

## TECHNICAL MEMORANDUM

Results of Cyanobacteria and Microcystin Monitoring in the Vicinity of the Klamath Hydroelectric Project:

**Prepared for:** Tim Hemstreet (PacifiCorp)

**Prepared by:** Sam Mackey

**Date:** 5/26/15



## Introduction

This technical memorandum summarizes the results for the 2015 public health monitoring for cyanobacteria species and an associated toxin, microcystin, in Copco and Iron Gate reservoirs within PacifiCorp's Klamath Hydroelectric Project (Project) and in the Klamath River below Iron Gate Dam. This monitoring is particularly focused on *Microcystis aeruginosa* (MSAE), variants of which are known to produce microcystin. This monitoring also assesses the presence of other potentially-toxic cyanobacteria, including *Anabaena* sp., and others. This monitoring is being conducted pursuant to Interim Measure 15, Water Quality Monitoring, contained in the Klamath Hydroelectric Settlement Agreement (KHSA) executed between the United States Department of Interior, the states of California and Oregon, PacifiCorp, and other parties.

Results from the public health sampling are used to determine if public health advisories are warranted<sup>1</sup>. In addition to PacifiCorp's website ([www.pacificorp.com/es/hydro/hl/kr.html#](http://www.pacificorp.com/es/hydro/hl/kr.html#)), these memos are also posted on the Klamath Basin Monitoring Program's (KBMP) website ([www.kbmp.net](http://www.kbmp.net)) and inform the Blue Green Algae tracker on the KBMP website.

The data summarized in this memorandum include results from the May 18, 2015 sampling event (see Appendix 1).

## Methods

PacifiCorp is conducting public health sampling at 5 sites (Table 1) for laboratory analysis of potentially toxic cyanobacteria, notably MSAE, and microcystin at:

- Four shoreline sites in coves in Copco and Iron Gate reservoirs (i.e., two cove sites in each reservoir).
- One Klamath River site below Iron Gate Dam near the hatchery bridge.

Samples are planned to be taken at shoreline locations in the reservoirs once in May; and twice per month in June, July, August, September, October, and November. Samples to be collected from the river site below Iron Gate Dam are scheduled to be collected according to the discretion of the sampling entity (PacifiCorp) based on river conditions.

---

<sup>1</sup> The California State Water Resources Control Board provides guidelines for posting advisories in recreation water (SWRCB 2010). SWRCB recommends posting advisories in recreation waters under three circumstances: (1) if "scum is present associated with toxic species"; (2) if scum is not present, but the density of *Microcystis* or *Planktothrix* is 40,000 cells/ml or greater; and (3) if scum is not present, but the density of all potentially toxic BGA is 100,000 cells/ml or greater, or 4) if microcystin is 8 µg/L or greater.

Public health samples are taken as grab samples offshore according to the standard operating procedure (SOP) developed by the Klamath Blue Green Algae Working Group ([www.kbmp.net/collaboration/klamath-hydroelectric-settlement-agreement-monitoring](http://www.kbmp.net/collaboration/klamath-hydroelectric-settlement-agreement-monitoring)). Samples collected for potentially toxic phytoplankton are preserved in Lugol's solution and sent to Aquatic Analysts in Friday Harbor, Washington for analysis. The samples are labeled to be rushed for timely analysis and only potentially toxic cyanobacteria are identified and enumerated. However, once the reservoirs are posted with health advisories signs, the reservoir samples are collected but not rushed until it visually appears that the algae bloom conditions have waned. Results for cyanobacteria species are reported as individual cells per milliliter.

Samples for determination of microcystin toxin are placed in a cooler on ice and shipped to the EPA Region 9 Laboratory in Richmond, California. The samples are analyzed using the competitive Enzyme-Linked ImmunoSorbent Assay (ELISA) method based on the EnviroLogix QuantiPlate Kit for microcystins. The quantitation limit is 0.18 µg/L or parts per billion (ppb). This test method does not distinguish between the specific microcystin congeners, but detects their presence to differing degrees. That is, ELISA test results yield one value as the sum of measurable microcystin variants.

Location	Approximate River Mile	Site ID
Copco Reservoir at Mallard Cove	201.5	CRMC
Copco Reservoir at Copco Cove	200.0	CRCC
Iron Gate Reservoir at Camp Creek	192.8	IRCC
Iron Gate Reservoir at John Williams campground	192.4	IRJW
Klamath River below Iron Gate dam near hatchery bridge	189.7	KRBI

## Results

Date	Time	Location	RM	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	ANA <sup>(3)</sup>	Other <sup>(5), (6), (7), (8), (9), or (10)</sup>	Microcystin (µg/L)
5/18/2015	16:00	CRMC	201.5	KR15800	SG	0	0	0	0	*
5/18/2015	17:00	CRCC	200.0	KR15801	SG	0	0	0	0	*
5/18/2015	17:40	IRCC	192.8	KR15802	SG	0	0	0	0	*
5/18/2015	18:05	IRJW	192.4	KR15803	SG	0	0	0	0	*

<sup>1</sup>MSAE = *Microcystis aeruginosa* (cells/mL)

<sup>2</sup>AFA = *Aphanizomenon flos-aquae* (cells/mL)

<sup>3</sup>ANA = *Anabaena flos-aquae* (cells/mL)

Other = either <sup>5</sup>*Planktothrix (Oscillatoria) sp.* or <sup>6</sup>*Gloeoetrichia echinulata* or <sup>7</sup>*Anabaena sp.* or <sup>8</sup>*Lyngbya sp.* (cells/mL) or

<sup>9</sup>*Anabaena circinalis* (cells/mL) or <sup>10</sup>*Anabaena planctonica* (cells/mL)

“0” value indicates non-detect by analytical laboratory

“\*” value indicates results were not available upon the date this memo was submitted and will be included in subsequent memos as availability allows

Algae speciation enumeration results of the public health samples collected on May 18, 2015 (see Table 2) did not indicate the presence of potentially-toxigenic cyanobacteria in Copco or Iron Gate reservoirs. Accordingly, no public health postings have yet occurred.

## References

SWRCB. 2010. Cyanobacteria in California Recreational Water Bodies: Providing Voluntary Guidance about Harmful Algal Blooms, Their Monitoring, and Public Notification. July 2010. Document provided as part of Blue-green Algae Work Group of State Water Resources Control Board (SWRCB) and Office of Environmental Health and Hazard Assessment (OEHHA).

# Appendix 1

## Cyanobacteria Species data for 2015 Public Health Samples

**Table 3.** Summary of 2015 laboratory algal identification and enumeration

Date	Time	Location	RM	Sample ID	Depth	MSAE <sup>(1)</sup>	AFA <sup>(2)</sup>	ANA <sup>(3)</sup>	Other <sup>(5), (6), (7), (8), (9), or (10)</sup>	Microcystin (µg/L)
5/18/2015	16:00	CRMC	201.5	KR15800	SG	0	0	0	0	*
5/18/2015	17:00	CRCC	200.0	KR15801	SG	0	0	0	0	*
5/18/2015	17:40	IRCC	192.8	KR15802	SG	0	0	0	0	*
5/18/2015	18:05	IRJW	192.4	KR15803	SG	0	0	0	0	*

<sup>1</sup>MSAE = *Microcystis aeruginosa* (cells/mL)

<sup>2</sup>AFA = *Aphanizomenon flos-aquae* (cells/mL)

<sup>3</sup>ANA = *Anabaena flos-aquae* (cells/mL)

Other = either <sup>5</sup>*Planktothrix (Oscillatoria) sp.* or <sup>6</sup>*Gloeotrichia echinulata* or <sup>7</sup>*Anabaena sp.* or

<sup>8</sup>*Lyngbya sp.* (cells/mL) or <sup>9</sup>*Anabaena circinalis* (cells/mL) or <sup>10</sup>*Anabaena planctonica* or

<sup>11</sup>*Planktothrix (Oscillatoria) limosa*

“0” value indicates non-detect by analytical laboratory

“NA” value indicates sample loss

“ND” value indicates result less than quantitation limit (0.18 µg/L) by analytical laboratory

## Appendix 2 – Laboratory Phytoplankton Results

Phytoplankton Sample Analysis					
Sample:	Klamath Basin				
Sample Site:	KR 15800				
Sample Depth:					
Sample Date:	18-May-15	1600			
Total Density (#/mL):	<3				
Total Biovolume (um <sup>3</sup> /mL):					
Trophic State Index:					
Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent	Group
1 No Toxic Algae Present	<3				
Note: Toxic Algae Only					
Aquatic Analysts			Sample ID:	SV17	

Phytoplankton Sample Analysis					
Sample:	Klamath Basin				
Sample Site:	KR 15801				
Sample Depth:					
Sample Date:	18-May-15	1700			
Total Density (#/mL):	<6				
Total Biovolume (um <sup>3</sup> /mL):					
Trophic State Index:					
Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent	Group
1 No Toxic Algae Present	<6				
Note: Toxic Algae Only					
Aquatic Analysts			Sample ID:	SV18	

Phytoplankton Sample Analysis					
Sample:	Klamath Basin				
Sample Site:	KR 15802				
Sample Depth:					
Sample Date:	18-May-15	1730			
Total Density (#/mL):	<7				
Total Biovolume (um <sup>3</sup> /mL):					
Trophic State Index:					
Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent	Group
1 No Toxic Algae Present	<7				
Note: Toxic Algae Only					
Aquatic Analysts			Sample ID:	SV19	

Phytoplankton Sample Analysis					
Sample:	Klamath Basin				
Sample Site:	KR 15803				
Sample Depth:					
Sample Date:	18-May-15	1805			
Total Density (#/mL):	<3				
Total Biovolume (um <sup>3</sup> /mL):					
Trophic State Index:					
Species	Density #/mL	Density Percent	Biovolume um <sup>3</sup> /mL	Biovolume Percent	Group
1 No Toxic Algae Present	<3				
Note: Toxic Algae Only					
Aquatic Analysts	Sample ID: SV20				