

Standard Operating Procedure (SOP) 2.1.1.3

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Construction and use of a syringe pump apparatus for water sampling

1.0 Application:

Collection of water samples at defined depths below the water surface without contact with air, for analyses of dissolved oxygen, sulfides, or any other water quality parameter. This apparatus can be used to monitor depth profiles in lakes, to sample groundwater monitoring wells, to sample pools in creeks, etc. The apparatus as specified below is useful for depths/heads of up to 3 meters. It is recommended to use shorter tubing where appropriate.

2.0 Components:

Disclaimer: The information provided below does not construe endorsement of these products by the Clean Water Team or the SWRCB. The list below contains information from 1998. Readers are encouraged to check the latest information with vendors.

Item C1. 60 ml disposable syringe with Luer-Lok* tip (without needle):
Fisher Catalog Number: 14-823-2D (30 pack) \$30.66 (Becton-Dickinson No.309663)

Item C2. Three-way stopcock with male Luer lock:
Cole-Parmer Catalog Number: E-30600-02 (10 pack) \$16.25

Item C3. Plastic tubing for the “long tubing” (diameter 1/8" (3.2 mm) inside, 1/4" (6.4 mm) outside) should be flexible, but rigid enough to resist collapsing under vacuum or kinking under water. Clear PVC Nalgene* 180 works well; here are the Fisher Catalog Numbers:

14-176-12 (50 ft pack) \$31.80 (Nalge Nunc No.8000-0020)

14-176-12 (10 ft pack) \$7.99 (Nalge Nunc No.8000-1020)

Item C4. One ml disposable syringe with Luer slip tip (Tuberculin without needle):
Fisher Catalog Number: 14-823-2F (100 pack) \$15 (Becton-Dickinson No.309602)

Item C5. Plastic tubing for the “side tube” (diameter 3/32" (2.4 mm) inside, 5/32" (4 mm) outside) should be flexible but does not have to be rigid.

Fisher Catalog Numbers: 14-176-192 (50 ft pack) \$20 (Nalge Nunc No.8000-0006)

Fisher and other vendors have their own brands of PVC tubing in the same sizes, but we have not tested performance or compatibility.

3.0 Assembly notes: (see diagram)

Step 1: Push the top (wide fitting end) of the three-way stopcock, Item C2, onto the 60 ml syringe (Item C1) tip and screw into lock.

Step 2: Prepare 9-10 ft length of “long tubing” (Item C3) and push onto the bottom, narrow tip (“male lock”) of the three-way stopcock (Item C2). For more strength, wrap joint with Parafilm or tape..

Step 3: Prepare 1 foot length of “side tube” (Item C5). Insert into the 1 ml syringe (Item C4) without the plunger; you may first cut this syringe about 1/2” from the tip if needed. Then push the tip of the 1 ml syringe into the side arm of the three-way stopcock. **Options:** Items C4 and C5 may be replaced by any other creative way to connect the side tube. Example: Prepare 1 ft tube (Item C3), cutting the end squarely; fit an insert piece (e.g. cut-off spare syringe tip, maybe aquarium connectors or a piece of ball-point pen tube?) into joint with side arm of stopcock, then wrap joint with Parafilm or tape (point 3 in the diagram).

4.0 Deployment Options:

Option 1: hold the end of the long tubing (farthest from the stopcock) in the creek or other sample source. Collect the sample as instructed below.

Option 2: Mark long tubing at 10 cm intervals, beginning from furthest end; attach a small weight to that end, deploy from above and collect sample. Caution: tubing will stretch, depth measurements may be inaccurate.

Option 3: Attach a non-stretching rope to a medium or heavy weight. Mark the rope at 10 cm intervals, beginning near the weight. Attach the end of the long tubing of the syringe apparatus to the weight or the rope, with the opening at zero cm, deploy from above and collect samples.

Option 4: Mark a “sampling pole” at 10 cm intervals, beginning from bottom tip, attach end of long tubing of the apparatus to tip of sampling pole with the opening at zero cm (see point 4 on the diagram), deploy from above or from the side (e.g. the bank of a creek). If the intake point of the syringe sampling apparatus is deployed at an angle, record the angle and the depth mark on the pole to calculate/estimate sampling depth.

5.0 Sample Collection: Preparation and priming

1. Assemble the apparatus: Connect the stopcock attached to the long tube to the 60-ml syringe. Connect the short tube to the side arm of the three-way stopcock. **(Be sure to hold the three-way stopcock in its center when you turn the selector. It is not strong enough to be held only by the syringe and will break if you attempt to turn the selector without support)**
2. Attach the end of the long tube to a rope or pole and dip in lake (or creek, or monitoring well) water.
3. Hold the stopcock and turn the selector so the “OFF” lever is in the direction of the short tube, and pull the plunger backwards slowly. This will fill the syringe with lake water (The volume of air in the tube should be about 30 ml, and then water will start coming in).
4. Hold the stopcock and turn the selector so the “OFF” lever is in the direction of the long tube, and push the plunger forward; this will push the water out through the short tube.
5. Hold the stopcock and turn the selector so the “OFF” lever is in the direction of the short tube, and pull the plunger backwards slowly. This will refill the syringe with lake water.
6. Hold the stopcock and turn the selector so the “OFF” lever is in the direction of the long tube, and push the plunger forward; this will push the water out through the short tube.

For most Water Quality parameters: After flushing 2-3 syringe-volumes through the system, take your sample for pH (and/or other water quality parameters) by placing the end of the short tube inside the sample container. Repeat steps 5 and 6 until the sample volume, in increments of 60 ml, is sufficient.

For Dissolved Oxygen (DO) or Sulfide: Make sure there are no air bubbles in the entire apparatus after step 6. Then place the short tube inside the DO bottle, and repeat steps 5 and 6 several times, flushing several bottle-volumes with sample water without contact with air. Then take the short tube out of the DO bottle and add to the bottle the reagents for the Winkler titration as instructed by the kit manufacturers.

6.0 Maintenance and Storage:

To clean the syringe and tubes, repeat steps 5 and 6 twice with tap water or deionized water. Clean the system immediately, or as soon as possible, after sampling. **Avoid drying of unwashed tubes.** Store syringe in partially opened position so you can push it forward in case rubber plunger sticks to the shaft. Store in a ziplock bag.

7.0 Sources and Resources

This SOP, as provided in the clean Water Team (CWT) Guidance Compendium, is identical to the following document (with slight revisions) and should be referenced as follows:

“Katznelson, R, and A. Feng 1998 Application, purchasing information, and use instruction of a syringe pump apparatus. Standard Operating Procedure submitted to the Alameda Countywide Clean Water Program, Hayward, CA. “

For an electronic copy, to find many more CWT guidance documents, or to find the contact information for your Regional CWT Coordinator, visit the CWT website at

www.swrcb.ca.gov/nps/volunteer.html

SYRINGE-PUMP APPARATUS

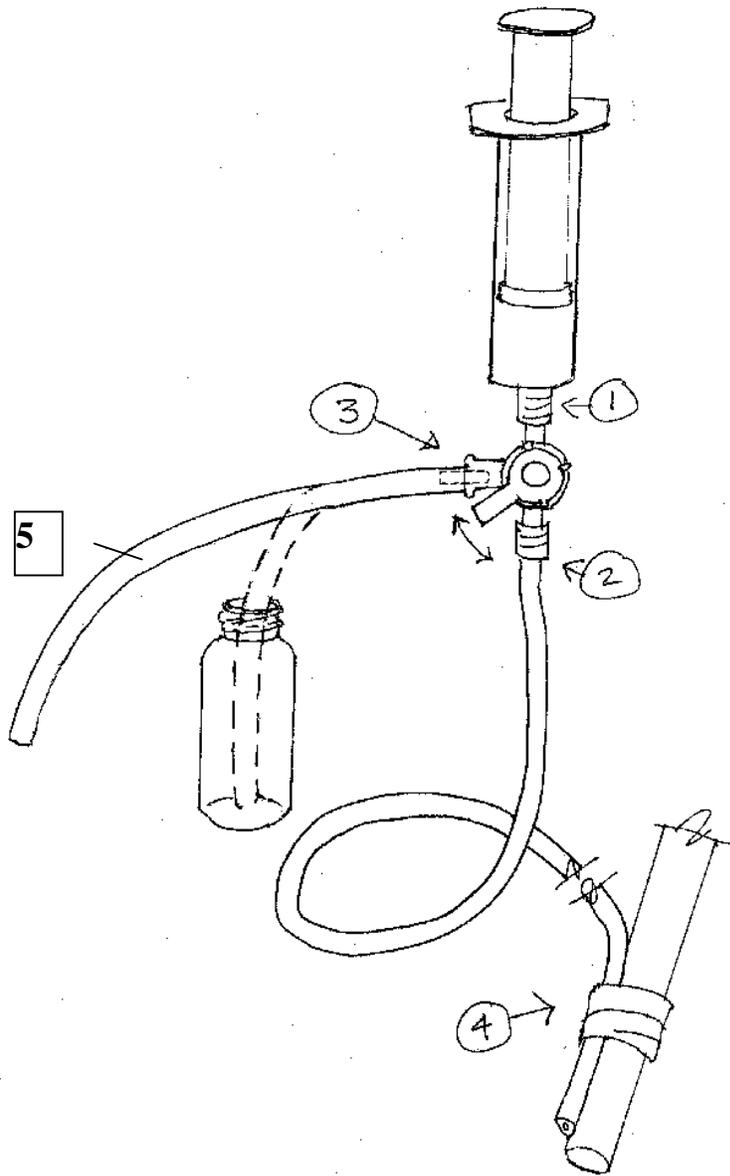


Diagram by Arleen Feng, Alameda County FCWCD, April 1998