

-  Biological filtration

-  PAC and GAC testing procedures

# The structure

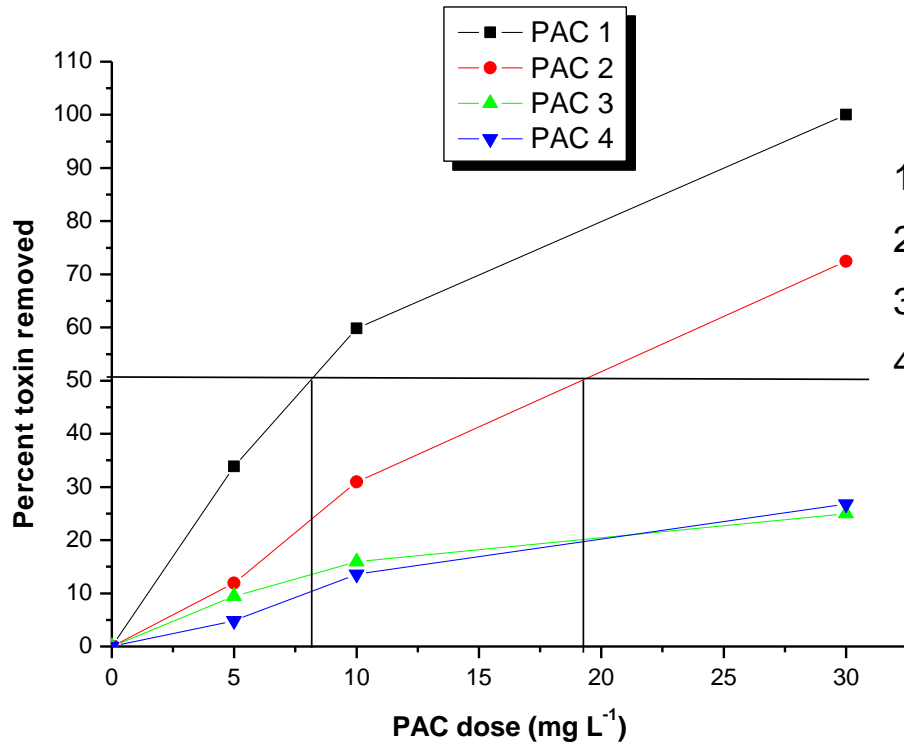
- *How much PAC should we dose?*

# Powdered activated carbon

	Inlet concentration (ng L <sup>-1</sup> )	PAC dose (mg L <sup>-1</sup> )	Type of PAC
Geosmin	10-30	4-15	Good quality wood, coal or coconut, steam activated
	30-100	15-35	
MIB	10-30	6-30	
	30-100	30-55	

**Table 3 Typical doses required to remove MIB and geosmin to levels below 10 ng L<sup>-1</sup>**

\*These doses were estimated from many laboratory experiments but the actual doses required will depend strongly on water quality. Site specific testing is recommended



PAC

	Dose required for 50% removal	Cost per kilogram	Cost per ML of water treated
1	8	4.20	<b>\$34</b>
2	19	1.80	<b>\$35</b>
3	>>30	3.80	<b>&gt;&gt;\$ 114</b>
4	>>30	2.30	<b>&gt;&gt; \$69</b>

# The structure

- ***What doses are required for reduction of toxin concentration using chlorination?***

# Oxidation

- **General recommendations**
- ***Microcystins saxitoxins, and cylindrospermopsin:***
- pH <8
- Residual >0.5 mg L<sup>-1</sup> after 30 minutes contact
- Chlorine dose > 3 mg L<sup>-1</sup>
- CT values in the order of 20 mg min L<sup>-1</sup>
- 
- Destruction of the toxins could be expected to range between almost 100% for cylindrospermopsin and the more susceptible microcystins to approximately 70% for saxitoxins



# Management of Cyanobacteria: A Guide for Water Utilities

Expected publication by WQRA, end  
of 2009



# International Guidance Manual for the Management of Toxic Cyanobacteria

# The idea

GWRC/CRC Workshop on current research and strategic directions for the management of toxic algae in water and drinking water supplies

Adelaide 2004

- ✚ WRC South African Manual
- ✚ EU TOXIC Project: Best Practice Guidance Manual
- ✚ and ours

# Aims of the project

- ✚ To develop an international manual for the management of toxic cyanobacteria
  - ✚ Combining different aspects of the three manuals

# Participants –members of the GWRC

- CRC (Australia)
- WSAA (Australia)
- Water Research Commission (South Africa)
- Anjou Recherche (France)
- UKWIR (UK)
- AwwaRF (USA)
- USEPA (USA)
- CDC (USA)
- TZW –Water Technology Centre (Germany)
- UBA (Germany)








# GWRC workshop

## Feb 2007, Capetown, SA

- ✚ Aim of the workshop
  - ✚ To develop the contents and allocate the effort to produce an international manual for the management of toxic cyanobacteria
    - ✚ Web-based document, written on several levels

# International Guidance Manual

## Table of contents

-  Foreword
-  Chapter 1: Introduction
-  Chapter 2: Hazard Identification in Source Waters
-  Chapter 3: Development and Implementation of a Monitoring Program
-  Chapter 4: Management in Source Waters
-  Chapter 5: Treatment Options
-  Chapter 6: Incident Management Plans

# International Guidance Manual

## Table of contents

- ✚ Foreword me
- ✚ Chapter 1: me
- ✚ Chapter 2: Bill Harding, Hein, Annalie, Nick, Carin, Mike
- ✚ Chapter 3: Nick Dugan, Hein Annalie, Carin, Gesche, Mike
- ✚ Chapter 4: Mike Burch, Carin, Sue Tom, Bill
- ✚ Chapter 5: Tom Hall, Gesche, Gayle
- ✚ Chapter 6: Hein du Preez, Annalie, Sue, Tom, Mike
  
- ✚ Editing, formatting, making sure it all makes sense... me

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- ✚ [Chapter 5: Treatment Options](#)
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# International Guidance Manual for the Management of Toxic Cyanobacteria

Expected publication end 2009



Government  
of South Australia



# Questions?

# The structure

- ***What doses are required for reduction of toxin concentration using chlorination?***