

Total and Dissolved Water Samples

PREPARED FOR: State of Utah, Division of Water Quality

PREPARED BY: Dr. David Naftz, USGS

COPIES: CH2M HILL

DATE: May 1, 2006

Sample Preparation

Verify that tubing, processing chamber, and sampling equipment are clean. If not clean, follow procedures below:

Tubing

Office or laboratory cleaning

Clean equipment using NFM protocols (See TWRI book 9, Chapter A3.2.1)

1. Soak in 0.2% Liquinox solution for 30 minutes. Scrub with brush.
2. Change gloves.
3. Rinse 3 times with tap water*.
4. Change gloves.
5. Soak in 5% HCl solution for 30 minutes.
(skip this step if your equipment has ANY non-removable metal)
6. Change gloves.
7. Rinse 3 times with deionized water (DIW)*.
8. Double bag equipment.

*To facilitate flow of solutions thru the tubing, use a peristaltic pump or large syringe.

Field cleaning

1. Pump 1 L of DIW through tubing and rinse tubing ends.
2. Inspect tubing
 - a. If tubing is visibly dirty or sampling site is contaminated continue to step 3.
 - b. If dirt is not visible continue to step 5.
3. Pump 1 L of 0.1% Liquinox solution through tubing and on ends.
4. Pump 1 L of tap water or DIW
5. Carefully pump 1 L of 5% HCl solution through tubing and on ends. Capture and dispose of HCl.
6. Pump 2 L of DIW through tubing and on ends.
7. Double bag equipment.
8. Discard neutralized solutions appropriately.
9. Clean stainless steel connections or metal tubing using detergent wash and tap water/DIW rinse procedures.

Sampling Equipment

Clean equipment using NFM protocols (See TWRI book 9, Chapter A3.2.1)

1. Soak in 0.2% Liquinox solution for 30 minutes. Scrub with brush.
2. Change gloves.
3. Rinse 3 times with tap water.
4. Change gloves.
5. Soak in 5% HCl solution for 30 minutes.
(skip this step if your equipment has ANY non-removable metal)
6. Change gloves.
7. Rinse 3 times with DIW.
8. Double bag equipment.

Pre-Rinse Sample Bottles

(Polyethylene, glass, and acid-rinsed bottles)

(This step can be done in the lab prior to going into the field)

1. Put on powderless Nitrile gloves.
2. Fill each bottle about $\frac{1}{4}$ full of DIW and cap.
3. Shake vigorously and decant DIW.
4. Repeat steps 2 and 3 two more times.
5. Following final rinse, fill each bottle half full with DIW and cap.
6. Rinse exterior of bottle with DIW and dry with lint-free laboratory tissue.
7. Store bottles in doubled plastic bags.

Label bottles with site id, date, time, and sample designation code (FA for filtered samples and RA for unfiltered samples).

Clean Hands/Dirty Hands Technique

Clean Hands/Dirty Hands technique will be used for all sample collection and sample processing. Before field work begins, the clean hands (CH) person and dirty hands (DH) person should be designated. Table 4-2 designates the duties of CH/DH. In summary of Table 4-2, the CH person has the only contact with the sample bottle; transfers sample from sampler to splitter; filters, extracts, and preserves sample. The DH person operates sampling equipment and manages any contact with sources of contamination (for examples, the churn carrier and pumps). CH works inside processing chamber while DH works outside processing.

Table 4-2. Clean Hands/Dirty Hands techniques for water-quality sampling

- Clean Hands/Dirty Hands techniques require two or more people working together.
- At the field site, one person is designated as Clean Hands (*CH*) and a second person as Dirty Hands (*DH*). Although specific tasks are assigned at the start to *CH* or *DH*, some tasks overlap and can be handled by either, as long as the prescribed care is taken to prevent contaminating the sample.
- Both *CH* and *DH* wear appropriate disposable, powderless gloves during the entire sampling operation and change gloves frequently, usually with each change in task. (Wearing multiple layers of gloves allows rapid glove changes.) **Gloves must be appropriate to withstand any acid, solvent, or other chemical substance that will be used or contacted.**
- *CH* takes care of all operations involving equipment that contacts the sample; for example, *CH*
 - Handles the surface-water sampler bottle.
 - Handles the discharge end of the surface-water or ground-water sample tubing.
 - Transfers sample to churn or cone splitter.
 - Prepares a clean work space (inside vehicle).
 - Sets up processing and preservation chambers.
 - Places equipment inside chambers (for example, sample bottles, filtration and preservation equipment).
 - Works exclusively inside chambers during collection/processing and preservation.
 - Changes chamber covers, as needed.
 - Sets up field-cleaning equipment and cleans equipment.
- *DH* takes care of all operations involving contact with potential sources of contamination; for example, *DH*
 - Works exclusively exterior to processing and preservation chambers.
 - Prepares and operates sampling equipment, including pumps and discrete samplers, peristaltic pump switch, pump controller, manifold system.
 - Operates cranes, tripods, drill rigs, vehicles, or other support equipment.
 - Handles the compressor or other power supply for samplers.
 - Handles tools such as hammers, wrenches, keys, locks, and sample-flow manifolds.
 - Handles single or multiparameter instruments for field measurements.
 - Handles the churn carrier, including outer protective bags.
 - Handles stream-gaging or water-level equipment.
 - Sets up and calibrates field-measurement instruments.
 - Measures and records water levels and field measurements.

Sample Collection:

1. Field rinse clean sampling equipment including collection bottle, nozzle, bottle head, and churn splitter (if applicable) in the stream
2. Collect grab sample
 - a. Record sampling start time.
 - b. Locate centroid of flow.
 - c. Lower field rinsed sampler into centroid of flow.
 - d. Don't let bottle overflow
 - e. Select correct nozzle size. If the velocity is causing bottle overflow, use smaller nozzle.
3. Cap bottle and place in transport bag.
4. Record sampling end time.

Sample Processing

Unfiltered Samples

1. CH/DH: Put on gloves.
2. CH: Prepare a clean processing area and surface.
3. DH: Assemble processing chamber.
4. CH: Insert processing chamber bag.
5. CH/DH: Change gloves.
6. DH: Remove capped sample bottle from transport bag and insert in processing chamber.
7. CH: Field rinse sample bottles with small amount well mixed raw sample (*raw sample must be well mixed by slowly inverting the capped sample bottle 3-5 times, do not aerate the sample by shaking vigorously*)
 - a. If bottles were previously rinsed and half-filled with DIW, discard DIW and rinse once with well mixed autosampler sample.
 - b. If bottles were not pre-rinsed with DIW, rinse twice with DIW, followed by one rinse with well mixed autosampler sample.
8. CH: Transfer well mixed sample from sampler bottle into appropriate sample bottle and cap.
9. CH: Preserve sample using 2-mL HNO₃ vial
10. Remove sticker from HNO₃ vial and stick it on the field sheet for acid lot tracking.
11. Dispose of empty HNO₃ vial in waste container.

Filtered Samples

Preparing work space, sample bottles, and capsule filter.

1. CH/DH: Put on one or several layers of powder-free gloves.
2. CH: Assemble clean processing chamber, attach chamber cover, and change gloves.
3. CH: Place capsule filter, sample bottles, and discharge end of peristaltic pump into chamber.
4. CH: Open DIW container and cover with plastic bag.
5. CH: Insert intake end of peristaltic pump tubing through the plastic covering and into a 1-L container of DIW.
6. DH: Attach tubing to peristaltic pump head and pump DIW to fill tubing.
7. Discharge waste rinse water through a sink funnel or a toss bottle.
8. Discard DIW stored in DIW-pre-rinsed sample bottles. If not pre-rinsed, rinse twice with DIW.

Clean capsule filter.

1. CH: In the processing chamber, remove capsule filter from protective bags.
2. CH: Attach pump tubing to inlet connector of filter. **Make sure direction of flow through capsule filter matches the direction-of-flow arrow on the side of capsule.**
3. CH: Select a short length of clean tubing onto capsule filter outlet extending into the sample bottle.

4. CH/DH: Pump 1 L (large-capacity >600cm² filter) or 100mL (small-capacity 19.6 cm² filter) through capsule filter.
 - a. DH operates pump at low speed.
 - b. CH inverts capsule filter so the arrow on the housing is pointing up.
5. DH: Remove tubing from DIW reservoir and continue operating pump in forward at mid-range speed to drain remainder of DIW in capsule filter.
6. CH: Detach capsule filter from tubing.
7. CH: Put in clean, sealable plastic bag, and leave in chamber until ready for use.

Filtering a composite sample

1. Field rinse peristaltic pump tubing with the water to be sampled
 - a. CH: Rinse the outside of each end of the pump tubing.
 - b. CH: Transfer intake end of pump tubing into composite sample.
 - c. DH: Start pump to slowly pump sufficient sample to completely fill tubing.
 - d. CH: Discard rinse water through appropriate receptacle. Prevent water from ponding in processing chamber.
 - e. DH: Stop pump after tubing is field rinsed.
2. Field rinse capsule filter:
 - a. CH: Remove cleaned capsule filter from plastic bag and attach discharge end of pump tubing to filter inlet connector.
 - b. DH: At low speed, pump sample through the tubing to capsule filter.
 - c. CH: Turn capsule filter so outlet is point up and flow of the sample forces trapped air out of capsule filter. **Do not let sample spray onto chamber cover.**

-Chamber cover must be changed if sample has sprayed on to it.
 - d. DH: Stop pump as soon as filter is full of sample.

Collect Sample Filtrate.

1. CH: Check that there is a tight connection between the pump tubing and the capsule filter.
2. DH: Check the intake tube is properly inserted in the sample and start pump.
3. CH: Collect a maximum of 25 mL of the water to be sampled. **Do not exceed 25 mL.**
4. CH: Field rinse a precleaned 250-ml FA bottle.
5. DH: Stop pump in time to prevent losing filtrate.
6. CH: Cap bottle, shake, and discard rinse water.
7. DH: Start pump and resume flow.
8. CH: **Filter only the next 200 mL of the sample** into the bottle.
9. DH: Stop pump after bottle is filled.
10. CH: Field rinse any remaining sample bottles. **Use no more that a total of 100 mL of filtrate per capsule filter to field rinse any remaining bottles for filtered samples.**

Sample Preservation.

All CH person.

1. Change gloves.
2. Change chamber cover.
3. Move samples requiring chemical treatment to preservation chamber.
4. Place first preservative and its waste container insider chamber.

5. Change gloves.
6. Add 2-mL HNO₃ vial to FA bottles.
7. Change gloves.
8. Disassemble and clean chamber frame.

For filtered samples that do not require preservation.

1. *CH*: Set samples outside processing chamber
2. *DH*: Check that information on bottle is correct and complete.
3. *DH*: Pack samples for shipping or in ice if cooling is required.
4. *CH*: Rinse all reusable equipment with DIW immediately-before equipment dries.
5. **Discard the capsule filter after filtering each sample-do not reuse.**

Equipment Cleaning

Clean equipment using NFM protocols See TWRI book 9, Chapter A3.2.1

1. Soak in 0.2% Liquinox solution for 30 minutes. Scrub with brush.
2. Change gloves.
3. Rinse 3 times with tap water.
4. Change gloves.
5. Soak in 5% HCl solution for 30 minutes.
(skip this step if your equipment has ANY non-removable metal)
6. Change gloves.
7. Rinse 3 times with DIW.
8. Double bag equipment.