AQUATIC ECOSYSTEM SCIENCES, LLC

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Email Memorandum

To:	Dave Stone/Ken Kauffman – OHD Mike Mader/Jason – TMLBP	From:	Jake Kann
email:	tlbp@presys.com,Dave.Stone@state.or.us, Kenneth.Kauffman@state.or.us	Pages:	10
Phone:		Date:	08-27-05
Re:	*Tenmile Sampling*	CC:	

To all,

August 22nd toxic algal cell count results for Tenmile Lakes are as follows:

STATION	DATE	*Microcystis* (cells/ml)	*Total Anabaena* (cells/ml)
S3	822-05	0	0
S8	8-22-05	0	0
N11	8-22-05	588	331
N16	8-22-05	195	1230

No *Microcystis aeruginosa* (MSAE) was detected at South Lake stations S3 and S8. Low MSAE counts were detected at North Lake stations N11 (588 cells/ml; down ~3–fold from 8/8/05) and N16 (195 cells/ml); however all counts were below the WHO Alert Level 2 drinking water guideline of 2000 cells ml^{-1} (see below figure). Total *Anabaena* cells/ml remained low at all stations, with station N16 remaining relatively stable at 1230 cells per ml. No *Anabaena* was detected in South Lake. At the Alert Level 2 guideline of 2000 cells/ml Oregon Human Services (OHS) issues public alerts for drinking water lakes. Levels are well below the 40,000 cells/ml and 100,000 cells/ml level when OHS recommends issuing recreational advisories for *Microcystis and Anabaena,* respectively. As always, those who utilize lake water for domestic purposes should take precautions to ensure water treatment systems are functioning properly and that Oregon Health Division recommendations for purification are being followed.

South lake stations were dominated by the cyanobacterium *Aphanizomenon;* North Lake Stations N11 and N16 were dominated by *Aphanizomenon, Anabaena,* and the diatom *Fragilaria.* Maximum *Microcystis aeruginosa* accounted for 3.5% of the biovolume at N11. Various Chrysophytes, Cryptophytes, and Diatoms comprised the remainder of the biovolume.

Due to the patchy nature of blue-green algal blooms it is possible for higher *Microcystis aeruginosa* and *Anabaena flos-aquae* densities (and therefore higher microcystin toxin and anatoxin concentrations to be

present in areas not sampled in this survey, particularly along shorelines or during calm conditions of little to no wind. Given the lakes' demonstrated history of toxic blooms, and the fact that all areas of the lake cannot be tested at all times, those utilizing the lake for drinking water should always follow Oregon Health Division recommendations for purification (attached). In addition, recreational users should always avoid contact with water whenever noticeable surface concentrations of algae are evident or when the lake has an obvious green to blue-green appearance. Moreover, because pets or other domestic animals are the most likely to ingest contaminated water, these animals should not be allowed access to the lakeshore whenever either noticeable surface concentrations of algae or an obvious green to blue-green appearance is evident.

Please call if you have any questions.

Sincerely,

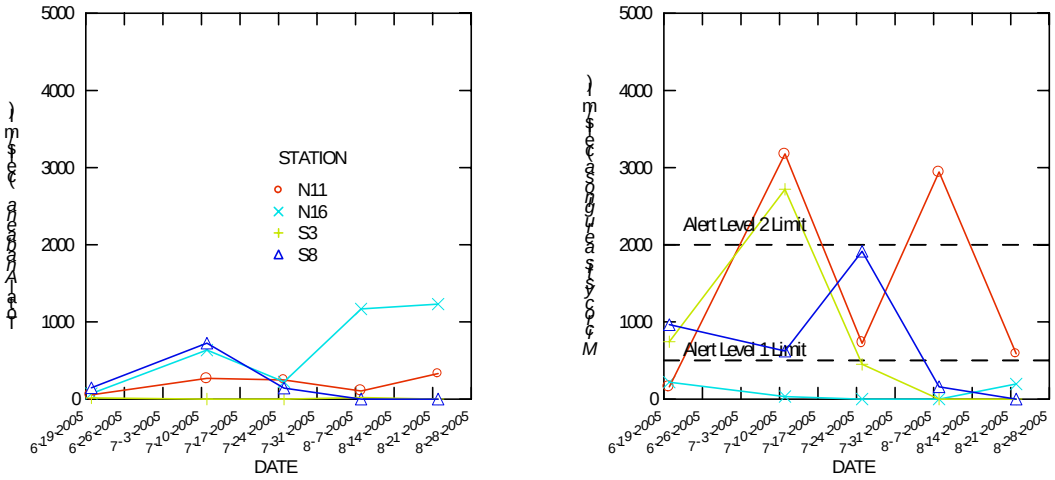
Jacob Kann Ph.D.

Aquatic Ecologist

References for Alert Levels

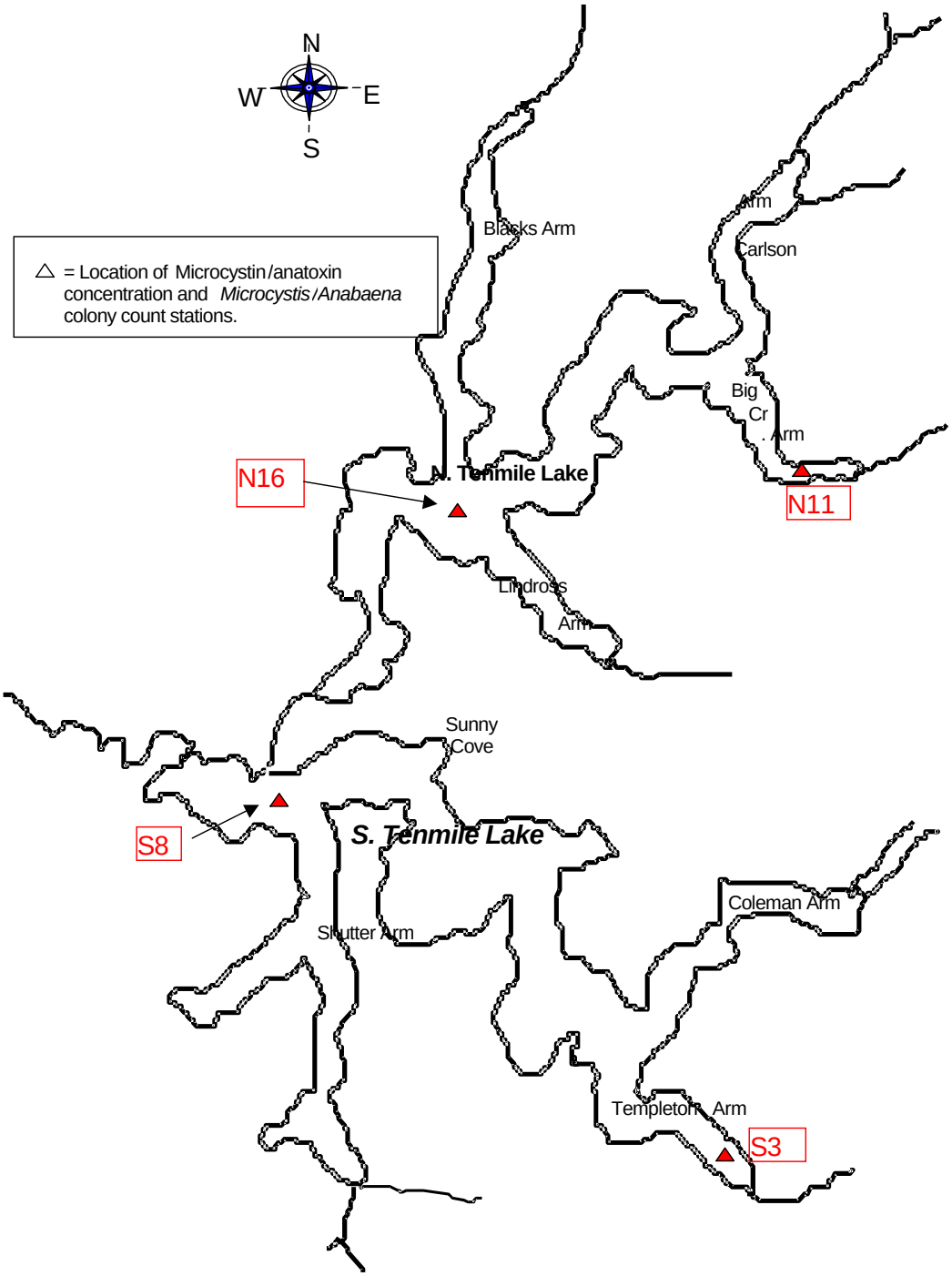
Yoo, S.R., W.W. Carmichael, R.C. Hoehn, and S.E. Hrudy. 1995. Cyanobacterial (blue-green algal) toxins: a resource guide. AWWA Research Foundation and American Water Works Association. Denver, CO. 229 p. (ISBN 0-89867-824-2)

Falconer et al. 1999. Safe levels and safe practices. Pages 155-177 *in*: I. Chorus and J. Bartram, editors. *Toxic Cyanobacteria in water: a guide to their public health consequences*. World Health Organization Report. E & FN Spon, London and New York.



Algal cell count trends for Tenmile Lakes, 2005.

Year 2005 Tenmile Lakes Sample Site Locations



Phytoplankton Sample Analysis

Sample:	Tenmile Lake
Sample Station:	S3
Sample Depth:	
Sample Date:	22-Aug-05

Total Density (#/mL):	899
Total Biovolume (um^3/mL):	1,247,767
Trophic State Index:	51.4

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Aphanizomenon flos-aquae	850	94.5	964,013	77.3
2	Melosira granulata angustissima	27	3.0	33,557	2.7
3	Melosira granulata	9	1.0	24,608	2.0
4	Fragilaria crotonensis	9	1.0	225,500	18.1
5	Rhodomonas minuta	4	0.5	89	0.0

Aphanizomenon flos-aquae cells/mL =	15,302
Aphanizomenon flos-aquae heterocysts/mL =	340

Aquatic Analysts **Sample ID:** HN64

Phytoplankton Sample Analysis

Sample:	Tenmile Lake
Sample Station:	S8
Sample Depth:	
Sample Date:	22-Aug-05
Total Density (#/mL):	2,069
Total Biovolume (um^3/mL):	2,801,904
Trophic State Index:	57.3

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Aphanizomenon flos-aquae	1,708	82.6	1,937,250	69.1
2	Melosira granulata	180	8.7	545,480	19.5
3	Melosira granulata angustissima	152	7.3	186,019	6.6
4	Achnanthes minutissima	9	0.5	475	0.0
5	Staurastrum gracile	9	0.5	5,125	0.2
6	Fragilaria crotonensis	9	0.5	127,556	4.6

Aphanizomenon flos-aquae cells/mL =	30,750
Aphanizomenon flos-aquae heterocysts/mL =	1,025

Aquatic Analysts **Sample ID:** HN65

Phytoplankton Sample Analysis

Sample: Tenmile Lake
Sample Station: N11
Sample Depth:
Sample Date: 22-Aug-05

Total Density (#/mL): 73
Total Biovolume (um^3/mL): 133,566
Trophic State Index: 35.4

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Aphanizomenon flos-aquae	21	28.0	20,738	15.5
2	Unident. green colony	16	22.0	4,041	3.0
3	Anabaena planctonica	8	11.0	45,852	34.3
4	Rhodomonas minuta	4	6.0	88	0.1
5	Fragilaria crotonensis	4	5.0	43,204	32.3
6	Microcystis aeruginosa	3	4.0	4,703	3.5
7	Cocconeis placentula	3	4.0	1,352	1.0
8	Melosira granulata	3	4.0	4,849	3.6
9	Anabaena circinalis	2	3.0	313	0.2
10	Ankistrodesmus falcatus	1	2.0	37	0.0
11	Cymbella minuta	1	2.0	816	0.6
12	Melosira granulata angustissima	1	2.0	2,204	1.7
13	Anabaena sp.	1	1.0	1,999	1.5
14	Cyclotella stelligera	1	1.0	40	0.0
15	Nitzschia capitellata	1	1.0	265	0.2
16	Sphaerocystis schroeteri	1	1.0	411	0.3
17	Anabaena flos-aquae	1	1.0	492	0.4
18	Dinobryon sertularia	1	1.0	699	0.5
19	Synedra ulna	1	1.0	1,462	1.1

Aphanizomenon flos-aquae cells/mL = 329
Aphanizomenon flos-aquae heterocysts/mL = 7

Microcystis aeruginosa cells/mL = 588

Anabaena planctonica cells/mL = 251
Anabaena planctonica heterocysts/mL = 8
Anabaena planctonica akinetes/mL = 1

Anabaena sp. cells/mL =	29
Anabaena sp. heterocysts/mL =	1
Anabaena circinalis cells/mL =	44
Anabaena circinalis heterocysts/mL =	1
Anabaena flos-aquae cells/mL =	7

Aquatic Analysts **Sample ID:** HN66

Phytoplankton Sample Analysis

Sample: Tenmile Lake
Sample Station: N16
Sample Depth:
Sample Date: 22-Aug-05

Total Density (#/mL): 197
Total Biovolume (um^3/mL): 615,293
Trophic State Index: 46.3

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Aphanizomenon flos-aquae	78	39.6	122,936	20.0
2	Anabaena planctonica	39	19.8	171,408	27.9
3	Melosira granulata	18	8.9	64,717	10.5
4	Fragilaria crotonensis	12	5.9	186,863	30.4
5	Anabaena circinalis	10	5.0	15,240	2.5
6	Melosira granulata angustissima	10	5.0	12,196	2.0
7	Synedra radians	6	3.0	2,740	0.4
8	Melosira ambigua	4	2.0	11,494	1.9
9	Dinobryon sp.	4	2.0	488	0.1
10	Cryptomonas erosa	2	1.0	1,015	0.2
11	Eudorina elegans	2	1.0	12,177	2.0
12	Unident. green colony	2	1.0	195	0.0
13	Anabaena sp.	2	1.0	5,308	0.9
14	Nitzschia frustulum	2	1.0	234	0.0
15	Ochromonas sp.	2	1.0	166	0.0
16	Microcystis aeruginosa	2	1.0	1,561	0.3
17	Ulothrix sp.	2	1.0	3,122	0.5
18	Asterionella formosa	2	1.0	3,434	0.6

Aphanizomenon flos-aquae cells/mL = 1,951
Aphanizomenon flos-aquae heterocysts/mL = 23

Anabaena planctonica cells/mL = 937
Anabaena planctonica heterocysts/mL = 25

Anabaena circinalis cells/mL = 215
Anabaena circinalis heterocysts/mL = 6

Anabaena sp. cells/mL = 78

Microcystis aeruginosa cells/mL = 195

Aquatic Analysts **Sample ID:** HN67

Oregon Health Division
Drinking water treatment guidance
August 31, 2001

Contact Person: Ken Kauffman
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kenneth.w.kauffman@state.or.us

1. Treatment systems should consist of sand filtration followed by chlorination, followed by activated charcoal filtration. It is essential that sand filtration be done before disinfection to remove as many algal cells as possible without killing or rupturing them.

2. Chlorination systems should be capable of maintaining at least 1 ppm of chlorine residual for at least 20 minutes contact time before the water enters the activated charcoal system.

3. The final step in the process should be effective activated charcoal treatment to remove toxin remaining after the sand filtration and disinfection processes.

4. All treatment equipment used should meet NSF standard 53, and should be adequately sized to treat the maximum amount of water that you use. Treatment equipment needs regular monitoring and servicing to assure that it functions properly.

5. Ideally all water entering your home should be treated as recommended. It is possible to treat only water used in the kitchen, but this increases chances that animals or pets would inadvertently drink untreated water.