Sampling for Cyanobacteria Blooms

1. INTRODUCTION: Use the procedures in this SOP to collect aqueous or cyanobacteria (blue-green algae) samples for toxin analysis, algal enumeration and identification, or biomass estimates. This SOP does not address sampling design issues which can be site or project specific. Care should be taken to ensure the sampling design will support the types of management decisions that the resulting data are intended to support.

   1.1. Use the following DEP SOPs in conjunction with this SOP (available at: http://www.dep.state.fl.us/labs/bars/sas/qa/sops.htm):
   - FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
   - FC 1000 Cleaning/Decontamination Procedures
   - FD 1000 Documentation Procedures
   - FM 1000 Field Planning and Mobilization
   - FQ 1000 Field Quality Control Requirements
   - FS 1000 General Sampling Procedures
   - FS 2000 General Aqueous Sampling
   - FS 2100 Surface Water Sampling
   - FT 1000 General Field Testing and Measurement
   - FS 7000 General Biological Community Sampling

   1.1.1. Use additional SOPs as required for specific applications.

2. Equipment and Supplies: Sample Containers
   2.1. Collect samples for algal toxin analysis in clean wide mouth amber glass bottles with caps having a Teflon® liner.
   2.2. Collect samples for algal enumeration and identification in clean plastic or glass containers.
   2.3. Collect samples for biomass estimates in clean plastic or glass containers.
   2.4. Visually inspect bottles and caps for defects. Do not use if defects are present or containers do not appear clean.
   2.5. Cyanobacteria bloom sampling requires knowledge of proper algal sampling techniques, safety protocols and personal protective equipment (PPE). The degree and type of safety measures and PPE required depends on the unique characteristics of the bloom to be sampled. Typical short-term acute risks include, but are not limited to, contact dermatitis and upper respiratory irritation. Long-term risks are unknown; however certain cyanobacteria are known to produce toxins that are tumor promoters, even at very low doses. Samplers should use appropriate PPE to reduce occupational exposure to these toxins.
      2.5.1. MINIMUM SAFETY PLANNING AND PROCEDURES: It is beyond the scope of this field sampling SOP to describe safety protocols for every contingency. Follow the listed minimum safety procedures below, where applicable:
         2.5.1.1. Produce a written sampling plan and review with all personnel.

2.5.1.2. Ensure that all personnel are appropriately trained.
2.5.1.3. Ensure that sampling personnel meet employer medical requirements.
2.5.1.4. Conduct site reconnaissance and identify hazards.
2.5.1.5. Provide appropriate PPE and sampling equipment to all samplers.
2.5.1.6. Establish site control (exclusion zones, access corridors, etc.).
2.5.1.7. Establish decontamination protocols for samplers.
2.5.1.8. Prepare for emergencies (backup personnel, spill containment, fire equipment, first aid, evacuations, etc.)

3. SAMPLE COLLECTION PROCEDURES

3.1. In order to provide consistency between sampling agencies and programs, it is recommended that all samples be collected as grab samples. Collect separate, discrete samples of the water column, the scum layer, and/or any algal mats. These samples should be analyzed and interpreted separately.

3.1.1. Clearly mark the sample container so that each sample is uniquely identified. Information, such as the water body name, station location, date and time collected, sampler's name, is important to help identify the individual sample.
3.1.2. If composite data are needed, collect individual grab samples over the specified time period or area.
3.1.3. Submit all samples for analysis.
3.1.4. Average the concentrations of the individual grab sample results to determine the average concentration over time or area. Do not average water column and scum values together.

3.2. Water Column Sample

3.2.1. Collect surface grab sample within the top 0.3 m of the water column. If the sample is to be collected from a depth other than 0.3 m, this should be noted on the sample container and sample submittal form. *Do not collect the sample by skimming the surface.*
3.2.2. Do not rinse the interior of the sample container with site water prior to collection.
3.2.3. Collect the surface grab sample directly into the container.
3.2.3.1. Slowly submerge the container, opening first, into the water. If an algal scum layer is present, attempt to avoid submerging the bottle through the algal scum layer as this may introduce algal scum into the sample and may not be representative of the water column.
3.2.3.2. Invert the bottle at the desired sampling depth so the opening is upright and pointing towards the direction of flow (if applicable). Allow water to enter the container until the bottle is almost full.
3.2.3.3. Return the filled container quickly to the surface.
3.2.3.4. Pour out a small volume of sample, if needed, to allow for homogenization back at the lab.
3.2.3.5. Quickly cap the container and tighten securely.

3.2.4. Collecting water column samples at depth
3.2.4.1. If a sample is to be collected using a Coliwasa tube, Alpha bottle, or other secondary sampling device, the method of sampling must be documented.

To the extent possible, the secondary sampling device must be constructed of materials compatible with sampling for cyanotoxins (e.g. glass, Teflon®). Record the depth sampled on the sample bottle if multiple depths are sampled. Record the method of collection and sample depth on the field sheet.

3.3. Surface Scum Sample

3.3.1. In order to collect an algal scum layer sample in a repeatable manner that would be representative of a potential recreational exposure, it is recommended that the scum layer be gently mixed to homogenize it with the underlying water such that it is dispersed in the upper 10 cm of the water column.

3.3.2. Homogenize the water and algal scum layer in a 0.5-m diameter area by agitating the surface scum with a gloved hand or other device.

3.3.3. Quickly collect a sample within the top 5-10 cm of the water column. *Do not collect the sample by skimming the surface*.

3.3.4. Do not rinse the interior of the sample container with site water prior to collection.

3.3.5. Collect the sample directly into the container.

3.3.5.1. Slowly submerge the container, opening first, into the water.

3.3.5.2. Invert the bottle so the opening is upright and pointing towards the direction of flow (if applicable). Allow the water to enter the container until the bottle is almost full.

3.3.5.3. Return the filled container quickly to the surface.

3.3.5.4. Pour out a small volume of sample, if needed, to allow for homogenization back at the lab.

3.3.5.5. Quickly cap the container and tighten securely.

3.3.5.6. Label the sample container.

3.3.6. Scum Sample Core

3.3.6.1 If conditions permit, a scum sample core can be taken using a wide mouth polycarbonate jar having a 3/8" diameter hole in the bottom and a line marking a known volume (see diagram at end of SOP).

3.3.6.2. The jar is inverted and gently forced through the scum layer until the surface of the scum reaches the line on the jar. The hole in the bottom of the jar allows air to escape while sampling.

3.3.6.3. With the jar still in place, the lid is screwed onto the jar securely before removing the jar from the water.

3.3.6.4. Once the jar is free of the water, a finger is placed over the hole in the bottom and the jar is mixed by gently inverting for 15-20 seconds in order to homogenize the scum layer with the underlying water.

3.3.6.5. The homogenized sample is then quickly transferred to a clean wide mouth amber bottle for transport.

3.3.6.6. Label the sample container.

3.3.6.7. A clean coring device must be used for each sample or the device must be decontaminated after each use.

3.3.6.8. If decontamination is to be performed in the field, equipment blanks will need to be collected to document that the decontamination process was

successful and subsequent samples were not contaminated by the equipment.

3.4. Benthic Algal Mat Sample

3.4.1. Sample for Taxonomic Identification

3.4.1.1 Benthic algal mat samples for taxonomic identification can be collected by pinching off algal filaments from 10 different substrates either within a 100-meter stretch of river or stream or from within the area of interest in a lake.

3.4.1.2. Place all 10 aliquots into a clean plastic 50-mL centrifuge tube.

3.4.1.3. Label the sample container.

3.4.2. Sample for Cyanotoxin Analysis

3.4.2.1. Benthic algal mat samples for cyanotoxin analysis can be collected in the same way as described in 3.4.1.1 for taxonomic identification.

3.4.2.2. Place all 10 aliquots into a clean wide mouth amber glass bottle with enough site water to keep the algae submerged.

3.4.2.3. Label the sample container.

3.4.3. Sample for Algal Mat Biomass

3.4.3.1. Use a plastic metric ruler to measure the thickness of the algal mat from the top of the mat to the surface of the substrate to which it is attached.

3.4.3.2. Record the thickness on the field sheet and the sample container. The thickness measurement can be used along with the diameter of the sample container opening to calculate the volume of water that contained the collected biomass.

3.4.3.3. Use a wide mouth sampling container as a coring device by first submerging the container to fill it with site water. Once filled, invert the container over the mat and force the container down through the mat until you have reached the bottom substrate.

3.4.3.4. If the bottom substrate is hard, twist the sample container back and forth to shear off any filaments that are trapped between the substrate and the lip of the container. This will result in a core sample within the bottle.

3.4.3.5. Press down firmly and slide the container sideways the width of the container opening to scrape the entrapped filaments off the substrate.

3.4.3.6. If the bottom substrate is soft, force a wide putty knife blade between the soft substrate and the lip of the containers. Remove the sample container from the water with the blade of the putty knife still completely covering the opening of the container. For best results the front edge of the putty knife should be sharpened (ground on one edge like a flat chisel) to better facilitate cutting off algal filaments.

3.4.3.7. Carefully lift the lip of the container enough to slide the putty knife blade over the mouth of the container.

3.4.3.8. With the putty knife covering the mouth of the container, right the container and remove from the water.

3.4.3.9. Place the lid on the container and tighten securely.

3.4.3.10. Label the sample container.

3.4.3.11. A clean putty knife must be used for each sample, or the device must be decontaminated after each use.

3.4.3.12. If decontamination is to be performed in the field, equipment blanks will need to be collected to document that the decontamination process was successful and subsequent samples were not contaminated by the equipment.

4. TRANSPORT AND HANDLING OF SAMPLES

4.1. After the samples have been collected and containerized, clean the outside of the containers with water, paper towels or other absorbent materials to remove any spilled sample from the exterior of the container.

4.2. Protect glass containers from breakage ("bubble wrap" is recommended).

4.3. Samples need to be shipped to the laboratory in time to meet the prescribed holding time for the analyses being performed. Since there is limited data available to establish appropriate holding times for cyanobacteria toxin analyses, initial holding times may be quite conservative until additional studies are completed. Contact the analytical laboratory to which you are submitting samples for hold time information.

5. PRESERVATION

5.1. Samples for cyanobacteria toxin analysis should immediately be placed in a cooler on wet ice.

5.2. Samples for which a quick turn-around time is needed to identify only the dominant bloom species should be placed on ice and submitted without preservation.

5.3. Samples for algal enumeration and identification should be either immediately placed on wet ice or immediately preserved with Lugol's solution in the field. If samples are shipped overnight to the laboratory performing the analysis, samples may be preserved with a sufficient volume (3 mL/L minimum) of Lugol's solution when the samples are received in the laboratory provided that the samples are kept on ice. Samples preserved with Lugol's solution in the field do not need to be placed on wet ice, but should be kept cool. The exact volume of Lugol's solution needed will be dependent upon the density of the algae and the size of the sampling bottle. Sufficient Lugol's solution has been added once a drop of the preserved sample placed on white writing paper turns the paper black almost immediately.

5.3.1. For long-term storage

5.3.1.1. Sample containers should be stored in the dark. Add buffered formalin to achieve a minimum of 2.5% final concentration (approximately 25 mL (See FS 7001, section 1).

5.4. Samples for biomass estimates should be placed in a cooler on wet ice.

6. DOCUMENTATION

6.1. Label each bottle with an appropriate field ID number.

6.2. Complete field records.

6.3. Make notes on the transmittal form and in field records about any relevant observations or problems.