Cyanobacteria and Cyanotoxins: Occurrence and Detection Methods

Detection Methods and Field Test Kits

Real Time Testing Alternatives for Cyanotoxins

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Real Time Testing Alternatives for Cyanotoxins

Commercially Available Technologies

- Enzyme Linked Immunosorbent Assay (ELISA)
- Protein Phosphatase Inhibition Assay (PPIA)
- Acetylcholinesterase Inhibition Assay (ACHe)
- *Receptor Binding Assay (RBA)*

Real Time Testing Alternatives for Cyanotoxins

Commercially Available Technologies / Analytes

- Enzyme Linked Immunosorbent Assay (ELISA)
  - Microcystins/Nodularins
  - Cylindrospermopsin
  - Saxitoxin
  - BMAA
- Protein Phosphatase Inhibition Assay (PPIA)
  - Microcystins/Nodularins
- Acetylcholinesterase Inhibition Assay (ACHe)
  - *Anatoxin – a(s)*
- *Receptor Binding Assay (RBA)*
  - *Anatoxin – a*

Real Time Testing Alternatives for Cyanotoxins

Common Genre of Toxin Producing Strains

Cyanobacterial Genera	Dermatoxins			Hepatotoxins			Neurotoxins				Tastes and odors	
	LYN	APL	LPS	CYL	MC	NOD	ATX	BMAA	NEO	SAX	GEOS	MIB
Colonial/filamentous												
Anabaena			X	X	X		X	X	X	X	X	
Anabaenopsis			X		X							
Aphanizomenon			X	X	X		X	X	X	X	X	
Aphanocapsa			X		X							
Cylindrospermopsis			X	X				X		X		
Microcystis			X		X			X				
Nodularia			X			X		X				
Oscillatoria (Planktothrix)	X	X	X		X		X	X		X	X	X
Pseudanabaena			X		X						X	X
Raphidiopsis			X	X			X					
Unicellular												
Synechococcus			X		X			X			X	X
Synechocystis			X		X			X				

Graham, J.L., Loftin, K.A., Ziegler, A.C., and Mayer, M.T., 2008, Guidelines for design and sampling for cyanobacterial toxin and taste-and-odor studies in lakes and reservoirs: U.S. Geological Survey Scientific Investigations Report 2008-5038, pg. 6

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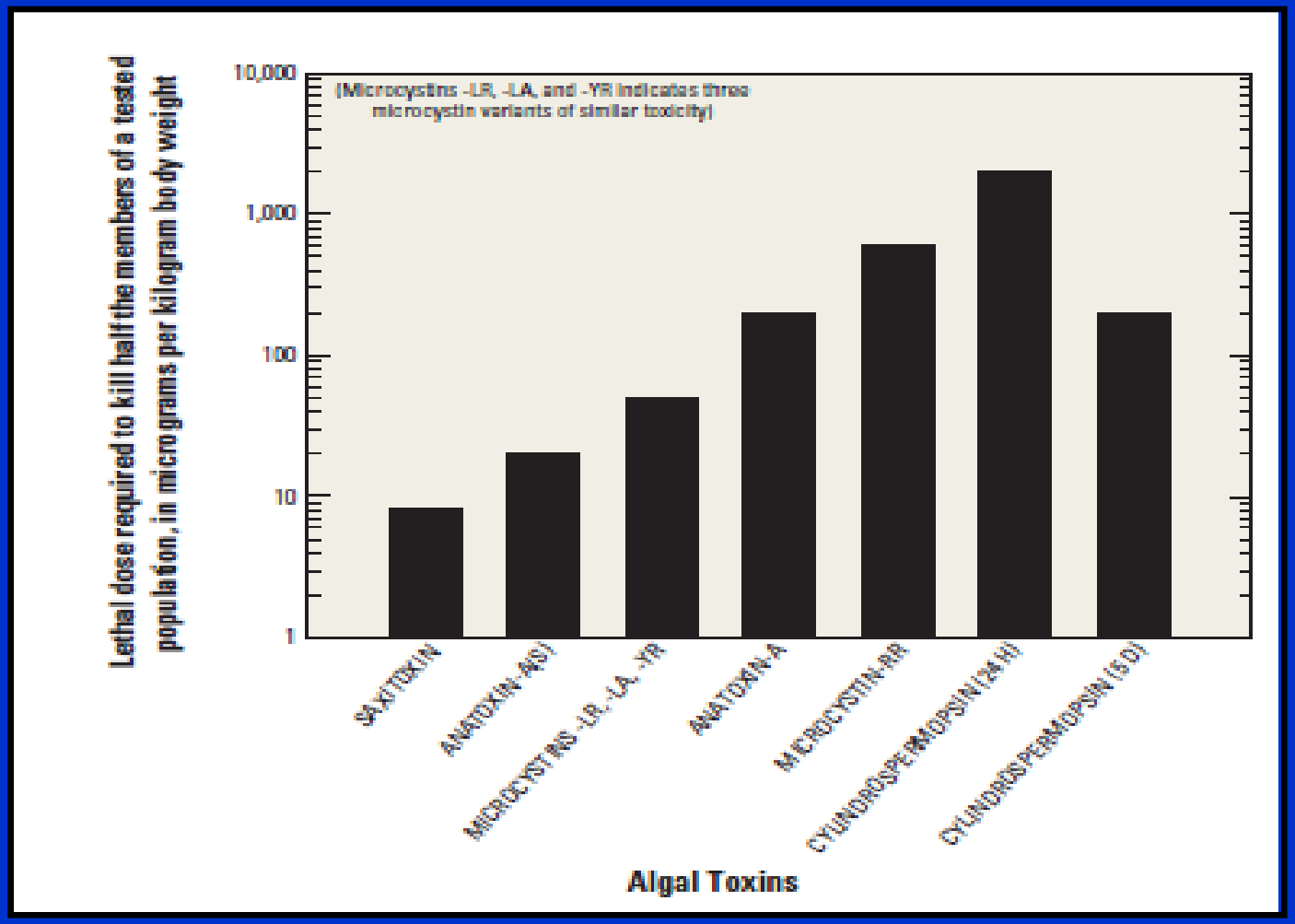
Toxicity



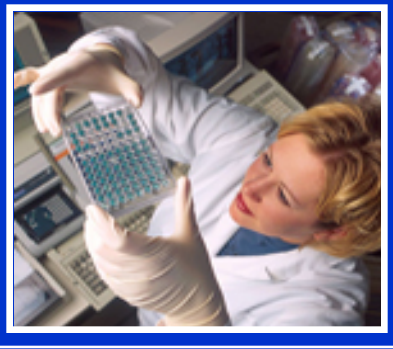
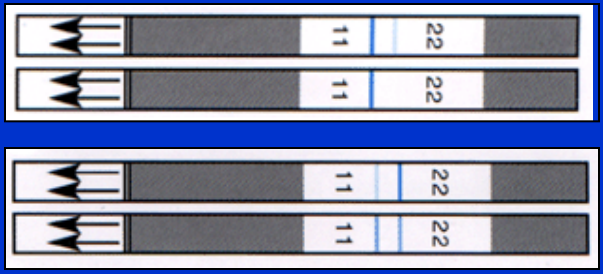
Graham, J.L., Loftin, K.A., Ziegler, A.C., and Mayer, M.T., 2008, Guidelines for design and sampling for cyanobacterial toxin and taste-and-odor studies in lakes and reservoirs: U.S. Geological Survey Scientific Investigations Report 2008-5038, pg. 7

Real Time Testing Alternatives for Cyanotoxins

Commercially Available Technologies / Analytes / Formats

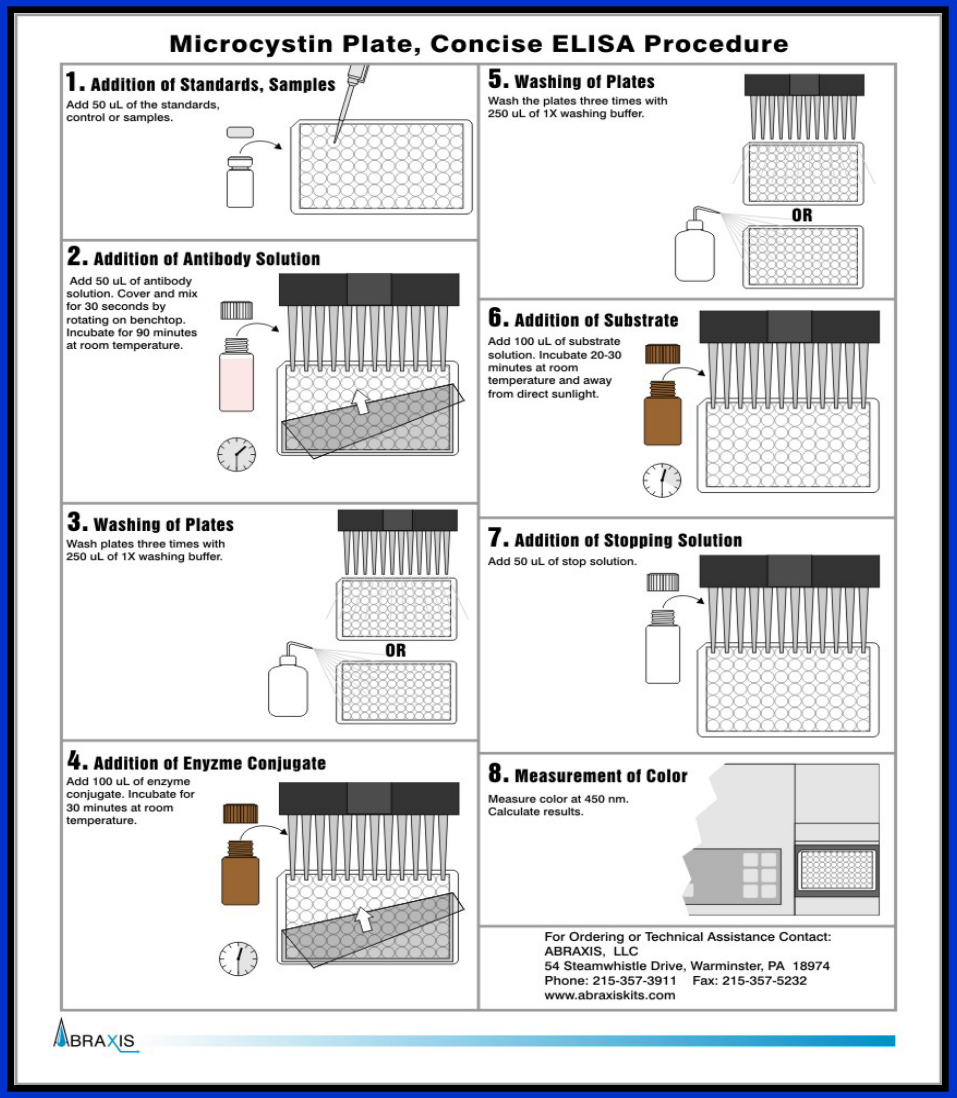
- Enzyme-Linked Immunosorbent Assay (ELISA)
  - Microcystins/Nodularins Plate Tube Strip
  - Cylindrospermopsin Plate
  - Saxitoxin Plate
  - BMAA Plate
- Protein Phosphatase Inhibition Assay (PPIA)
  - Microcystins/Nodularins Plate Tube
- Acetylcholinesterase Inhibition Assay (ACHe)
  - *Anatoxin – a(s)* Plate Tube
- *Receptor Binding Assay (RBA)*
  - *Anatoxin – a* Plate

Immunoassay Test Formats

Microtiter Plate	
Strip	
Tube	

Real Time Testing Alternatives for Cyanotoxins

Microtiter Plate Procedure



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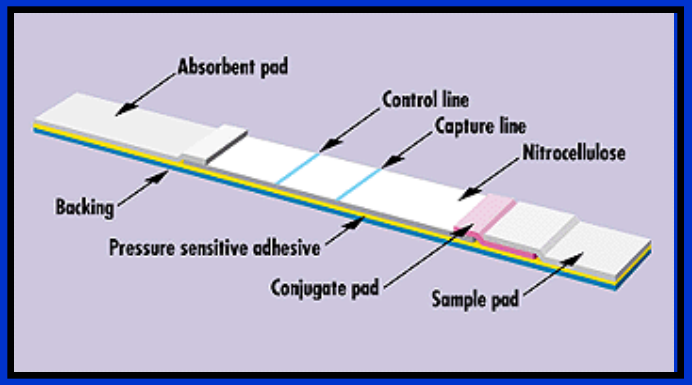
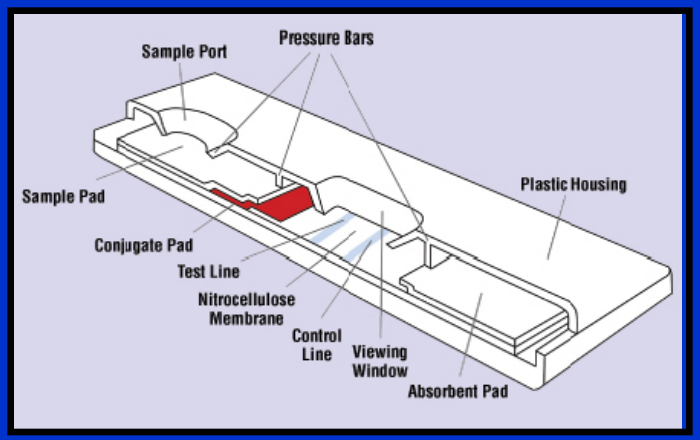
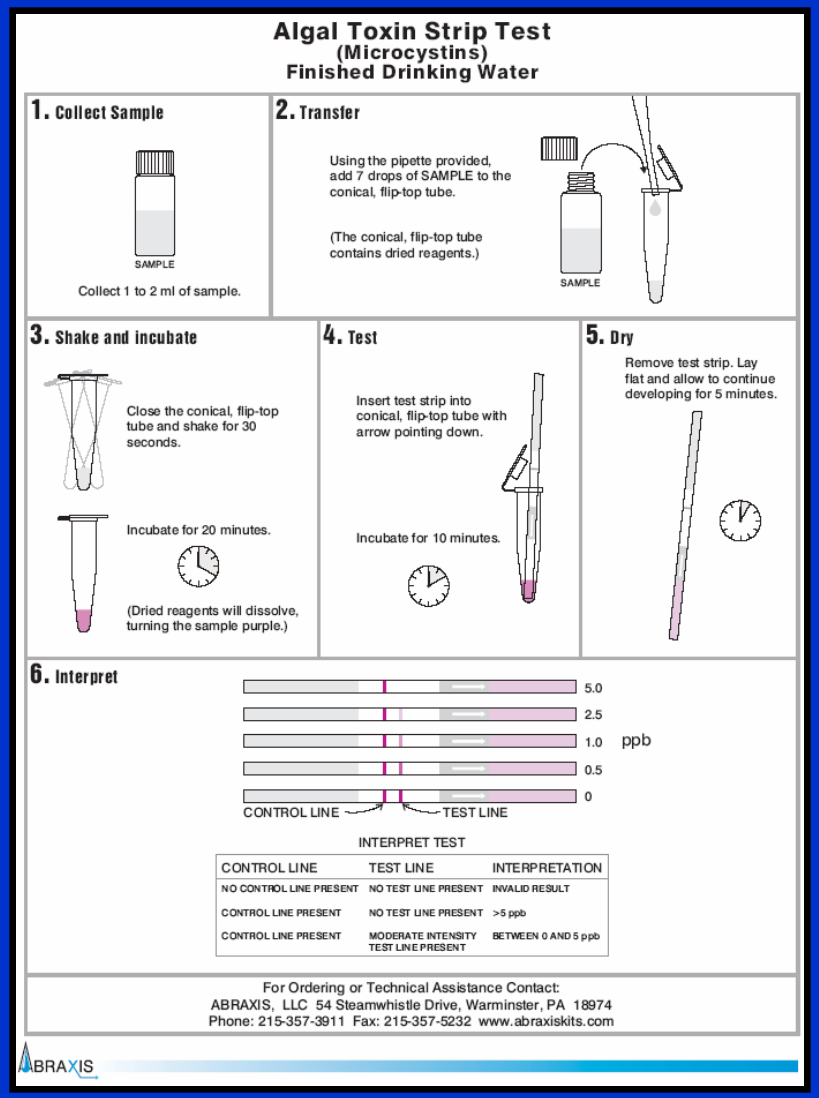
Microcystins Strips







Real Time Testing Alternatives for Cyanotoxins

Microcystins Strip Test

Drinking Water (DW)	Recreational Water (RW)
(PPB) 0 0.5 1.0 2.5 5.0	(PPB) 0 2.5 10 20

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Applications

Operational/Risk Management	DW: Q, SQ ES: Q RW: Q, SQ Aerosol: Q Serum: Q Brackish/Seawater: Q Fish Tissue: Q
Regulatory/ Compliance	DW: Q RW: Q

Q: Quantitative, SQ: Semi-Quantitative, ES: Enhanced Sensitivity

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