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Technical Memorandum

Copco/Iron Gate Reservoir Toxic Cyanobacteria Results: May 31st, and June 12-13th, 2007

To all concerned:

Recent phytoplankton cell count results for May 31st and June 12-13th were received from Aquatic Analysts (AA; see lab data sheets in Appendix I). Although additional stations and depths were sampled, Aquatic Analysts performed a “rush” analysis on surface samples from the red-labeled stations in Figure 1 (based on visual assessment of density only IR01 was rushed on 5-31-07). Reservoir data are from the standard open-water sites, IR01 and CR01; as well as a shoreline location at the Copco Cove recreational access point (CRCC; Figure 1). Samples from the Klamath River upstream from Copco (KRAC) and downstream from Iron Gate (KRBI) were also analyzed (Figure 1).

A low level of potentially hepato-toxic (microcystin producing) *Microcystis aeruginosa* (MSAE) was detected at IR01 on 5/31 (12,528 cells/ml; Table 1). On June 13th, IR01 continued to show a low level of MSAE (7,091 cells/ml) while MSAE was not detected at CR01 (Table 1). However, the shoreline station CRCC had 360,800 cell/ml of MSAE (Table 1; Figure 2). In addition, the CRCC station also showed 65,996 cells/ml of *Anabaena flos-aquae* (ABFA), while another potentially toxic cyanobacteria, *Planktothrix*, occurred at low levels (5,318 cells/ml) at IR01. ABFA can produce the neurotoxin anatoxin-a, while *Planktothrix* (formerly called *Oscillatoria* and is identified as such in the AA reports) can produce the liver toxin microcystin. Previous Department of Health Services data from 2005 has shown the presence of anatoxin-a in Iron Gate reservoir.

Data from late May and mid-June, 2007 indicate that blooms of potentially toxic cyanobacteria appear to be occurring approximately one month earlier than in 2005 and 2006. At this time only the CRCC station exceeded (by 9x for MSAE) the California harmful algal bloom public notification guidance level of 40,000 cell/ml (see Appendix II). The combined MSAE and *Planktothrix* level at IR01 was 12,409 cells/ml, while the ABFA level at CRCC was below the 100,000 cell/ml level for this species. Additional sampling for cyanobacteria cell density and toxin, particularly at recreational access points, should be initiated at a minimum of a biweekly basis.

No MSAE was detected at either KRAC above Copco Reservoir, or KRBI below Iron Gate Reservoir.

Please let me know if you have any questions. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Jacob Kann", with a long horizontal flourish extending to the right.

Jacob Kann, Ph.D.
Aquatic Ecologist

Disclaimer

*Due to the patchy nature of blue-green algal blooms it is possible for higher *Microcystis aeruginosa* densities (and therefore higher microcystin toxin concentrations) to have been present in locations not covered in this survey, particularly along shorelines or protected coves and backwaters during calm conditions of little to no wind. Recreational users should always avoid contact with water whenever noticeable surface concentrations of algae are evident. Moreover, because pets or other domestic animals are the most likely to ingest contaminated water, these animals should not be allowed access to areas of either noticeable surface concentrations of algae or when an obvious green to blue-green appearance is evident*

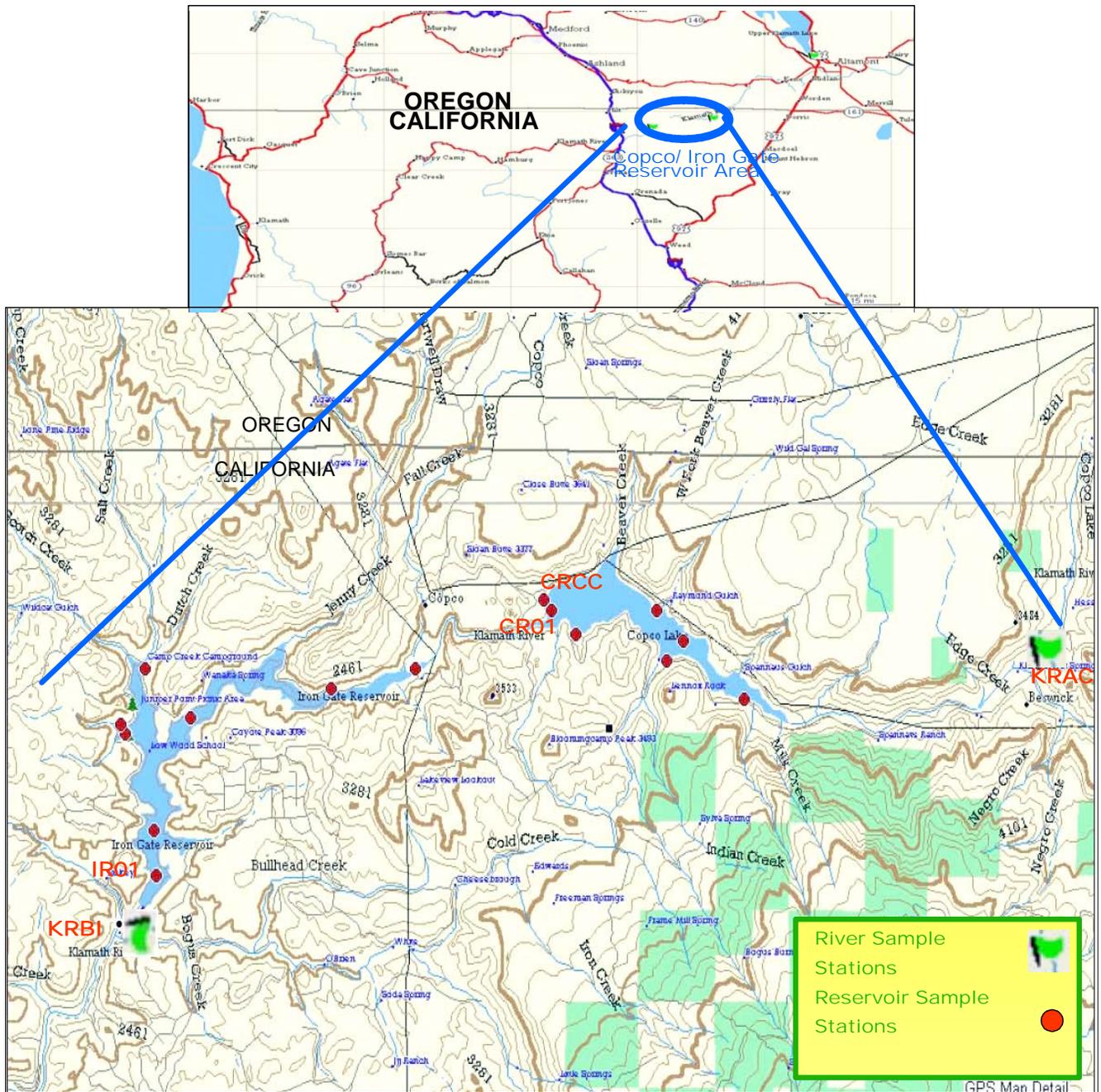


Figure 1. Location of Copco and Irongate Reservoir and Klamath River toxic cyanobacteria sampling/photo stations, 6-12 and 6/13, 2007 (only labeled stations analyzed for this report).

Table 1. Cell density and risk exceedance for toxigenic cyanobacteria in Copco and Irongate Reservoirs and the Klamath River, 2007.

DATE	STATION NAME	DEPTH	<i>Microcystis aeruginosa</i> (cells/ml)	<i>Planktothrix (Oscillatoria) sp.</i> (cells/ml)	<i>Anabaena sp.</i> (cells/ml)	Microcystin Total (µg/L)	Exceedance of SWRCB ¹ risk level of 40,000 cells/ml <i>Microcystis</i> or <i>Planktothrix</i> (x greater than 4 ⁵ cells/ml)	Exceedance of SWRCB ¹ risk level of 8 µg/L microcystin (x greater than 8 µg/L)	Exceedance of TDI of 0.04 µg/kg/day for a 40 lb (18kg) child ingesting 100 mls (x greater than TDI)
5/31/2007	IR01	0	12,528	0	863		0.31		
6/13/2007	KRAC	0	0	0	0		0		
6/12/2007	KRBI	0	0	0	0		0		
6/13/2007	CR01	0	0	0	2,747		0		
6/13/2007	CRCC	0	360,800	0	65,996		9.02		
6/13/2007	IR01	0	7,091	5,318	1,968		0.18		

¹From: Blue Green Algae Work Group of the State Water Resources Control Board and Office of Environmental Health and Hazard Assessment: *Cyanobacteria in California Recreational Water Bodies Providing Voluntary Guidance about Harmful Algal Blooms, Their Monitoring, and Public Notification (DRAFT June 2007)*



Figure 2. Bloom conditions at CRCC in Copco Reservoir, June 13, 2007.

Appendix I: Aquatic Analysts Phytoplankton Lab Sheets

Phytoplankton Sample Analysis

Sample: Irongate Res
Sample Station: IR01
Sample Depth: 00
Sample Date: 31-May-07

Total Density (#/mL): 1,239
Total Biovolume ($\mu\text{m}^3/\text{mL}$): 316,507
Trophic State Index: 41.6

Species	Density #/mL	Density Percent	Biovolume $\mu\text{m}^3/\text{mL}$	Biovolume Percent
-	-	-	-	-
Rhodomonas minuta	376	30.3	7,517	2.4
Unidentified flagellate	167	13.5	3,341	1.1
Cryptomonas erosa	139	11.2	72,383	22.9
Ankistrodesmus falcatus	139	11.2	3,480	1.1
Microcystis aeruginosa	125	10.1	100,222	31.7
Chromulina sp.	111	9.0	2,227	0.7
Chlamydomonas sp.	42	3.4	13,572	4.3
Anabaena flos-aquae	28	2.2	55,957	17.7
Nitzschia frustulum	28	2.2	3,341	1.1
Gomphonema subclavatum	28	2.2	16,704	5.3
Nitzschia dissipata	14	1.1	3,744	1.2
Nitzschia paleacea	14	1.1	1,364	0.4
Synedra ulna	14	1.1	27,700	8.8
Closteriopsis longissima	14	1.1	4,955	1.6

Microcystis aeruginosa cells/mL = 12,528

Anabaena flos-aquae cells/mL = 835

Anabaena flos-aquae heterocysts/mL = 28

Note: pollen very abundant! (estimate 877 per mL)

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Sample ID: KP15

Phytoplankton Sample Analysis

Sample: Klamath River
Sample Station: KRAC
Sample Depth: 0C
Sample Date: 13-Jun-07

Total Density (#/mL): 790
Total Biovolume (um³/mL): 416,810
Trophic State Index: 43.5

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
-	-	-	-	-
Nitzschia frustulum	142	17.9	17,002	4.1
Navicula cryptocephala veneta	75	9.4	7,084	1.7
Melosira granulata	75	9.4	135,345	32.5
Rhoicosphenia curvata	67	8.5	7,852	1.9
Cocconeis placentula	52	6.6	24,012	5.8
Nitzschia dissipata	37	4.7	10,030	2.4
Cryptomonas erosa	37	4.7	19,388	4.7
Achnanthes minutissima	37	4.7	1,864	0.4
Aphanizomenon flos-aquae	30	3.8	28,188	6.8
Achnanthes lanceolata	30	3.8	8,054	1.9
Gomphonema angustatum	22	2.8	4,027	1.0
Diatoma vulgare	22	2.8	57,001	13.7
Navicula mutica	15	1.9	820	0.2
Nitzschia paleacea	15	1.9	1,462	0.4
Rhodomonas minuta	15	1.9	298	0.1
Fragilaria vaucheria	15	1.9	4,295	1.0
Gomphoneis herculeana	7	0.9	40,268	9.7
Fragilaria capucina mesolepta	7	0.9	5,705	1.4
Chlamydomonas sp.	7	0.9	2,424	0.6
Amphora ovalis	7	0.9	4,310	1.0
Navicula mournei	7	0.9	1,752	0.4
Navicula pupula	7	0.9	2,013	0.5
Ankistrodesmus falcatus	7	0.9	746	0.2
Stephanodiscus hantzschii	7	0.9	895	0.2
Melosira varians	7	0.9	9,694	2.3
Navicula tripunctata	7	0.9	8,352	2.0
Fragilaria construens venter	7	0.9	358	0.1
Nitzschia microcephala	7	0.9	746	0.2
Gomphonema subclavatum	7	0.9	4,474	1.1
Sphaerocystis schroeteri	7	0.9	8,352	2.0

Aphanizomenon flos-aquae cells/mL = 447

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Sample ID: KP37

Phytoplankton Sample Analysis

Sample: Copco Res
Sample Station: CR01
Sample Depth: 00
Sample Date: 13-Jun-07

Total Density (#/mL): 3,093
Total Biovolume (um³/mL): 794,049
Trophic State Index: 48.2

Species	Density		Biovolume	
	#/mL	Density Percent	um ³ /mL	Biovolume Percent
-	-	-	-	-
Stephanodiscus hantzschii	1,185	38.3	142,238	17.9
Rhodomonas minuta	954	30.8	19,081	2.4
Cryptomonas erosa	347	11.2	180,400	22.7
Chlamydomonas sp.	318	10.3	103,354	13.0
Anabaena flos-aquae	116	3.7	170,455	21.5
Aphanizomenon flos-aquae	87	2.8	163,921	20.6
Selenastrum minutum	29	0.9	578	0.1
Ankistrodesmus falcatus	29	0.9	723	0.1
Cocconeis placentula	29	0.9	13,299	1.7

Anabaena flos-aquae cells/mL = 2,544
 Anabaena flos-aquae heterocysts/mL = 116
 Anabaena flos-aquae akinetes/mL = 87

Aphanizomenon flos-aquae cells/mL = 2,602
 Aphanizomenon flos-aquae heterocysts/mL = 116
 Aphanizomenon flos-aquae akinetes/mL = 29

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Sample ID: KP35

Phytoplankton Sample Analysis

Sample: Copco Res
Sample Station: CRCC
Sample Depth: SG
Sample Date: 13-Jun-07

Total Density (#/mL): 10,674
Total Biovolume ($\mu\text{m}^3/\text{mL}$): 7,808,313
Trophic State Index: 64.7

Species	Density #/mL	Density Percent	Biovolume $\mu\text{m}^3/\text{mL}$	Biovolume Percent
Microcystis aeruginosa	3,608	33.8	2,886,400	37.0
Rhodomonas minuta	2,856	26.8	57,127	0.7
Anabaena flos-aquae	2,105	19.7	4,230,380	54.2
Chlamydomonas sp.	1,052	9.9	342,008	4.4
Cryptomonas erosa	226	2.1	117,260	1.5
Chromulina sp.	150	1.4	3,007	0.0
Nitzschia frustulum	150	1.4	18,040	0.2
Stephanodiscus hantzschii	150	1.4	18,040	0.2
Nitzschia palea	75	0.7	13,530	0.2
Achnanthes minutissima	75	0.7	3,758	0.0
Epithemia sorex	75	0.7	85,690	1.1
Gomphonema angustatum	75	0.7	13,530	0.2
Scenedesmus quadricauda	75	0.7	19,543	0.3

Microcystis aeruginosa cells/mL = 360,800

Anabaena flos-aquae cells/mL = 63,140

Anabaena flos-aquae heterocysts/mL = 2,856

Aquatic Analysts

Sample ID: KP31

Phytoplankton Sample Analysis

Sample: Irongate Res
Sample Station: IR01
Sample Depth: 00
Sample Date: 13-Jun-07

Total Density (#/mL): 1,578
Total Biovolume (um³/mL): 780,209
Trophic State Index: 48.1

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
-	-	-	-	-
Rhodomonas minuta	762	48.3	15,246	2.0
Epithemia sorex	124	7.9	141,469	18.1
Stephanodiscus hantzschii	106	6.7	12,764	1.6
Ankistrodesmus falcatus	89	5.6	2,216	0.3
Chromulina sp.	71	4.5	1,418	0.2
Microcystis aeruginosa	71	4.5	56,730	7.3
Chlamydomonas sp.	71	4.5	23,046	3.0
Anabaena flos-aquae	71	4.5	128,280	16.4
Unidentified flagellate	53	3.4	1,064	0.1
Nitzschia frustulum	35	2.2	4,255	0.5
Cryptomonas erosa	35	2.2	18,437	2.4
Nitzschia palea	18	1.1	3,191	0.4
Nitzschia dissipata	18	1.1	4,769	0.6
Oscillatoria sp.	18	1.1	329,741	42.3
Synedra ulna	18	1.1	35,279	4.5
Scenedesmus quadricauda	18	1.1	2,305	0.3

Microcystis aeruginosa cells/mL = 7,091

Anabaena flos-aquae cells/mL = 1,915

Anabaena flos-aquae heterocysts/mL = 53

Oscillatoria sp. cells/mL = 5,318

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Sample ID: KP30

Phytoplankton Sample Analysis

Sample: Klamath River
Sample Station: KRBI
Sample Depth: 0C
Sample Date: 12-Jun-07

Total Density (#/mL): 920
Total Biovolume (um³/mL): 430,956
Trophic State Index: 43.8

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
Rhodomonas minuta	374	40.6	7,471	1.7
Epithemia sorex	118	12.9	256,551	59.5
Cryptomonas erosa	109	11.9	56,853	13.2
Chromulina sp.	55	5.9	1,093	0.3
Nitzschia frustulum	55	5.9	6,560	1.5
Diatoma tenue	36	4.0	10,569	2.5
Cocconeis placentula	27	3.0	12,573	2.9
Cryptomonas ovata	18	2.0	31,470	7.3
Rhoicosphenia curvata	18	2.0	2,132	0.5
Navicula minuscula	9	1.0	410	0.1
Nitzschia amphibia	9	1.0	875	0.2
Achnanthes minutissima	9	1.0	456	0.1
Melosira granulata	9	1.0	10,022	2.3
Mallomonas sp.	9	1.0	3,462	0.8
Gomphonema angustatum	9	1.0	1,640	0.4
Ankistrodesmus falcatus	9	1.0	228	0.1
Euglena sp.	9	1.0	5,284	1.2
Synedra ulna	9	1.0	18,131	4.2
Nitzschia volcanica	9	1.0	1,458	0.3
Stephanodiscus hantzschii	9	1.0	1,093	0.3
Fragilaria vaucheria	9	1.0	2,624	0.6

Aquatic Analysts

Sample ID: KP38

Appendix II

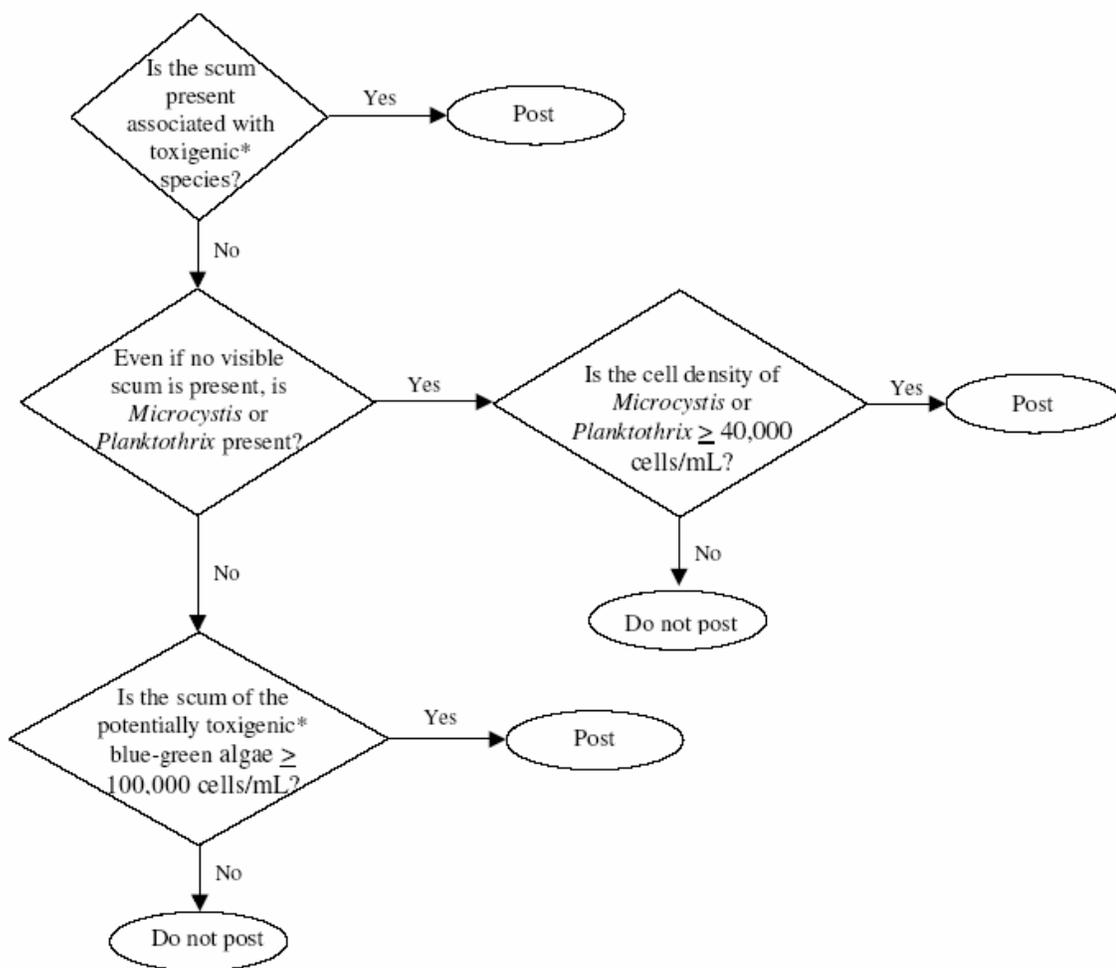
From: Blue Green Algae Work Group of the State Water Resources Control Board and Office of Environmental Health and Hazard Assessment

Cyanobacteria in California Recreational Water Bodies Providing Voluntary Guidance about Harmful Algal Blooms, Their Monitoring, and Public Notification (DRAFT June 2007)

<http://www.waterboards.ca.gov/bluegreenalgae/index.html>

Posting Decisions:

- If visible scum is present: Post warning signs and distribute informational brochures.
- When sampling with microbial identification is available, the following decision chart is recommended:



*Potentially toxic blue-green algae that have been detected in California include those of the genera *Anabaena*, *Microcystis*, *Aphanizomenon*, and *Gloeoetrichia*. Additional blue-green algae that are known to be potentially toxic may be added to this list.