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:	08-15-05
Re:	*Tenmile Sampling*	CC:	

To all,

August 8th toxic algal cell count results for Tenmile Lakes are as follows:

STATION	DATE	*Microcystis* Cells (no./ml)	*Total Anabaena* Cells (no.ml)
S3	8-08-05	0	20
S8	8-08-05	160	0
N11	8-08-05	2943	104
N16	8-08-05	0	1167

Microcystis aeruginosa at stations S3, S8, and N16 (0,160, and 0 cells/ml, respectively) were all below the WHO Alert Level 1 drinking water guideline of 500 cells ml^{-1} (see below figure). *Microcystis aeruginosa* cells increased ~4-fold to 2943 cells/ml at N11; exceeding the WHO Alert Level 2 drinking water guideline of 2000 cells ml^{-1}. Total *Anabaena* cells/ml remained relatively low at all stations, although station N16 increased to 1167 cells per ml. At the Alert Level 2 guideline of 2000 cells/ml Oregon Human Services (OHS) issues public alerts for drinking water lakes. However, 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. With station N11 exceeding Alert Level 2, 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 *Fragilaria crotonensis and Aphanizomenon,* while North Lake Station N11was dominated by *Microcystis,* and station N16 by *Anabaena* sp. Maximum *Microcystis aeruginosa* accounted for 38.7% 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,

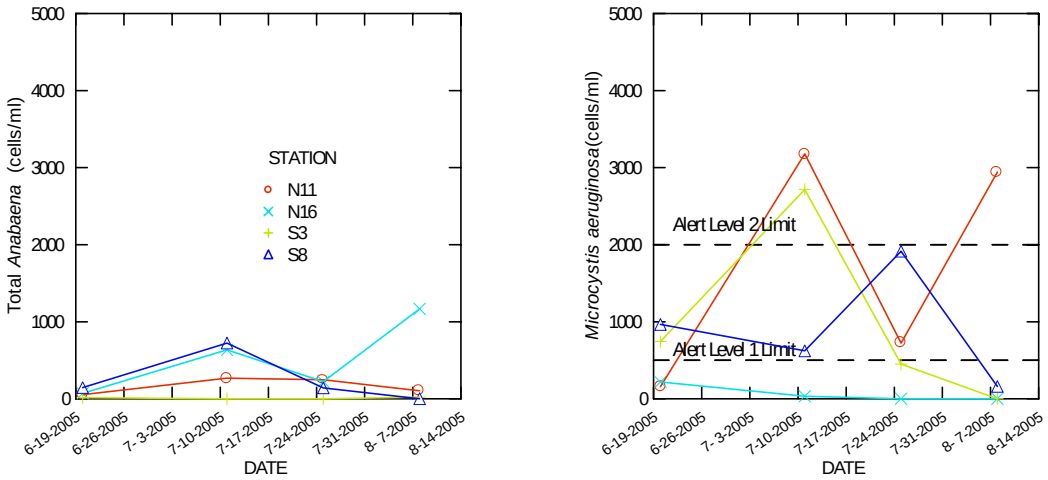
Jacob Kann Ph.D.

Aquatic Ecologist

References for Alert Levels

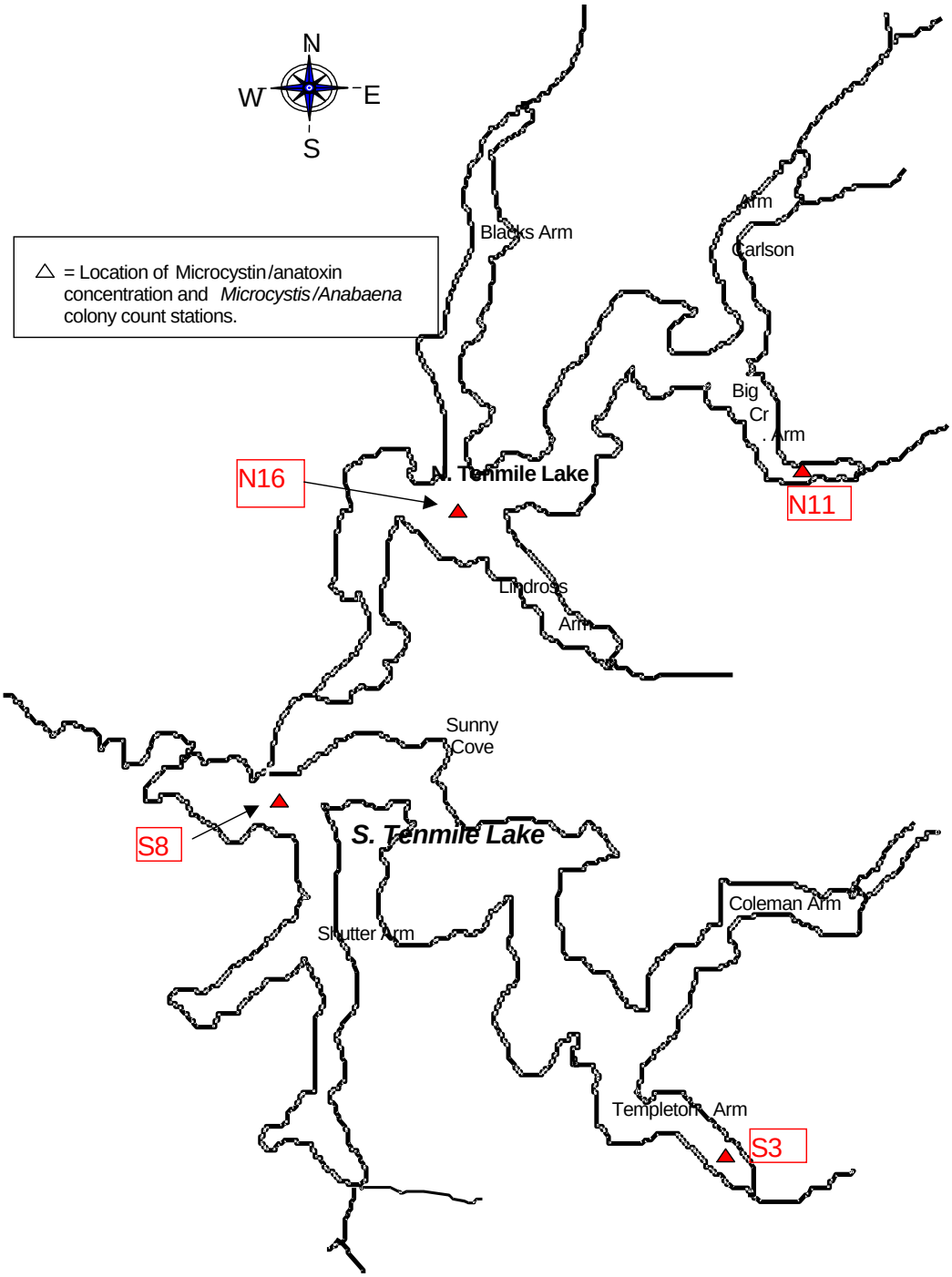
Yoo, S.R., W.W. Carmichael, R.C. Hoehn, and S.E. Hrudy. 1995. Cyanobacterial (blue-green algal) toxins: a resource guide. AWWA Research Foundation and American Water Works Association. Denver, CO. 229 p. (ISBN 0-89867-824-2)

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:	8-Aug-05

Total Density (#/mL):	190
Total Biovolume (um^3/mL):	1,221,832
Trophic State Index:	51.3

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Melosira granulata angustissima	71	37.5	98,202	8.0
2	Fragilaria crotonensis	49	25.9	994,166	81.4
3	Aphanizomenon flos-aquae	36	18.8	47,244	3.9
4	Melosira granulata	22	11.6	51,065	4.2
5	Cosmarium sp.	3	1.8	714	0.1
6	Melosira ambigua	3	1.8	9,014	0.7
7	Tabellaria fenestrata	3	1.8	20,406	1.7
8	Dinobryon bavaricum	2	0.9	1,020	0.1

Aphanizomenon flos-aquae cells/mL =	750
Anabaena flos-aquae heterocysts/mL =	20

Aquatic Analysts **Sample ID:** HN60

Phytoplankton Sample Analysis

Sample:	Tenmile Lake
Sample Station:	S8
Sample Depth:	
Sample Date:	8-Aug-05

Total Density (#/mL):	560
Total Biovolume (um^3/mL):	1,340,385
Trophic State Index:	52.0

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Aphanizomenon flos-aquae	480	85.7	634,578	47.3
2	Melosira granulata	22	4.0	65,249	4.9
3	Fragilaria crotonensis	22	4.0	582,872	43.5
4	Melosira granulata angustissima	16	2.9	21,584	1.6
5	Melosira ambigua	6	1.1	26,368	2.0
6	Dinobryon sertularia	3	0.6	381	0.0
7	Dinobryon sp.	3	0.6	400	0.0
8	Microcystis aeruginosa	3	0.6	1,279	0.1
9	Tabellaria fenestrata	3	0.6	7,674	0.6

Aphanizomenon flos-aquae cells/mL =	10,073
Aphanizomenon flos-aquae heterocysts/mL =	192
Microcystis aeruginosa cells/mL =	160

Aquatic Analysts **Sample ID:** HN61

Phytoplankton Sample Analysis

Sample:	Tenmile Lake
Sample Station:	N11
Sample Depth:	
Sample Date:	8-Aug-05

Total Density (#/mL):	84
Total Biovolume (um^3/mL):	60,766
Trophic State Index:	29.7

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Microcystis aeruginosa	29	35.2	23,544	38.7
2	Unident. green colony	14	17.1	3,007	4.9
3	Synedra rumpens	5	5.7	668	1.1
4	Dinobryon sp.	5	5.7	776	1.3
5	Cryptomonas erosa	3	3.8	1,654	2.7
6	Nitzschia acicularis	2	2.9	668	1.1
7	Achnanthes minutissima	2	2.9	477	0.8
8	Synedra tenera	2	1.9	477	0.8
9	Fragilaria crotonensis	2	1.9	10,690	17.6
10	Anabaena circinalis	2	1.9	3,953	6.5
11	Anabaena flos-aquae	2	1.9	213	0.4
12	Cocconeis placentula	2	1.9	732	1.2
13	Melosira ambigua	2	1.9	2,811	4.6
14	Synedra radians	2	1.9	573	0.9
15	Trachelomonas volvocina	1	1.0	1,499	2.5
16	Mallomonas sp.	1	1.0	302	0.5
17	Rhodomonas minuta	1	1.0	16	0.0
18	Asterionella formosa	1	1.0	1,400	2.3
19	Trachelomonas hispida	1	1.0	1,670	2.7
20	Selenastrum minutum	1	1.0	32	0.1
21	Cyclotella stelligera	1	1.0	44	0.1
22	Eunotia incisa	1	1.0	455	0.7
23	Aphanizomenon flos-aquae	1	1.0	1,503	2.5
24	Anabaena planctonica	1	1.0	2,911	4.8
25	Gomphonema angustatum	1	1.0	143	0.2
26	Cosmarium sp.	1	1.0	167	0.3
27	Oocystis pusilla	1	1.0	172	0.3
28	Scenedesmus quadricauda	1	1.0	207	0.3

Microcystis aeruginosa cells/mL = 2,943

Anabaena circinalis cells/mL =	56
Anabaena circinalis heterocysts/mL =	3
Anabaena flos-aquae cells/mL =	32
Anabaena flos-aquae heterocysts/mL =	2
Aphanizomenon flos-aquae cells/mL =	24
Aphanizomenon flos-aquae heterocysts/mL =	1
Anabaena planctonica cells/mL =	16
Anabaena planctonica heterocysts/mL =	1
Anabaena planctonica akinetes/mL =	1

Aquatic Analysts **Sample ID:** HN62

Phytoplankton Sample Analysis

Sample:	Tenmile Lake
Sample Station:	N16
Sample Depth:	
Sample Date:	8-Aug-05

Total Density (#/mL):	95
Total Biovolume (um^3/mL):	164,313
Trophic State Index:	36.9

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent
1	Anabaena sp.	34	35.4	68,557	41.7
2	Asterionella formosa	12	12.4	9,575	5.8
3	Anabaena planctonica	8	8.8	19,988	12.2
4	Synedra radians	8	8.0	2,994	1.8
5	Melosira granulata angustissima	7	7.1	5,209	3.2
6	Aphanizomenon flos-aquae	5	5.3	4,764	2.9
7	Nitzschia acicularis	3	3.5	941	0.6
8	Cryptomonas erosa	3	2.7	1,311	0.8
9	Melosira ambigua	3	2.7	8,907	5.4
10	Synedra rumpens	3	2.7	459	0.3
11	Rhodomonas minuta	3	2.7	50	0.0
12	Anabaena circinalis	3	2.7	3,579	2.2
13	Fragilaria crotonensis	2	1.8	35,287	21.5
14	Dinobryon sp.	2	1.8	210	0.1
15	Melosira granulata	1	0.9	1,848	1.1
16	Cyclotella stelligera	1	0.9	46	0.0
17	Glenodinium sp.	1	0.9	588	0.4

Aphanizomenon flos-aquae cells/mL =	76
Aphanizomenon flos-aquae heterocysts/mL =	2
Anabaena planctonica cells/mL =	109
Anabaena planctonica heterocysts/mL =	3
Anabaena sp. cells/mL =	1,008
Anabaena sp. heterocysts/mL =	37
Anabaena circinalis cells/mL =	50
Anabaena circinalis heterocysts/mL =	2

Aquatic Analysts **Sample ID:** HN63

August 16, 2005

Oregon Health Division
Drinking water treatment guidance
August 31, 2001

Contact Person: Ken Kauffman
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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.