Alliance for Aquatic Resource Monitoring

Chemical Monitoring Manual

January 2010

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Background on ALLARM:

The Alliance for Aquatic Resource Monitoring (ALLARM) is a project of the Environmental Studies Department at Dickinson College. Since its founding in 1986, ALLARM has become a nationally recognized technical and programmatic support center for community organizations interested in watershed assessment, protection, and restoration. ALLARM program goals are to:

1) Enhance local action for the protection and restoration of Pennsylvania watersheds by empowering communities with scientific knowledge and tools to implement watershed assessments;
2) Provide Dickinson College students with opportunities to participate in community-based participatory research thereby enhancing the quality of undergraduate science education; and
3) Be the leader in volunteer monitoring in Pennsylvania and a national model for college-community partnerships.

Through the work of student and professional staff, ALLARM offers comprehensive services to enable groups to use critical scientific tools to enhance environmental quality and fully participate in community decision-making. The program staff includes a Director, an Assistant Director, a faculty Science Director, and 12-14 undergraduate student staff.

For more information on please visit: www.dickinson.edu/allarm or email: allarm@dickinson.edu

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Foundation for Pennsylvania Watersheds

Chemical Monitoring Manual Background:

What is the purpose of chemical monitoring?

Chemical monitoring is a way to look at specific water parameters in greater detail in order to determine the health of a stream. It is also a snapshot view in time of the chemistry of the stream since the water chemistry is always changing. Since most aquatic organisms need to live in water all of the time, the chemistry of the water affects whether organisms are able to survive there or not. Measuring water chemistry can also be helpful in identifying whether there is a pollution source in the water and what type of pollution it might be.

What is this manual?

When conducting chemical monitoring there are a lot of steps to consider and put into practice to ensure that data you are collecting are as credible as possible. This manual is designed to be a reference point for best chemical monitoring practices. Part of this manual is focused on equipment cleaning and maintenance – practices that cannot be understated. For example, if you do not wash your glassware properly you will inaccurately inflate your nutrient testing results. In developing volunteer monitoring protocols, ALLARM has done and continually conducts extensive research to make sure that the protocols volunteer monitors use are the most up to date and relevant for their monitoring objectives. The methods reflected in this manual reflect laboratory and field standard practices.

On average it takes a volunteer monitor 3-5 hours to conduct chemical monitoring for eight parameters each month. This manual is designed to ensure that time spent monitoring is well spent.

Cleaning your kits and sampling containers

Always wear latex gloves when using this cleaning procedure!

Wash all glassware, plasticware, droppers, syringes, and sample bottles using the following procedure:

1. Thoroughly wash with a brush and phosphate-free detergent (Alconox or equivalent).
2. Rinse 3 times with cold tap water.
3. Rinse with 10% Hydrochloric acid solution (use a very small amount 2 – 5 mL depending on the container).
4. Rinse 3 times with distilled/deionized water.

The phosphate-free soap is used as a general cleaning (like when you wash dishes at home, except the soap is phosphate-free to prevent phosphorus contamination) to remove larger particles from your kit equipment. The dilute hydrochloric acid (HCl) solution will remove any atomic particles that have adhered to your equipment.

Tip: Three is the magic number for rinsing.
A little solution goes a long way. HCl is expensive use a little of the solution and roll it around to make sure it comes into contact with the whole interior of your sampling equipment.

Hints and tips to make cleaning easier:

Syringes:

- Wash the syringe by separating the plunger from the body of the syringe.
- Flush the syringe by pulling and pushing the plunger repeatedly into and out of the body of the syringe while pulling in and expelling out the detergent.

Droppers:

- Pull off the rubber bulbs and thoroughly wash the bulb and tube of the dropper.
- Pour a small amount (0.5 mL) of the 10% HCl acid solution into the dropper tube. Carefully reattach the rubber bulb and thoroughly rinse all inside surfaces of the tube and bulb by rotating and inverting the dropper.
- Dispose of the used HCl solution in your sink drain with running tap water.

TIP! Unless noted in the procedure, kit parts do not have to be completely dry before reuse.

Handling hydrochloric acid solution:

Handling the 10% Hydrochloric Acid Solution (HCl):

1. PRODUCT IDENTIFICATION AND INGREDIENTS
    - 10% by volume Hydrochloric Acid in distilled water.

2. PRECAUTIONARY MEASURES
    - Avoid contact with eyes, skin and clothing.
    - Do not breathe mist or vapor.
    - Wash thoroughly after handling.
    - Wear disposable latex gloves when handling.
3. FIRST AID
    - Eye And Skin Contact
        - Immediately flush eyes and skin with water for 10 to 15 minutes.
        - Remove contaminated clothing.
        - Call a physician.
    - Ingestion
        - Call a physician immediately.
    - Inhalation
        - Remove to fresh air.

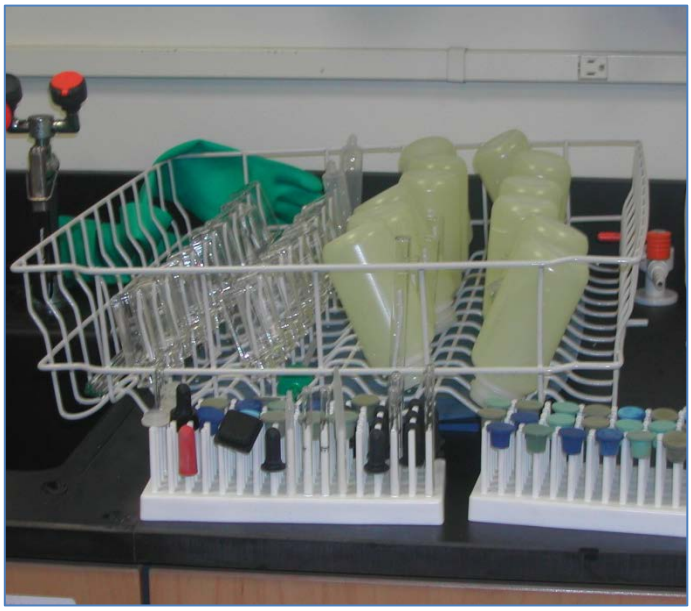
4. SPILL AND DISPOSAL PROCEDURES
    - Pick up liquid with a sponge or cloth.
    - Rinse liquid down the drain with cold running tap water.
    - Wear disposable latex gloves.

Tip: HCl will stain stainless steel sinks pink. Consider using a different sink.

General safety precautions:

- Read all instructions to familiarize yourself with the test procedure before you begin. Note any precautions.
- Read the labels on the reagents and the Material Safety Data Sheets prior to use.

- Keep all chemicals and equipment out of the reach of young children.
- Do not dispose of chemicals on the ground or in the stream. Unless otherwise noted in the directions dispose of used reagents in your sink drain while running cold water for one to two minutes.
- Avoid contact between reagent chemicals and skin, eyes, nose, and mouth. Wear rubber gloves when conducting chemical analysis.
- Use the test tube caps or rubber stoppers (*not your fingers*) to cover the test tubes when shaking or mixing.
- When dispensing reagent from a plastic squeeze bottle, hold the bottle straight up and down (*not at an angle*) and squeeze gently. If the gentle squeeze does not work, the bottle may be clogged.



- Never use chemicals beyond their expiration date. When you receive your materials note the expiration dates.
- **In the event of accidental poisoning, contact your local poison control center listed in the blue pages of your phone book. Be prepared to provide the name of the reagent in question and the code number.**

Sample Collection:

This sampling program is designed to collect a water sample that is small enough in volume to be conveniently collected, transported and handled, while accurately representing the quality of the entire stream segment at the point in time when the sample was taken. This requires that the sample be taken and handled in such a way that no significant changes in composition occur before the at-home or field tests are made. The water quality monitoring program is designed to ensure that sampling and subsequent analytical methods provide a true basis for answering the questions that originally prompted the sampling.

Where should I collect the sample?

In general, you should collect your sample away from the stream bank in the current. Do not sample stagnant water. Where practical, you will wade into the stream to collect the sample. Sample collection in deep sites can be done from a boat or you may tape your bottle to an extension pole to reach the deep water. Sampling from a bridge is

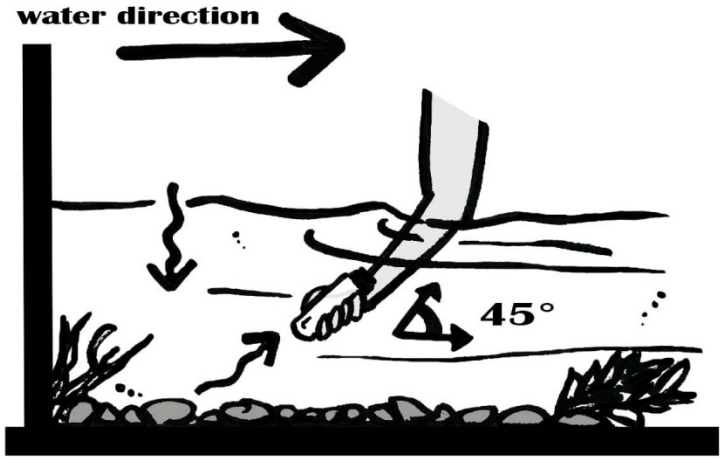
also an alternative. Note any variations in sample collection on your data sheet.

How should I collect the sample?

1. Enter the stream downstream of the monitoring point, to avoid introducing disturbed stream sediment to the sample.
2. Move to the center of the stream, if possible.
3. Take the sample facing upstream from where you are standing:

For streams where water depth and current allow for safe entry and complete emersion of the sample bottle, use the following procedure:

1. Wear latex gloves when collecting samples and rinse your gloved hands with the stream water.
2. Rinse the bottle and cap with the stream water, being careful not to touch the insides of the bottle or cap with your hands. Totally fill the bottle and cap with water. Pour out the rinse water downstream from where you are standing to avoid reintroducing the rinse water back to the collected sample. **Repeat 3 times.**
3. Prepare to fill the bottle by slightly tilting the mouth towards you. This will position the bottle opening away from the direct flow of the stream current.



4. Lower the bottle into the stream current at an angle, attempting to smoothly and evenly sample the entire depth of the stream. Keep the same tilt to the axis of the bottle throughout the fill cycle. Keeping the sample bottle slightly tilted in this manner will prevent total filling. This empty space will allow for thermal expansion during shipping. Try to get the same volume of sample at each depth.
5. If you are not satisfied with your collection procedure, throw out the water and try again.
6. Cap the filled bottle tightly and immediately put it on ice.

TIP! Be careful not to disturb the bottom sediment of the stream.

Special Notes for Shallow Streams:

1. For shallow streams where this procedure is not practical, simply lower the tilted bottle into the stream, to the depth possible, and allow the bottle to slowly fill with water while maintaining the tilt. Be careful not to disturb the bottom sediment.
2. When very shallow stream depth does not allow either procedure to be used, use a clean 2nd bottle to collect as much sample as possible, being careful not to disturb the stream bottom. Slowly and carefully pour the water into the sample bottle. Continue this procedure until the sample bottle is nearly full.

NOTE: Do not later use this 2nd bottle as a sample collection bottle or use this procedure for sample collection at another location. This 2nd bottle can only be used to collect additional samples at the same location.

Special Note for Deep Streams:

For deep or high current waters where it is not safe to enter the stream, take samples from a boat, bridge or stream bank, and note this sample procedure on the bottle or forms. You can build a sampling pole for $20 or you can use a bucket with a rope.

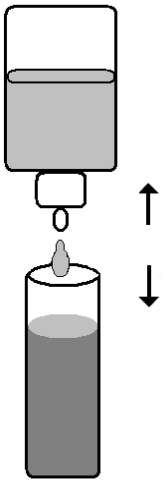
Tip: Be sure that the bucket and sampling bottle are used only for monitoring and are cleaned properly!

What if there is suspended matter in the sample?

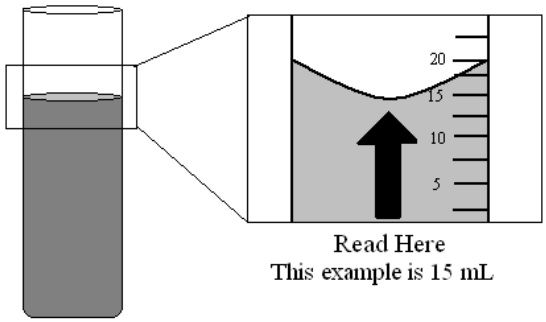
If any significant amount of suspended matter is present in the stream, the suspended matter should be separated from the sample by the following procedure:

1. Fill a container larger than the sample bottle with stream water, using the above procedures as applicable.
2. Allow the suspended matter to settle.
3. Slowly and carefully pour water into the sample bottle.

General tips and suggestions:



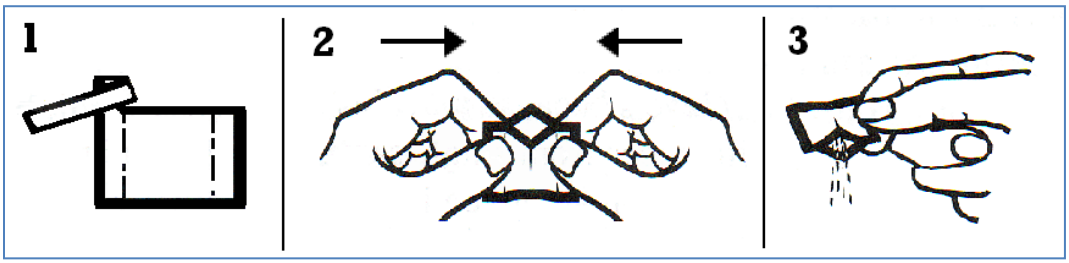
- Water samples should be at room temperature (20 – 23 °C) when testing for nutrients (nitrate and phosphate). Colder samples will give lower, inaccurate results.
- Results can vary by shaking technique. To check your technique, purchase a standard (a solution of known concentration). Run the test using the standard and vary your shaking technique until you get the correct result.
- Dropper bottles should be held exactly vertically to yield the most even sized drops.
- Always fill your test tubes exactly to the line, remembering to account for the meniscus. You can purchase syringes to assist with measuring the correct amount.



- Clean, clean, clean. Don't forget the lids, stoppers and syringes.
- Purchase enough glassware so that you can run two replicates without cleaning.
- Remember to shake sample lightly for 3 minutes just prior to analysis.
- Read the directions! Read them again. Follow them precisely.
- Set up a clean and open work area and place something on the table or area to catch spills (newspaper works well).
- Prior to testing, make sure everything is clean. Check reagents for discolorations. If you believe there is a problem with the reagents, buy new ones.

- When you receive your kits, date the reagents and note the expiration date so you know when to replace the reagents.
- Use gloves, as many of the chemicals are harmful and this will help lower the chance of contamination from your hands.
- Prior to running tests, rinse all sample tubes and mixing bottles with the sample water three times.
- When performing the test follow the times for reactions and shaking exactly. Use a stopwatch or kitchen timer to help you with this.
- When you put the reagent in the tube, start shaking immediately.
- Be objective (it is harder than you think).
- For color comparisons, sunlight is best, but always hold the color comparator up to a light source. When using the color wheel, place your finger over the area where the concentrations are listed in order to be objective.
- If you are performing the tests on site, bring a bottle to dispose the wastewater and bring it home. Unless otherwise noted in the procedure, pour wastewater down the sink while running the water, or pour into kitty litter and dispose of in the trash.
- When done with the test, thoroughly clean and allow everything to dry prior to resealing the kit.

- Practice with tap water or stream water at home so you can become familiar with the kits before testing samples.
- To open reagent packets, tap the packet on a hard surface to gather powder on bottom. Using scissors, cut across packet top horizontally. With both hands, push packet open to create a pouring spout, then tilt packet to empty.



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