Identifying and quantifying the benefits of cyanobacteria research for the Australian drinking water industry

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Approach Outline

- **Historical drivers** and **chronology** of subsequent research
- **Major research projects/programs** *(CRCWQ&T/WRF/WaterRA)*
- Putting research into perspective: Research themes and areas of impact
- Anabaena circinalis: from unknown toxin producer to minor aesthetic nuisance – *how far we have come*
- Applications in the Australian water industry
- Quantification of benefits – scorecard approach
- Next steps.....
Identify and quantify benefits

- Specific projects – large projects/programs: CRCWQ&T; WaterRA; WRF (>50)
- Specific benefits and outcomes
Outcomes and benefits from research include........

- Peer reviewed publications
- Guideline derivations
  - Alert Levels Framework for the management of cyanobacteria
  - Guidelines for recreational use
  - Reduced risk to health
- Improved instrumental and other measurement techniques
  - Improved monitoring
  - Reduced turnaround time
  - Reduced risk to health
- Optimised processes
  - Improved water quality
  - Reduced PAC use
  - Reduced risk to health
What were the projects that achieved these benefits?
PROJECT

PROJECT

PROJECT

PROJECT

PROJECT

PROJECT

BENEFIT/IMPACT
PROJECT

BENEFIT/IMPACT

BENEFIT/IMPACT

BENEFIT/IMPACT
What were the projects that achieved these benefits?

• Individual projects can have multiple benefits and vice versa

• “areas of research” vs “areas of impact”
  – Assess separately

• Examine project list and categorize into “Themes”
  ➢ Thematic model of cyanobacterial research
Thematic model of cyanobacteria research

**Measuring**
Identifying cyanobacteria, structure of toxin, measuring toxins and toxicity - instrumental, biochemical, toxicity, rapid, genetic methods

**Understanding**
Ecology, biology, toxicology, genetics, toxin production, occurrence, impact

**Controlling**
Cyanobacteria and toxins - source water, treatment processes, physical, chemical, biological
RESEARCH THEMES

Measuring
Identifying cyanobacteria, structure of toxin, measuring toxins and toxicity - instrumental, biochemical, toxicity, rapid, genetic methods

Understanding
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Controlling
Cyanobacteria and toxins - source water, treatment processes, physical, chemical, biological

AREAS OF IMPACT/BENEFIT

Managing risk
Guidelines, alert levels framework, management plans, guidance manuals

Optimising operations
Source water management and treatment strategies and monitoring methods identified, modified and improved
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1989</td>
<td>Survey shows toxic cyanobacteria widespread in Murray Darling system, search for the neurotoxin begins</td>
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<tr>
<td>1989</td>
<td>Neurotoxicity of <em>Anabaena circinalis</em> can be removed by GAC filtration</td>
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<tr>
<td>1991</td>
<td>Murray/Darling bloom of <em>Anabaena circinalis</em> causes stock deaths: neurotoxin responsible</td>
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<tr>
<td>1991</td>
<td>Paralytic shellfish poisons identified as the toxins present in <em>A. circinalis</em></td>
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<tr>
<td>1992</td>
<td>Instrumental methods developed for drinking water (based on methods for shellfish)</td>
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<tr>
<td>1992</td>
<td>Occurrence and characterisation of toxic mixtures reported</td>
</tr>
<tr>
<td>1995</td>
<td>Treatment strategies tested, conditions and extent of removal studied</td>
</tr>
<tr>
<td>2004</td>
<td>Existing toxicity data used to develop a health alert and fact sheet for ADWG</td>
</tr>
<tr>
<td>00’s</td>
<td>Rapid methods of saxitoxin analysis validated for use in drinking water</td>
</tr>
<tr>
<td>00’s</td>
<td>Removal by powdered activated carbon confirmed, types and doses of PAC recommended</td>
</tr>
<tr>
<td>00’s</td>
<td>Removal by chlorine confirmed, CT requirements identified</td>
</tr>
<tr>
<td>2009</td>
<td>Guidance manual published, incorporating Alert Level Framework (ALF) and treatment strategy summary</td>
</tr>
<tr>
<td>2009</td>
<td>Various versions of the ALF implemented by Australian water industry</td>
</tr>
<tr>
<td>2009</td>
<td>Implementation of the ADWG Framework for Management of Drinking Water Quality requires all outcomes</td>
</tr>
</tbody>
</table>
Identification is easy, but quantifying? Not so easy....

- Number of publications
- Expenditure deferred or reduced
Scorecard approach

• R&D value = f(alignment, impact, cost) (completed)
Scorecard approach

- Criteria to score impact
- *Research benefit calculator*
Ongoing efforts

• Constant justification of R&D budgets in the water industry requires concrete measures:
  – $ direct and equivalent
  – Demonstrable intangible benefits

• SA Water currently developing framework based on cash value to the organisation as well as a modified scorecard measuring impact against strategic priorities and cost/leverage
Acknowledgements

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• All of the researchers who have done such brilliant work over the past 30 years!!!
Thanks for your attention!