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) in the water column that include monitoring and data management. The decision criteria for determining and communicating related health advisories is maintained in the New Mexico HABs Advisory Program Guidance Document. 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 lake littoral zones where past HABs have been known to happen or areas that are prone to heavy public recreation (swim beach, boat launch, campground, etc.). For information regarding HABs sampling and analyses in fish tissue, see SOP 11.5.

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.

SWQB staff utilizing this protocol 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 and SQUID;
- 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

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

3.3 Safety Precautions

HABs pose a risk to human health; therefore, whenever sampling, staff should 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
- Do not inhale aerosolized particles (e.g., spray from boat) where a HAB is suspected
- Wash hands with soap or use hand sanitizer 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 Information 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 Supplies

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 and/or face sheild
- Waders and/or Muck Boots
- Mask (for aerosolized particles) when sampling areas suspected of high toxin levels.
- Shoulder length gloves for deeper samples

Equipment Required for Sampling

- HABs Field Form
- Sample Bottles: Outlined in Table 1. Sample Containers
- Phone or iPad with camera and GPS
- Sonde (with phycocyanin (BGA) sensor installed)
- High Precision pH Strips (recommended pH resolution of ≤ 1.0 pH) if sonde is not used or available
- RIDs
- Sharpie
- Cooler with ice
- Ethanol or Lugol's solution for HABs identification & Enumeration as needed

Table 1. Sample Containers

Microcystins	30-60 mL PETG or glass amber bottle per site
Cylindrospermopsin	30-60 mL PETG or glass amber bottle per site
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

The Bureau maintains a programmatic HABs SAP as well as watershed-based survey SAPs that contain HAB-related sampling. However, sample locations identified in these SAPs will likely change as a HAB season (generally July through November) progresses. HABs are an emerging contaminant, and sampling differs from the more systematic planning process in ambient water quality sampling surveys 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.

When possible, communicate with water resource managers for most up to date information on bloom location, appearance, and any other pertinent information. If unable to contact before heading out, try to make contact once on site.

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. For more information regarding the creation of HAB recreation monitoring sites contact the Monitoring Team Supervisor. 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(s) dependent on analyses 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. 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. Sonde parameters should be taken directly in bloom itself. 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 most HAB analytical services. Cloud cover, water color, wind speed and direction should also be collected and recorded in Sampling Notes section of the electronic HAB field data form.

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 requested analysis: The analysis could include: microcystins, cylindrospermopsin, and cyanobacteria ID. Review of past data may also be useful to help determine the presence of other HABs that may have existed, for example anatoxins. If possible and as resources allow, a nutrient sample and *E. coli* sample should also be collected (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)

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 rocks or plants. HABs can vary greatly in appearance and may not always be easy to identify. True genera 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

Using a jar test can also help to distinguish cyanobacteria (HAB) form other forms of algae.

1. Collect sample by submerging clear jar in water just below surface layer filling about ¾ full.
2. Place jar in refrigerator overnight and do not disturb.
3. Observe the following day. If the bloom material settled near the bottom of the jar it is likely not a cyanobacteria bloom. If the bloom material aggregated towards the surface it likely is cyanobacteria bloom.



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.

While cyanotoxins are produced by the bloom and contained within the cells of the cyanobacteria, it is possible for the toxin to be released from the cell. It is possible for a cyanotoxin to be present even when it appears there is no bloom in the vicinity. Field staff should use best professional judgement when choosing the sampling location.

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.
    a. At a minimum 3 photos should be taken. 1 photo to capture the full extent of the bloom, 1 photo taken 10-30 feet away from the bloom at the sampling location, and 1 photo showing a close-up view of the bloom.
    b. The following naming convention should be used for naming HAB photos: HABs_LakeName_LakeLocation_Date (e.g., HABs_QuemadoLake_SouthCove_4-20-2026)
2. Complete a HABs Field Data Form 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 of bloom.
2. Tilt the bottle parallel to the water surface to capture the potential highest concentration, typically 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	pH ranges for analytical test(s)
Microcystin	PETG[1] or glass amber bottle (60mL or 30mL)	On ice in the dark ≤ 6°C for up to 72 hours. Upon return to the lab prior to shipping to the lab, freeze at -20°C in dark up to 14-days.	pH Range: 4 – 11[2]
Cylindrospermopsin	PETG[1] or glass amber bottle (60mL or 30mL)	On ice in the dark ≤ 6°C for up to 72 hours. Upon return to the lab prior to shipping to the lab, freeze at -20°C in dark up to 28-days[4].	pH Range: 4 – 11[2]
Anatoxins	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 28-days[4].	pH Range: 5 – 7[2]
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.	pH Range: 3 – 11[2]
Cyanobacteria ID	Two 125mL or 250mL HDPE or PETG bottles. One with Lugol's[3] 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] Can be adjusted within 24 hours of sample collection
[3] Adding enough Lugol's solution to achieve a tea color
[4] Typically, the SWQB will utilize a 14-day hold time to maintain consistency for sample hold time.

Note: pH must be adjusted using 1N Hydrochloric Acid (HCl) and 1N Sodium Hydroxide (NaOH), as applicable

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. Freeze vials at -20°C for up to 28 days if samples cannot be analyzed by lab within 5 days.

6.2.4 Cyanobacteria ID and/or Cell Enumeration 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 concentrate HAB sample if possible.
3. Avoid any unnecessary ambient lake water, to help identify most prevalent HAB species during identification.
4. Project specific objectives may require samples to be preserved with ethanol or Lugol's solution. See project specific sample analysis plans or fields sampling plans for more information. Typically, the SWQB Monitoring Team will not preserve with Lugol's.

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). 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:

1. Enter the Project Name.
2. Select the Station Name from the drop-down list and enter RIDs.
3. 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.
4. Select flow condition rating as "MDP" if sampling a lake.
5. 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.
6. Record instantaneous Sonde measurements on HAB Field Data Form.
7. If pH strips were used enter the pH data on HAB Field Data Form and add a note
8. Add cloud cover, water color, wind speed and direction on HAB Field Data Form, within the Sampling Notes section
9. Select the Streamflow Measurement method as NA.
10. 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.
11. The Publish Field sheet button creates a pdf of the completed field sheet.
12. Published and draft files are saved in the C:\FIELD_SHEETS folder on the local hard drive.
13. Upon returning to the office ensure pdf and excel files of fields sheets are transferred to HABs project folder.
14. 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 Advisory Program Guidance Document
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.
• Revision 1. May 11, 2026. Revised Personnel Responsibilities be more broadly applicable to all staff who utilize this SOP; included collection of cloud cover, water color, wind speed and wind direction data to field protocols; added pH ranges and updated sonde parameter collection procedure;

11.0 References

New Mexico Administrative Code (NMAC). 2025. State of New Mexico Standards for Interstate and Intrastate Streams. 20.6.4. New Mexico Water Quality Control Commission. August 14, 2025. https://www.env.nm.gov/surface-water-quality/wqs/

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US EPA Houston Laboratory. Region 6. Laboratory Support & External Oversight Branch Houston TX. Sample Collection and preservation Methods for ELISA. 2025. Allison Scott.

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