STANDARD OPERATING PROCEDURE FOR COLLECTION OF PHYTOPLANKTON SAMPLES DURING HARMFUL ALGAL BLOOMS

State of Utah
Department of Environmental Quality
Division of Water Quality

Revision 1
Effective July 13, 2015

Utah Division of Water Quality (DWQ) Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical experts. The primary purpose of this document is for internal DWQ use. This SOP should not replace any official published methods.

Any reference within this document to specific equipment, manufacturers, or supplies is only for descriptive purposes and does not constitute an endorsement of a particular product or service by the author or by DWQ. Additionally, any distribution of this SOP does not constitute an endorsement of a particular procedure or method.

Although DWQ will follow this SOP in most instances, there may be instances in which DWQ will use an alternative methodology, procedure, or process.

REVISION PAGE

Date	Revision #	Summary of Changes	Sections	Other Comments
July 13, 2015	1	Not applicable	Not applicable	New SOP. Adapted from lakes and wetlands sampling protocols. Began document control/revision tracking.

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1. SCOPE AND APPLICABILITY

This document presents the Utah Division of Water Quality's (DWQ) Standard Operating Procedure (SOP) for collecting phytoplankton samples during harmful algal blooms (HAB). Although technically inaccurate, the terms "algae" and "algal" are commonly used to refer to both algae and cyanobacteria.

This SOP applies to any DWQ monitor or non-DWQ cooperator or local health department (LHD) official performing algal bloom sampling in lakes, reservoirs, rivers, or streams. The goal of this sampling is to provide results that may be used: 1) to inform LHD of potential risks for recreation, 2) to inform DDW/public water systems of potential risks to drinking water supplies, and 3) for DWQ to record bloom conditions for use in lake assessments.

Phytoplankton sampling is intended to collect photoautotrophs in the water column, which reflect the biological water quality of the aquatic ecosystem. In the case of HAB monitoring programs or event response, phytoplankton samples are used to detect, identify and quantify specific cyanobacteria in the water column. The purpose of the sampling is to characterize the nature of the bloom in the context of plausible human exposure. Therefore, samples should target areas where there is the highest likelihood or risk of human-cyanotoxin interaction and exposure. This may require some planning to determine common use areas such as, beaches, piers, shoreline access areas, etc. and wind direction, as blooms may be blown to the downwind side of the lake. This information will inform partner agencies whether to take further actions according to their respective response plans.

2. SUMMARY OF METHOD

Phytoplankton samples can be collected from the water column or from the surface depending on the type or phase of the bloom. The extent of cyanobacteria blooms exhibits extensive temporal and spatial variation. As a result, it may be necessary to take several samples from various places around the lake to estimate the threat of the bloom to humans, pets or wildlife. There are several factors that should be considered when selecting sample locations and technique. Samples should be collected in areas of the lake where there is evidence of a potential bloom at the time of sample collection. Within these broader areas, samples should be collected where potential exposure is greatest. In many cases, this means samples should be collected near the shorelines where cyanobacteria cells accumulate, especially in areas that are frequented by recreationists. In addition to targeting potential recreational exposure areas, additional samples should be collected across the extent of the bloom so that the spatial extent of the bloom can be characterized, especially if the waterbody is a drinking water supply. Visual estimates, documented by taking photographs and GPS coordinates, can be used to determine the extent of the bloom. Samples require no immediate field preservation and are kept in the dark and on ice until they can be refrigerated.

3. DEFINITIONS

HAB – Harmful algal bloom

LHD – Local Health Department

m – meter(s)

ml – milliliter(s)

SAV – submerged aquatic vegetation

4. HEALTH AND SAFETY WARNINGS

Algal blooms may contain toxin-producing cyanobacteria. Samplers should wear elbow/shoulder length gloves, eye protection (such as goggles), and waders/boots during sampling. Do not ingest water or allow the water to come into contact with exposed skin. Avoid inhaling spray caused by boats, wind or other water surface disturbances. If these conditions are present, wear a mask to avoid inhalation of water spray. Hands should be washed thoroughly after sampling before eating or drinking. Waders/boots should be rinsed of algal material using fresh water (not lake water) before storage.

It is important that monitors also watch for and report any symptoms of exposure to cyanotoxins, which can occur immediately to several days following exposure. Potential symptoms include:

- Liver toxicity –may take hours or days for symptoms to appear in animals and humans; they include abdominal pain, diarrhea, and vomiting,
- Kidney toxicity –acute, severe gastroenteritis (including diarrhea and vomiting),
- Neurotoxicity –often appear within 15 to 20 minutes of exposure; animals may experience increased salivation, weakness, staggering, convulsions, difficulty breathing, and in severe cases, death. Humans may experience numb lips, tingling fingers and toes, or dizziness,
- Respiratory problems –runny eyes and nose, sore throat, and asthma-like symptoms,
- Skin irritation –visible rash, hives, or blisters, especially under clothing, swimsuits, or wetsuit.
- If any of these symptoms occur, monitors should seek medical treatment immediately.

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water. All boats should be equipped with safety equipment such as personal flotation devices (PFDs), oars, air horn, etc. Utah's Boating Laws and Rules shall be followed by all field personnel.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit is recommended to be rescheduled. If hazardous weather conditions arise during sampling, such as lightning or high winds, personnel should cease sampling and move to a safe location.

5. SAMPLE CAUTIONS AND INTERFERENCES

Care should be taken not to include lake bottom materials that may be disturbed and suspended if wading. Also, avoid collecting a sample in areas with abundant duckweed.

Anything that makes the sample more difficult to visualize in the laboratory can cause interference with results. Try to minimize duckweed, filamentous algae, sediment, etc. in the sample.

High turbidity or dense SAV may also interfere with sample collection.

Samples should not be frozen nor exposed to hot temperatures during storage (i.e., do not store in a hot vehicle outside of a cooler).

6. PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

Monitors collecting phytoplankton samples must read this SOP annually and acknowledge they have done so via a signature page (see **Appendix 1**). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new monitor is competent in carrying out this SOP. The signature page will be kept on-file at DWQ along with the official hard copy of this SOP.

7. EQUIPMENT AND SUPPLIES

___ Copy of this SOP

____Protective equipment: extended gloves, safety goggles, mask, chest/hip waders, and PFD

____Clean, plastic ½ gallon sample bottles. The State Lab provides these bottles. Alternatively, a new, unused jug of deionized/distilled/RO water could be used for sample collection. Open the bottle, pour out the contents, and rinse the bottle with native water before using.

____Clean 1 gallon or greater bucket for compositing samples

____1 clean stirring rod

____Digital camera

____GPS

____Pencils and sharpies

____Sample labels

____Phytoplankton sample labels (**Figure 1**)
____Sample tracking forms (**Appendix 2**)
____Bloom Report Form (**Appendix 3**)
____Field notebook or field form
____Cooler and wet ice or ice packs

Figure 1. Sample label (U:\PERMITS\MONITORS\Labels\HAB-PHYTO-CYANO(5163or5523).doc)

HAB CYANO ID & QUANT. (wet ice) Rushforth Phycology

Site Desc:_____

_____

MLID: _____ Bloom Observed?_____

Samplers: _____Date:_____Time:_____

8. PROCEDURE

If the bloom is obvious, (i.e., concentrated surface scum), perform a simple, surface grab sample from the center of the bloom with a 1 liter bottle. Follow the steps outlined below only ignoring steps 5-8.

If the bloom appears dispersed (i.e., mixed throughout the water column) collect three grab samples in 1 liter bottles. These triplicate samples will be composited into a ½ gallon sample bottle for analysis. The following procedure should be followed:

1) Upon arrival at the lake, check the GPS coordinate to locate the predetermined area. Please note that this coordinate point is a recommendation and should not supersede the current, ground-based information. Use your judgement to identify the area(s) where the public has access such as beaches, piers, docks, etc., and where the bloom is concentrated. Take note of wind direction and whether the bloom has blown across the lake to another public access point. If so, collect the sample from that location. If no coordinates are given, or if the sample location changes, ensure that GPS coordinates are collected from the shoreline at the first sampling point and record them. Label the ½ gallon sample bottle with the sampling location, date and time of collection.
2) Put on personal protective gear such as gloves, eye protection, mask, waders/ boots, etc.
3) Gather the 3 unopened sample bottles and wade into the reservoir until knee deep.

4) Remove the lid of the sample bottle and carefully dip the bottle beneath the surface of the water to fill, evenly sampling as much of the water column as possible without disturbing the bottom sediments. Replace the lid and move to the next sample point.
5) Walk 10 feet in one direction (paralleling the shoreline) to grab the second replicate; then walk another 10 feet further to grab the third replicate sample. Take extra care when paralleling the shoreline to minimize disturbance of the bottom sediments (i.e. do not sample the kicked up sediment plume).
6) Return to shore and composite the three samples in a bucket, mix the samples using a clean stirring rod, and then fill a ½ gallon plastic collection bottle leaving a small headspace
7) Store the samples in a cooler on wet ice or ice packs.
8) Fill out bloom report form (**Appendix 3**) accurately and completely.
9) If samples are to be delivered to the lab immediately, fill out a Sample Tracking form (**Appendix 2**). Samples must be kept in the cooler on wet ice, or otherwise refrigerated in dark conditions until delivery to the lab for analysis.

9. LABORATORY ANALYTICAL METHODS

Phytoplankton samples will be analyzed within 36 hours of collection. Samples will be analyzed quantitatively for community composition and involves direct observation and enumeration of the dominant algae and any cyanobacteria present in the water column sampled. Species are identified to the lowest possible taxonomic category (generally species) and counted. Cell density for all identified cyanobacteria *sp.* will be calculated. The methodology and quality assurance and quality control procedures for this analysis and analyzing laboratory can be obtained from:

Dr. Samuel R. Rushforth
Rushforth Phycology, LLC
Orem, UT
(801) 225-5736
sam@rushforthphycology.com
http://rushforthphycology.com/201.html

10. DATA AND RECORDS MANAGEMENT

Fill out the bloom report form accurately and completely. Make sure information on the field sheet is consistent with the information on the sample container label.

11. QUALITY ASSURANCE AND QUALITY CONTROL

Not applicable to this SOP.

12. REFERENCES

http://epa.ohio.gov/portals/35/hab/HABResponseStrategy.pdf

http://publicfiles.dep.state.fl.us/dear/labs/biology/hab/cyanobacteria_sop.pdf

http://water.usgs.gov/owq/FieldManual/Chapter7/7.5.pdf

http://www2.coastalscience.noaa.gov/publications/detail.aspx?resource=VZxir09ShLAS4Hsc64yGhWnfPJg+wTJW+oxUb7z0Mr8=

http://www.esf.edu/glrc/documents/GLRR06.pdf

http://www.cdph.ca.gov/HealthInfo/environhealth/water/Documents/BGA/ISOCHABdocument.pdf

https://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Documents/HABPublicHealthAdvisoryGuidelines.10.10.12.pdf

13. APPENDICES

Appendix 1 - SOP Acknowledgment and Training Form (front and back)

(U:\WQ\PERMITS\MONITORS\QAQC\Helpful Templates\SOP Acknowledgement and Training Form.doc)

DWQ SOP Acknowledgement and Training Form
2/28/2011
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SOP Acknowledgement and Training Form

This SOP must be read and this form signed annually. This form must be kept with the current version of the SOP.

Document Title:	
Document Revision Number:	
Document Revision Date:	

Please sign below in accordance with the following statement: "I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent approved revision."

Printed Name	Signature	Date

SOP Acknowledgement and Training Form (continued)

Trainee: Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer: Sign below to acknowledge that training on this SOP was completed for the individual listed and that trainee is competent to perform the procedures described within.

Date of Training	Trainee Printed Name	Trainee Signature	Trainer Printed Name	Trainer Signature

Appendix 2 – Chain Of Custody form for phytoplankton samples analyzed by Rushforth Phycology

(U:\PERMITS\MONITORS\Forms\Chain of Custody Forms\ COC_HAB-CYANO_Rushforth.pdf)

UTAH DIVISION OF WATER QUALITY				Harmful Algal Bloom - CYANO CHAIN OF CUSTODY RECORD (Rushforth Phycology, LLC)		
PROJECT:				Sample Collection Method: Grab Sample	Preservation: Refrigerated	
Sample Date Range:					Analysis Requested: Quantitative Cyanobacteria ID	
Sample Number	Date Collected	Time Collected	MLID or Lat/Long	Site Name	Collector Initials	Notes
Relinquished By:				Date:	Time:	REMARKS:
Received By:				Date:	Time:	

Page _____ of _____

Appendix 3 – Bloom Report Form

P:\WQ\WQM\HAB\Guidance\ UT DWQ Algal Bloom Report Form.docx)