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:	09-15-05
Re:	*Tenmile Sampling*	CC:	

To all,

September 6th toxic algal cell count results for Tenmile Lakes are as follows:

STATION	DATE	*Microcystis* (cells/ml)	*Total Anabaena* (cells/ml)
S3	9-06-05	0	0
S8	9-06-05	21	14
N11	9-06-05	0	1131
N16	9-06-05	0	803

Microcystis aeruginosa (MSAE) was low lake-wide on September 6th, with a maximum of only 21 cells per ml detected at South Lake station S8, and none detected at all other stations. All counts were below the WHO Alert Level 1 drinking water guideline of 500 cells ml^{-1} (see below figure). Total *Anabaena* cells/ml remained low at all stations, with station N16 decreasing slightly to 803 cells per ml, and station N11 increasing to 1131 cells per ml. 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 diatoms and the cyanobacterium *Aphanizomenon;* North Lake Stations N11 and N16 were dominated by *Aphanizomenon, Anabaena,* and the diatom *Fragilaria.* 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,

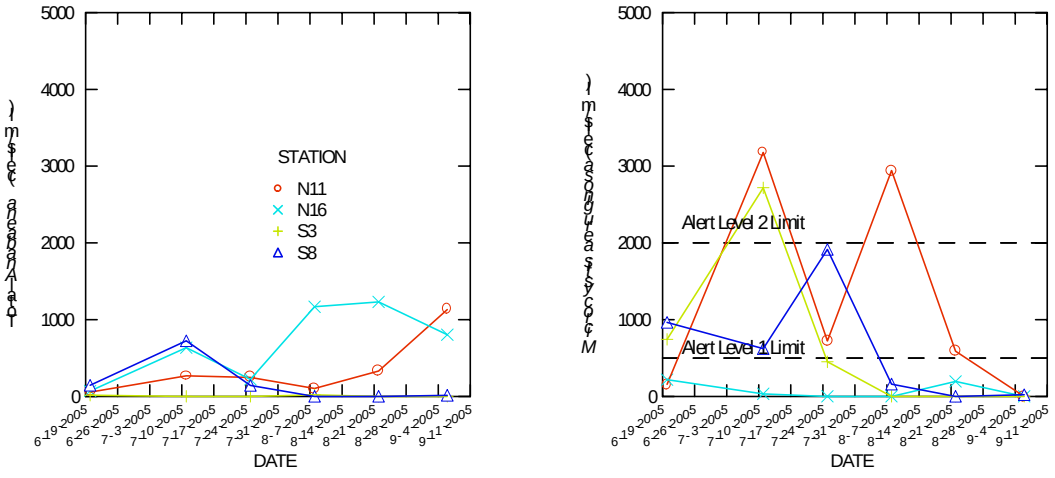
Jacob Kann Ph.D.

Aquatic Ecologist

References for Alert Levels

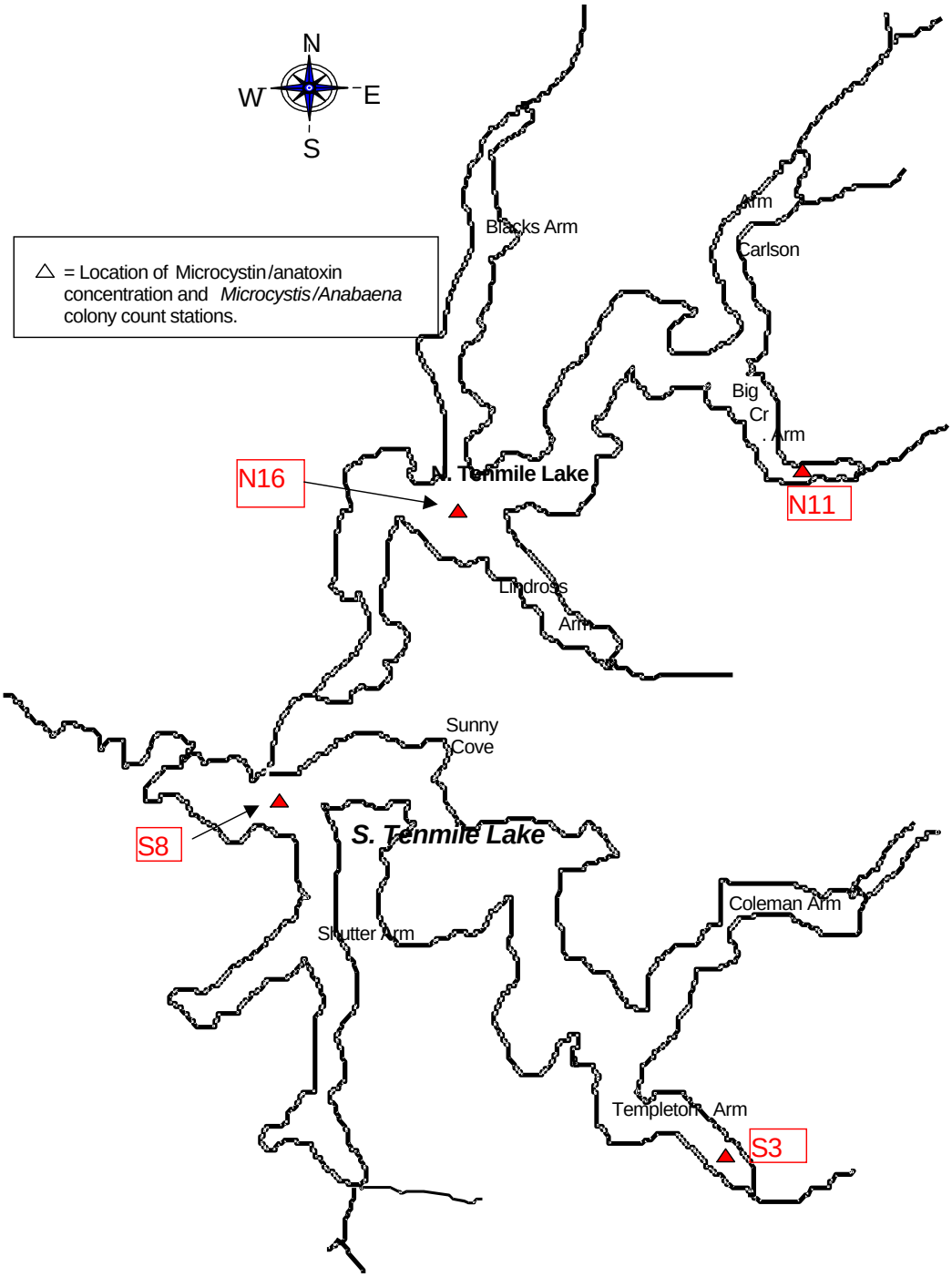
Yoo, S.R., W.W. Carmichael, R.C. Hoehn, and S.E. Hrudy. 1995. Cyanobacterial (blue-green algal) toxins: a resource guide. AWWA Research Foundation and American Water Works Association. Denver, CO. 229 p. (ISBN 0-89867-824-2)

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: 6-Sep-05

Total Density (#/mL): 178
Total Biovolume (um^3/mL): 69,613
Trophic State Index: 30.7

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Ochromonas-like	146	81.8	6,561	9.4
2	Rhodomonas minuta	8	4.5	162	0.2
3	Aphanizomenon flos-aquae	5	2.7	7,042	10.1
4	Cryptomonas erosa	5	2.7	2,527	3.6
5	Ceratium hirundinella	5	2.7	47,627	68.4
6	Achnanthes minutissima	2	0.9	81	0.1
7	Ankistrodesmus falcatus	2	0.9	40	0.1
8	Mallomonas sp.	2	0.9	616	0.9
9	Sphaerocystis schroeteri	2	0.9	907	1.3
10	Melosira granulata angustissima	2	0.9	1,620	2.3
11	Trachelomonas crebea	2	0.9	2,430	3.5

Aphanizomenon flos-aquae cells/mL = 112
Aphanizomenon flos-aquae heterocysts/mL = 3

Aquatic Analysts **Sample ID:** HN68

Phytoplankton Sample Analysis

Sample:	Tenmile Lake
Sample Station:	S8
Sample Depth:	
Sample Date:	6-Sep-05

Total Density (#/mL):	39
Total Biovolume (um^3/mL):	40,176
Trophic State Index:	26.8

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Aphanizomenon flos-aquae	12	32.1	13,367	33.3
2	Cryptomonas erosa	5	12.5	2,524	6.3
3	Melosira granulata angustissima	5	12.5	8,858	22.0
4	Ochromonas-like	4	10.7	187	0.5
5	Ankistrodesmus falcatus	2	5.4	52	0.1
6	Dinobryon sertularia	2	5.4	1,807	4.5
7	Melosira granulata	2	5.4	2,288	5.7
8	Anabaena circinalis	1	3.6	985	2.5
9	Dinobryon sp.	1	1.8	87	0.2
10	Rhodomonas minuta	1	1.8	14	0.0
11	Fragilaria crotonensis	1	1.8	4,659	11.6
12	Melosira ambigua	1	1.8	3,676	9.1
13	Fragilaria vaucheria	1	1.8	200	0.5
14	Microcystis aeruginosa	1	1.8	166	0.4
15	Trachelomonas volvocina	1	1.8	1,307	3.3

Aphanizomenon flos-aquae cells/mL =	212
Aphanizomenon flos-aquae heterocysts/mL =	1
Anabaena circinalis cells/mL =	14
Microcystis aeruginosa cells/mL =	21

Aquatic Analysts **Sample ID:** HN69

Phytoplankton Sample Analysis

Sample: Tenmile Lake
Sample Station: N11
Sample Depth:
Sample Date: 6-Sep-05

Total Density (#/mL): 297
Total Biovolume (um^3/mL): 377,410
Trophic State Index: 42.8

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Dinobryon sertularia	124	41.7	64,796	17.2
2	Aphanizomenon flos-aquae	74	25.0	84,200	22.3
3	Dinobryon sp.	25	8.3	3,094	0.8
4	Anabaena planctonica	25	8.3	172,112	45.6
5	Desmidium sp.	17	5.6	24,833	6.6
6	Anabaena circinalis	8	2.8	7,615	2.0
7	Achnanthes minutissima	6	1.9	275	0.1
8	Cryptomonas erosa	3	0.9	1,430	0.4
9	Anabaena flos-aquae	3	0.9	5,528	1.5
10	Gymnodinium sp.	3	0.9	7,425	2.0
11	Nitzschia acicularis	3	0.9	770	0.2
12	Melosira granulata	3	0.9	3,025	0.8
13	Synedra radians	3	0.9	990	0.3
14	Dinobryon bavaricum	3	0.9	1,320	0.3

Aphanizomenon flos-aquae cells/mL = 1,337
Aphanizomenon flos-aquae heterocysts/mL = 8

Anabaena circinalis cells/mL = 107

Anabaena planctonica cells/mL = 941
Anabaena planctonica heterocysts/mL = 19

Anabaena flos-aquae cells/mL = 83

Aquatic Analysts **Sample ID:** HN70

Phytoplankton Sample Analysis

Sample: Tenmile Lake
Sample Station: N16
Sample Depth:
Sample Date: 6-Sep-05

Total Density (#/mL): 271
Total Biovolume (um^3/mL): 984,172
Trophic State Index: 49.7

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Aphanizomenon flos-aquae	164	60.7	217,250	22.1
2	Ochromonas-like	30	11.1	1,353	0.1
3	Anabaena circinalis	19	6.8	32,842	3.3
4	Dinobryon sertularia	19	6.8	17,394	1.8
5	Anabaena planctonica	16	6.0	6,222	0.6
6	Fragilaria crotonensis	14	5.1	699,397	71.1
7	Melosira granulata	5	1.7	7,632	0.8
8	Cryptomonas erosa	2	0.9	1,203	0.1
9	Mallomonas sp.	2	0.9	879	0.1

Anabaena planctonica cells/mL = 340
Anabaena planctonica heterocysts/mL = 12
Anabaena planctonica akinetes/mL = 2

Anabaena circinalis cells/mL = 463
Anabaena circinalis heterocysts/mL = 14

Aphanizomenon flos-aquae cells/mL = 3,448
Aphanizomenon flos-aquae heterocysts/mL = 23

Aquatic Analysts

Sample ID: HN71

Oregon Health Division
Drinking water treatment guidance
August 31, 2001

Contact Person: Ken Kauffman
503-731-4015
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.