

Procedures for using I.C.E. 450 Membranes with the Aerohead Sampler to Measure Dry Deposition of Atmospheric Mercury

Last Revised: August 17, 2007, by Zach Johnson

1. Description of Supplies Needed

1.1. Membranes – Supported I.C.E. 450 cation-exchange membranes will be supplied (hereafter referred to as IX membrane or membrane) that have been pre-cut into discs 5 3/8" in diameter at UNR. Six discs will be cut and shipped on a weekly basis to each site. All discs are stored in 1L jar that has been cleaned using trace metal protocols.

1.2. Aerohead Sampler – Membranes are deployed on specially designed aerodynamic sampling heads designed by Eric Prestbo, Phil Kilner and Frontier Geosciences. Each sampler head consists of 3 sections (see figure 1 and Figure 2). The IX membrane is stretched between the middle and lower sections of the sampler. A fitted steel spring in the upper section presses the free floating middle section against a shelf in the lower section of the sampler. The upper section allows for insertion of a pole and locking the field stand with a 1/4" bolt. The upper and lower sections thread into each other forming a disc 1" thick, 10 1/2" in diameter with a post 2" tall and 1 1/4" diameter (Frontier Geosciences). The Aerohead Samplers are trace-cleaned according to the steps outlined in Section 2.1 by UNR prior to shipping. Each Aerohead sampler has been given a letter identification by UNR. On each of the three sections you will find identifications ranging from "A-A" to "A-S" etched in. All three components should have the same label.

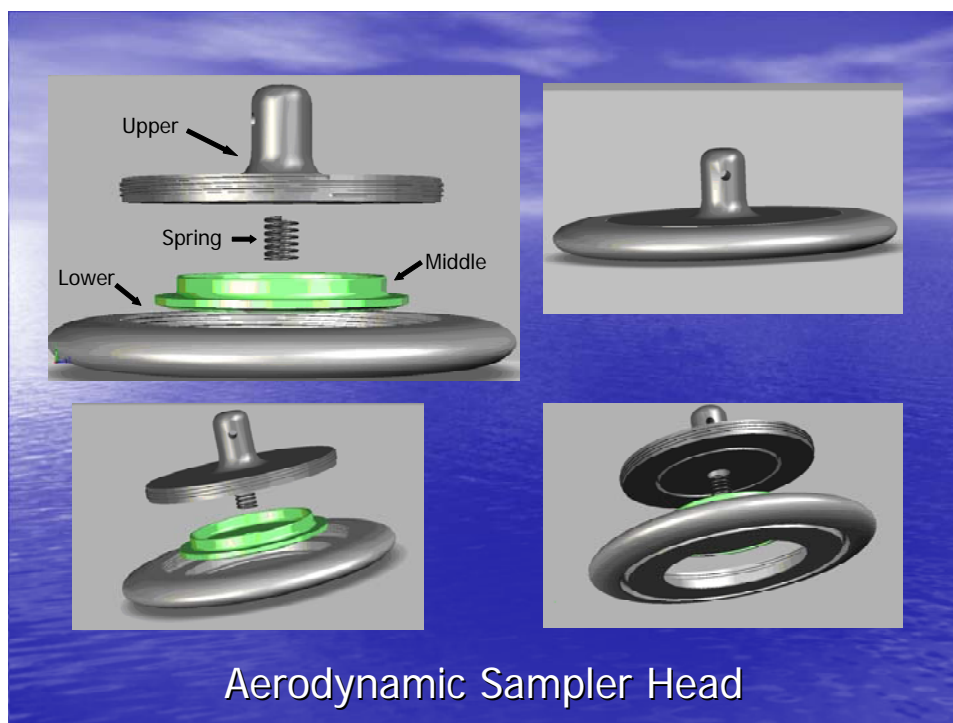


Figure 1. Schematic of Aerohead Sampler used in deployment of I.C.E. 450 membranes.



Figure 2. Schematic of UNR's Aerohead Sampler

1.3. Stands – Retractable Pole on top of Shelter.

1.4 Tweezers and Teflon tape- Teflon coated tweezers to handle the membranes.

1.5 125mL and 1L I-Chem Jars- 6 125mL and 1 1L jars will be needed each week at each site.

1.5 Ziploc Freezer Bags- To store the I-Chem jars and Aerohead samplers.

1.6 Latex Gloves- For clean handling of the materials.

1.7 KimTech critical task wipes-To ensure clean surfaces.

1.8 Acrylic Square- Used for a surface to prepare membranes for deployment and collect membranes after deployment. This should be stored in double Ziplock bags on site and does not require regular cleaning.

2. Preparation- 1L and 125mL jars used for transporting membranes between UNR and field sites will be subjected to trace metal cleaning at UNR. The 125 mL and 1L jars (as well as the samplers) will be double bagged in new Ziploc bags for shipment and these jars should remain in the bags until collection of the membranes and rebagged immediately after samples are collected.

UNR-Cleaning and Packaging Aerohead Samplers

1. A clean sponge will be used to scrub all surfaces, and then deionized water will be used to rinse the samplers three times.
2. Samples will be placed in dilute 5% HCl acid bath for 12-24 hrs and then rinsed 3 times with DI water.

3. Cleaned samplers will be placed in a particle-free drying hood on a clean surface until dry.
4. Once dry, samplers will be stored at room temperature, double bagged in Ziploc bags.

3. Deployment and Collection

Notes:

- Because they are extremely sensitive to contamination, special care must be taken to keep membranes clean. Membranes should be handled only with clean Teflon-coated tweezers, and clean gloves should be worn at all times while working with membranes.

3.1. Deployment –

NOTES:

- Membranes are to be deployed for 7 days from Tuesday morning to Tuesday morning.
- Be sure to record the date and exact time of membrane deployment and collection on the log sheet. This will be necessary when calculating depositional flux values from the membrane data. Also, note when collecting membranes the aerodynamic sampler and fill out the log sheet with as much information as possible. For example; it has rained for the past couple of days; it has been very hazy here; or sample 2 had dirt on it.

The following protocol is to be carried out on a clean surface immediately before deployment. Each week 3 samples and 3 blanks will be prepared.

1. Put on a clean pair gloves.
2. Set down a sufficient number of large KimTech towels on the surface you will be working on.
3. Wrap tweezers with Teflon tape and set the tweezers aside on the KimTech towels. The tweezers should have about 7 layers of Teflon at the tips and ~1-3 layers four inches from the tip.
4. Place the acrylic plate on the KimTech towels, set the lower section of the sampler on the plate, and lay out the other two sections of the sampler on the KimTech towels.
5. Open the 1L I-Chem Jar of pre-cut IX membranes. Using the Teflon-coated tweezers, pull a membrane from the container. You will also have to pull out (and discard) the two layers of waxy protective paper surrounding the membrane.
6. Holding the sampler's lower section, place the membrane smooth side facing out evenly on the center shelf with the tweezers.
7. Lower the middle section into place and gently push down to seat.
8. Thread the upper and lower section together. A finger tight fit is all that is necessary.

Do not touch the IX membrane and minimize handling of the sampler as much as possible. Do not handle without a clean pair of gloves.

3.2. Collection –

1. Cover a pair tweezers with new Teflon tape and set the tweezers aside on clean, large KimTech wipes.
2. Make sure you have adequate (6) clean 125 mL I-Chem sample jars for all the membranes that were deployed and blanks.
3. Label all sample jars with the location, sampler identification, and date of deployment with a Sharpie pen. Note that each aerohead has a letter identification. Label jars as follows: YrkA-C070828; “Yrk” for York; “A-C” for Aerohead sampler C; “070828” for the year, month, and date. However, for membrane blanks label as: YrkMeB070828-1, where the “-1” represents replicates. Make sure to label the membrane blank jars with the same date as the corresponding sample jars. For example, if you deployed the membranes on August 28th and collected the samples and blanks on September 4th the jars should be labeled for August 28. Each week you will be deploying 3 samples and at the end of the week will be collecting 3 blanks.

3.2.1. Collecting Samples

4. Set acrylic plate on KimTech wipe then set sampler onto the acrylic plate. Unscrew top section of sampler and remove middle section. (Note: an acrylic plate has been supplied to the field sites and should be stored in double Ziplock bags between use.)
5. Find the labeled 125mL I-Chem jar for that Aerohead and place it on a clean surface with the lid off.
6. Using gloved hands grasp the membrane with the long Teflon-coated tweezers and place it in the jar. Do this by the following method:
 - a. Grasp the membrane with the tweezers so the tweezer tips are near the center of the membrane;
 - b. Use the tweezers to place the membrane over the mouth of the jar with the smooth side up;
 - c. Press the membrane into the jar with the tweezers. If necessary, guide the membrane into the jar by folding its edges inward with your gloved hand. Only touch the membrane on its edges, and only touch it at all if absolutely necessary. Figure 3 shows a sample jar with a membrane placed properly inside.
 - d. Close the jar lid.
7. Bag each sample jar separately in 2 Ziplock freezer bags and ship them back to UNR with the aerohead samplers or else store them under 10°C until you are ready to ship.



Figure 3. Membrane inside sample jar.

3.2.2. Collecting Blanks

NOTE: Clean, un-deployed membranes taken from their storage jars at the time of sample collection and placed in sample jars are used as blanks. Blanks are stored along with samples. Three blanks are to be taken every week. Place the sample jars for membrane blanks on a clean surface and take off the lids.

8. Open the 1L jar of pre-cut IX membranes.
9. Using the long Teflon-coated tweezers, place one membrane from the membrane container into each of the open sample jars and close jar lids. See Step 6 in **3.2.1** for instructions on placing membranes in jars.
10. Double bag filled jar in Ziploc freezer bags and store them as described in Section **3.2.1** Step 7.

3.2.3 Returning

11. Complete the log sheet for the week and place it in the cooler.
12. A FedEx US Airbill form will be provided and filled out. Take this form and put it on the outside of the cooler before shipping.
13. Double Ziplock bag the 3 samplers.
14. Bubble wrap each individually double bagged jar and sampler and place them in the cooler or place them in their foam compartments to protect them from damage.
15. Check to make sure that the 3 aerohead samplers, 6 125mL I-Chem jars with membranes inside and 1 1L I-Chem Jar (empty) have all been double bagged and put into the cooler. Also, check to make sure the log sheet is included.
16. Tape the cooler shut and ship it out.

Note: If you feel there are any areas in this protocol that you can improve on, please let us know and changes can be made.

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