New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB)

Standard Operating Procedure (SOP) for

Harmful Algal Blooms (HABs) Monitoring and Data Management

Approval Signatures

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1.0 Purpose and Scope

The purpose of this procedure is to describe and detail the processes associated with Harmful Algal blooms (HABs) that include monitoring and data management. The decision criteria for determining and communicating related health advisories is maintained in the New Mexico HABs Response Plan. HABs are overgrowths of certain algae in water that pose a health risk to people and animals due to potential toxins. In New Mexico, HABs are most often attributed to cyanobacteria, also known as blue-green algae. The Standards for Interstate and Intrastate Surface Waters codified at 20.6.4 New Mexico Administrate code (NMAC) (2025) includes water quality standard criteria (i.e., total microcystins and cylindrospermopsin) for Primary Contact Use (i.e., Recreational Use). Recreational stations are selected for HAB sampling that occur in littoral zones of lake where past HABs have been known to happen or areas that are prone to heavy public recreation (swim beach, boat launch, campground, etc.).

2.0 Personnel Responsibilities

The Quality Assurance Officer (QAO) is involved in the development and revision of this SOP to ensure the SOP meets the requirements of the SWQB's Quality Assurance Project Plan. The QAO; the Monitoring, Assessment, and Standards Section (MASS) Program Manager; and SWQB quality subject matter experts (e.g., the HABs Outreach Coordinator, the Monitoring Supervisor, and field staff scientists) will determine if any revisions to this SOP are needed at a minimum of every two (2) years in accordance with the most current SOP 1.1 for the Creation and Maintenance of SOPs (NMED/SWQB 2020). Pending the review and approval of the document, the QAO will ensure the SOP is accessible through the SWQB's website.

The HABs Outreach Coordinator is responsible for:

- Coordinating with the Monitoring Supervisor and MASS Program Manager on Sampling and Analysis plan development which includes scope of projected seasonal HABs sampling (dependent on staff and financial resources) and use of related monitoring equipment;
- Coordinating HABs data collection and photo documentation with external partners such as Lake Managers and interested stakeholders;
- Drafting and finalizing HAB Data Field Forms for sample events not conducted by MASS;
- Entering sampling event information from Field Forms into SQUID not conducted by MASS;
- Coordinating with QAO to upload HAB data;
- Verification and Validation of HAB data according to SOP 15.0 Verification and Validation for Clean Water Act (CWA) §303(d)/ §305(b) assessments;
- Coordinating HAB advisories, warnings, and lake closures with the MASS Program Manager, applicable NMED staff, and external entities; and
- Maintaining the SWQB HABs website with the latest information regarding HABs events.

Field Staff are responsible for their specific sample data collection events which includes the following processes:

- Coordinating with the Monitoring Supervisor on the scope of the project and use of the equipment;
- Calibrating sonde(s) used for sample collection and maintaining electronic calibration sheets on NMED's internal server;
- Electronic HAB Field Data Form (i.e., HABs Field Sheet) and data files on NMED's internal server;

- Post-checking sonde calibration within 48 hours of sampling run completion, reporting post-deployment calibration values on the calibration sheet and storing on NMED's interval server; and
- Ensuring SWQB equipment is cleaned and stored in accordance with specification in SWQB SOP.

Bureau personnel conducting water quality monitoring associated with HABs are responsible for ensuring that the procedures prescribed in the SOP are followed and implemented in accordance with this SOP and shall acknowledge such by signing the Acknowledgment Form for SOP 13.2 HABs Monitoring.

3.0 Background and Precautions

3.1 Background

Cyanobacteria generally grow in lakes, ponds, and slow-moving streams when water is warm and stagnant. Under normal conditions, cyanobacteria are present in surface waters at low levels and play an important role in aquatic ecosystems. However, some cyanobacteria blooms (i.e., HABs) produce cyanotoxins that pose a threat to human and animal health.

Cyanobacterial blooms pose a direct health threat via food, water, and recreational exposures and cause ancillary economic impacts to tourism and real estate. From an ecological perspective, CyanoHABs can lead to undesirable biogeochemical changes, including large accumulations of biomass that create hypoxic zones as they decay, often resulting in fish kills and the release of toxic gases such as hydrogen sulfide, ammonia and methane from the sediments. Their poor nutritional value, large colony sizes, and prolific production of toxic secondary metabolites all negatively impact food webs, inducing cascading effects on biodiversity, fisheries production, and habitat. Blooms may also produce a variety of earthy and/or musty taste-and-odor compounds (e.g., geosmin and 2-methylisoborneol) that render waters unpalatable for drinking. Lastly, and most importantly, numerous cyanobacteria HAB species produce potent toxins that impact the liver, digestive, and nervous systems of animals and humans that ingest contaminated waters. (Paerl, et. al. 2018)

3.2 Procedural Precautions

To ensure the ambient water quality of the water body is measured during an active HAB event, do not place the sonde directly into a specific HAB bloom when collecting sonde parameters.

Note: high loads of sediment may pose issues for analytical cyanotoxin analysis and may bias results due to interference caused by sediment. Staff should contact laboratory for more information if questions or concerns arise.

3.3 Safety Precautions

Harmful Algal Blooms pose a risk to human health, whenever sampling follow these Best Management Practices (BMPs):

- Avoid contact with water (wear nitrile gloves)
- Never ingest water suspected of containing HABs
- Wear eye protection to avoid getting water in eyes
- Try not to inhale aerosolized particles (e.g., spray from boat)

- Wash hands with soap after sampling
- Wash waders with clean water, mild soap, an/or diluted bleach, or disinfectant
- Follow general wading safety practices
- Follow acid safety protocols when handling Lugol's solution

4.0 Definitions, Abbreviation, Acronyms

For common definitions and acronyms not defined in this SOP, refer to the most up to date SWQB Quality Management Plan for Environmental Data Operations.

Sampling and Analysis Plan (SAP) – A document that provides guidance for all fieldwork by defining in detail the sampling and field data-gathering methods as well as resource requirements for the project.

RID – A reference ID. This is a unique number and barcode assigned to each sample. RID stickers are provided by the NM Department of Health State Laboratory.

SQUID – The SWQB internal database for entering and storing surface water quality information including but not limited to projects, monitoring locations and all associated water quality data.

5.0 Equipment and Tools

A list of Personal Protective Equipment and the equipment and tools that are needed to accomplish the task described by the SOP are detailed below.

Personal Protective Equipment (PPE)

- Powderless Nitrile gloves
- Eyewear
- Waders
- Mask (for aerosolized particles)
- Muck Boots
- Shoulder length gloves for deeper samples

Equipment Required for Sampling

- HABs Field Form
- High Precision pH Strips (recommended pH resolution of ≤ 1.0 pH)
- RIDs
- Lugol's solution
- Sonde
- Sharpie
- Cooler with ice

Table 1. Sample Containers

Microcystins and Cylindrospermopsin	30-60 mL PETG or glass amber bottle
Anatoxins	Preservative and vials supplied by Laboratory
Saxitoxins	Amber glass bottles with preservative supplied by Laboratory
Cyanobacteria ID	HDPE bottles (125 mL or larger)

SPATTs Equipment

- SPATT bag in Ethanol
- Ziplock Bags
- Embroidery Hoop
- Hammer
- Zip Ties
- Rebar
- Dry Ice
- Dry Ice Cooler (if available)

6.0 Step-by-step Process Description

A Sampling and Analysis Plan (SAP) should be developed for HAB sampling each field season to identify priority water bodies for seasonal sampling (generally July through November). However, sample locations identified in the SAP will most likely change as the season moves forward. HAB sampling differs from ambient water quality sampling surveys regarding the systematic planning process in that not all steps are followed. HAB sampling surveys are more dynamic and include targeted response monitoring as additional information becomes available. More information on Systematic Planning can be found in the most up to date Quality Management Plan for Environmental Information Operations (NMED/SWQB 2025).

6.1 Office Procedures (Prior to field work)

Prior to leaving the office, staff must utilize the EPA CyAN application to identify locations of potential bloom areas via satellite (Blake, et al. 2018). The EPA CyAN application website can be accessed at https://www.epa.gov/water-research/cyanobacteria-assessment-network-mobile-application-cyan-app. Identify sampling location by evaluating the highest risk and use areas for recreationalists, typically where the most prevalent bloom occurs with heavy recreational activity in the area. Once locations have been reviewed using the CyAN application and other mapping programs, prioritize sample locations that are identified as areas of concern.

Begin drafting HAB Field Form for each location that may be sampled and save on device that can be taken to the field when sampling. HAB Field Forms are accessible at https://www.env.nm.gov/surface-water-quality/sop/ under related forms for SOP 13.2 Harmful Algal Blooms. **Station and RID information on HAB form should be entered in preparation for the sampling event.**

6.2 Field Protocols

Typically, the NMED SWQB will collect at least one (1) HAB sample at the main boat dock of a lake suspected to have HABs and will also include areas of suspected HABs in high recreation locations immediately off the shore or bank. As stated previously, the EPA CyAN application should be used to evaluate and identify area of suspected HAB blooms prior to leaving the office.

HAB sample(s) should be collected directly from bloom using specified container dependent on analysis being conducted. Staff should ensure they take precautions and utilize proper PPE when collecting HAB samples. Nitrile gloves must be worn when collecting samples at a minimum.

Sonde parameters should be collected at all sample locations, when possible, just below water surface above substrate. Sonde parameters should include at a minimum pH and dissolved oxygen (mg/l and %). The sonde must be calibrated prior to data collection according to SOP 6.1 Sondes. The sonde parameters must be taken from the ambient surface water adjacent to bloom just below the surface. If sonde parameters are also taken of the bloom a note must be made on the field data form to indicate parameters are from bloom. If a sonde is not available for data collection, pH strips must be used to determine pH of the water body and GPS coordinates must also be taken. pH is a required parameter for HAB analytical services submittal forms for some toxins.

The type of analysis being conducted will determine preservatives, hold time, and sample containers. Typically, the NMED SWQB will initially request microcystins and cylindrospermopsin analysis (Cyanobacteria Toxins suite) when first conducting sampling for the season. Future analysis will be determined based on initial results of the analysis for microcystins and cylindrospermopsin. If possible and resources allow a nutrient sample and *E. coli* sample should be taken as well (see SOP 8.2 Chemical Sampling in Lotic Environments and SOP 9.1 Bacteriological Sampling).

Analyses utilized by the SWQB include:

- Microcystins (EPA method 546 or equivalent (e.g., ELISA))
- Cylindrospermopsin (EPA method 545 or equivalent (e.g., ELISA))
- Anatoxins (EPA method 545 or equivalent (e.g., ELISA))
- Saxitoxins (ELISA, LC-MS/MS, or equivalent)
- Cyanobacteria ID (IFCB, Microscopy, Flow cell)

The SWQB is currently utilizing the EPA Region 6 Houston Laboratory as well as contract laboratories for HAB analyses.

6.2.1 Identifying HABs

HABs generally occur in standing water such as reservoirs, lakes, or ponds. They may also occur in slower moving areas in rivers, or on the bottom of the river attached to robles, rocks, or plants. HABs can vary greatly in appearance and may not always be easy to identify. True species identification can only be done under a microscope, but a bloom is often visible with the naked eye. HABs can appear blue/green, green, brown, red, or gold in color. They can look like foam, scum, paint, grass clippings, globules, or mat-like formations on the water's surface or subsurface. They may also have a gasoline, septic, or fishy smell. Some example photos of HABs in New Mexico are included in Figures 1 & 2 below.

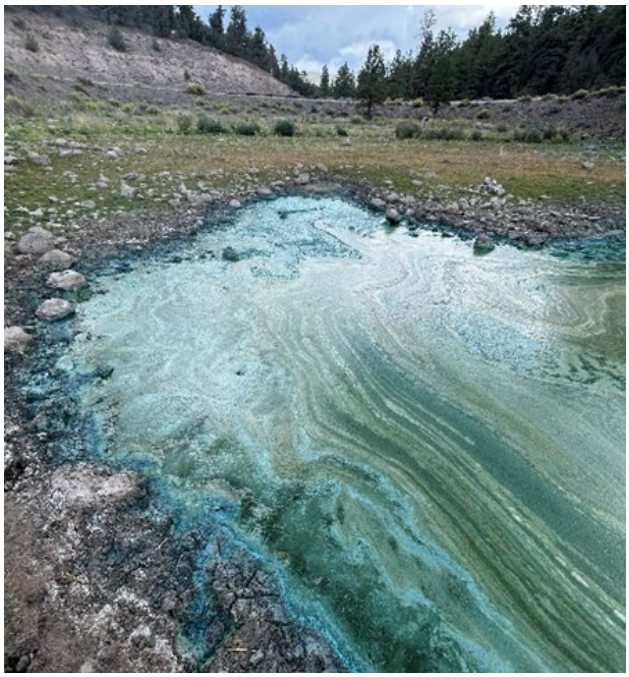

Figure 1. Microcystis bloom – Quemado Lake (2025)

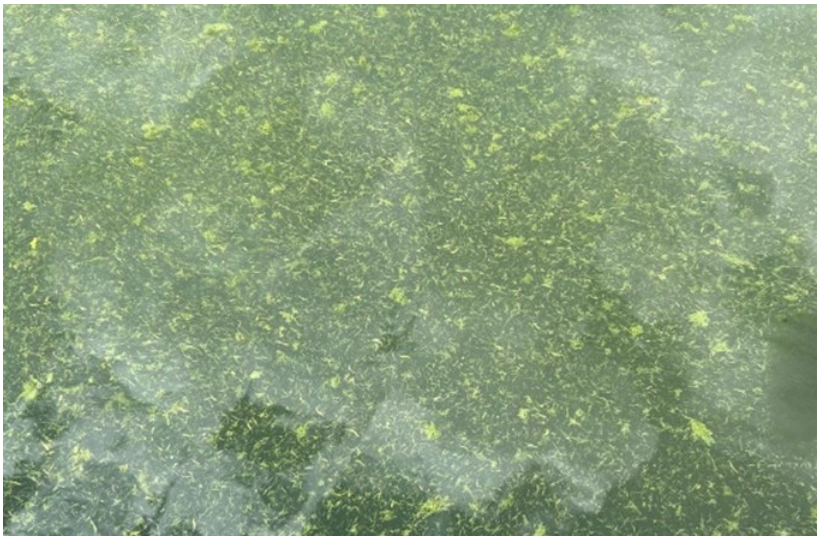

Figure 2. Aphanizomenom bloom – Eagles Nest Lake (2025)

Filamentous algae are often mistaken as a HAB. Using a stick test can help distinguish between filamentous algae and cyanobacteria (HABs).

1. Run a stick through the bloom
2. If the stick looks like it has been in a can of paint, it is likely a HAB.
3. If the bloom hangs off in filaments, or thin hairs, it is likely filamentous green algae and not a HAB

Figure 3. Filamentous Algae - Credit Utah DEQ


Figure 4. Filamentous Algae - Credit Lake Restoration Incorporated.


Figure 5. Duckweed – can make surface water look bright green. Credit: Getty Images/iStockphoto

For more examples of HABs in New Mexico please see related SOP forms under SOP 13.2, HAB Examples.

6.2.2 Sample Collection

During sample collection the following must be completed:

1. Take photos of the sampling area to be filed in the appropriate folder in the HABs Advisory Program subfolder on the SWQB network at \\FS01\Data$\WPD\SWQB\MASS.
2. Complete a HABs Field Data Form with one RID for each sample taken and the required pH or full sonde parameters.
3. Record any notes regarding surface water conditions such as location, appearance of water, appearance of algae, extent of bloom, smell, etc.
4. Upload sampling event data from field form to SQUID upon returning to the office. This should be done immediately upon returning to the office to avoid loss of information.

Grab samples should be taken just off the shore or boat ramp/dock at potential HAB location. The sample should be taken directly with the sample container, except when sampling anatoxins, a secondary container (amber glass bottle) is required. See Table 2 for specifics regarding required sample container(s), preservatives and hold times for each analytical constituent.

6.2.3 Procedure for Collecting HAB Targeted Grab Sample(s)

Typically, NM blooms contain a concentrated algal mat or scum on the surface of the water, which requires a surface grab sample:

Microcystin, Cylindrospermopsin and Saxitoxin – Sample Collection Procedure

1. Target the highest visual accumulation area.
2. Tilt the bottle parallel to the water surface to capture the top 1-2 inches of the surface water scum. If there is any preservative in the bottle, be careful not to invert the bottle.
3. Fill the microcystins, cylindrospermopsin, and saxitoxin bottles only ½ to ¾ full due to the need to freeze the sample.
4. Container and preservation requirements for each parameter are detailed in Table 2.

Table 2. Containers, Preservatives, and Hold Times

Parameter	Container	Preservation
Microcystins	PETG[1] or glass amber bottle (60mL or 30mL)	On ice in the dark ≤ 6°C for up to 72 hours. After 72 hours -20°C in dark up to 14 days.
Cylindrospermopsin[2]	PETG[1] or glass amber bottle (60mL or 30mL)	On ice in the dark ≤ 6°C for up to 72 hours. After 72 hours -20°C in dark up to 14 days.
Anatoxins[3]	Preservative and vials supplied by Laboratory	On ice in the dark ≤ 6°C for up to 72 hours. After 72 hours -20°C in dark up to 14 days.

Saxitoxins	Amber glass bottle with preservative supplied by Laboratory	On ice in the dark ≤ 6°C for up to 72 hours. After 72 hours -20°C in dark up to 14 days.
Cyanobacteria ID	Two 125mL or 250mL HDPE or PETG bottles. One with Lugol's[4] and w/out	On ice in the dark ≤ 10°C

[1] PETG amber bottles are preferred, because samples must be frozen to -20°C after returning to office.
[2] pH must be between 4 and 11 for analytical test, can be adjusted at laboratory
[3] pH must be between 5 and 7 for analytical test, can be adjusted at laboratory
[4] Adding enough Lugol's solution to achieve a tea color

Anatoxins – Sample Collection Procedure

1. Sample each HAB sample location with a secondary container (typically, an 8 oz amber glass bottle).
2. Use a pipette to aliquot ~3 mL from the secondary container to each of three (3) pre-preserved vials provided by laboratory. *Note: Do not submerge vials to collect samples due to preservative included in vial.*
3. Once vials are filled, tape caps shut with electrical tape.
4. Keep each set of triplicates vials in their own bag.
5. Keep vials in the dark and on Ice while in the field.
6. If analysis is planned to be completed within 5 days, vials do not need to be frozen at -20°C.
7. If analysis is not planned to be completed within 5 days, freeze vails at -20°C for up to 90 days.

6.2.4 Cyanobacteria ID Sample Collection Procedure

1. Target the highest visual accumulation area.
2. Tilt a 125 mL or 250 mL HDPE or PETG sample bottle parallel to the water surface to capture the top 1-2 inches of the surface water scum, try to contrate HAB sample if possible.
3. Avoid any unnecessary ambient lake water, to help identify most prevalent HAB species during identification.

6.2.5 SPATTs

Deployment:

Wear gloves when handling SPATT bag due to ethanol. Use a SPATT Deployment/Retrieval Sheet for deployment.

1. Remove SPATT bag from Container stored in ethanol.
2. Zip tie SPATT bag to embroidery hoop.
3. Attach embroidery hoop to rebar ensuring it will remain under water level and is secure.

Retrieval:

1. Remove SPATT bag from water and embroidery hoop.
2. Store SPATT bag in Ziplock ® bag.
3. Label Ziplock ® with toxin for analysis, time and date deployed, time and date retrieved and RID.
4. Store on dry ice.
5. When return to office store in -20 C freezer.

6.3 Sample Shipping and Handling

The type of analysis being conducted will determine preservatives, hold time, and sample containers (see Table 2). HAB samples should be shipped frozen on ice (or blue ice) in a sealed cooler. If wet ice is used it needs to be sealed so that it does not leak out of cooler. A Chain of Custody (COC) is required and is specific to the contract laboratory being used for analysis. COC templates for contract laboratories are located in the HABs Folder on the SWQB network.

7.0 Data and Records Management

7.1 Sample Event Data

Electronic versions of the HABs Field Data Form must be used to document sample collection events. Staff must use the most up to date version of HAB Field Data Form. The electronic form has built in data entry quality checks and automated functions. Use of the electronic form also allows for batch uploads of sample event data and results into SQUID.

Sample Event Upload into SQUID:

- Enter the Project Name.
- Select the Station Name from the drop-down list and enter RIDs.
- At sampling station enter sampling event information: date and time (use the "Now" button as a shortcut). Select from the drop-down lists: field staff, sampling equipment, sampling media, and indicate DO recalibration and enter pressure.
- Select flow condition rating as "MDP" if sampling a lake.
- Enter RID numbers (the grey button on the right side of the RID field adds the next number in sequence) and select Analytical Suites and sample processing/preservation information. If not already completed in the laboratory prior to sampling. Typically, this will be microcystin or cylindrospermopsin but does vary.
- Record instantaneous Sonde measurements on HAB Field Data Form.
- Select the Streamflow Measurement method as NA.
- If the form is complete, press the "Publish Field Sheet" button. Resolve any error messages. If the form is not complete, press the "Save Draft" button to save the file and complete at a later time.
- The Publish Field sheet button creates a pdf of the completed field sheet.
- Published and draft files are saved in the C:\FIELD_SHEETS folder on the local hard drive.
- Upon returning to the office ensure pdf and excel files of fields sheets are transferred to HABs project folder.
- The final HABs Field Sheet in excel format should be saved in the following folder: "Sample event upload" for current year.

All data obtained during HAB sampling are recorded on a HAB Field Data Form for each station sampled. The HAB Field Form is then published and filed in HABs folder after data collection is complete. The Output Tab on the HAB Field Data Form is then used to important data from the HAB Field Data Form into SQUID using the macro-enabled processes. Refer to the section above regarding SQUID upload instructions. Once uploaded into SQUID a person who did not create the field data forms or upload will verify that the information in SQUID matches the field form for each location sampled. Any corrections

needed will be added to the Field Data Form and finalized in the HABs folder on the SWQB network. Corrections in SQUID can be made if you have editing permission (see Monitoring Team Supervisor for more information). Once information is confirmed initial and date the top of the Field Form where it says "Verified."

7.2 Results Upload into SQUID

To upload HAB cyanobacteria toxins results for a sample station, ensure sampling event data has been uploaded prior to moving forward with cyanobacteria toxin result upload. The data results will be uploaded by the QAO, more information may be provided via electronic mail as requested.

Because of the public health concerns related to HABs, data will be uploaded within 4 hours of data reporting when possible.

8.0 Quality Assurance and Quality Control (QAQC)

The SWQB controls the quality of field data by using standardized methods that are documented in SOPs. All personnel who collect monitoring data must be familiar with these protocols, sign acknowledgment form associated with this specific SOP and collect data in accordance with the procedures as they are defined in this SOP and all other applicable SOPs. In addition to standardized methods, proper training of field personnel represents a critical aspect of meeting the data quality objectives in order to fulfill the goals of the SWQB's QAPP (NMED/SWQB 2024).

Assurance of field data collection for HAB monitoring are done through adherence to the process outlined in this and other applicable SOPs and oversight of the process by the QAO. If at any time the QAO determines this process is not being adhered to, the QAO has the authority to cease activities specific to this SOP with prior support and approval by the SWQB Bureau Chief and MASS Program Manager, until such a time that the issue can be resolved.

9.0 Related Forms

HABs Field Data Form
HAB Advisory Signage
HAB Examples

10.0 Revision History

• Revision 0. December 10, 2025. Original SOP.
Emily Miller QAO; Lynette Guevarra Program Manager Monitoring, Assessment and Standards Section.

11.0 References

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