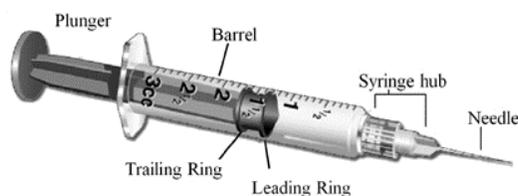


GAS SAMPLING – STATIC VENTED CHAMBER METHOD

Part I – Collecting a Gas Sample

Equipment

- Static Vented Chamber with a secured lid (either box or cylinder)
- 20 mL syringe
- Needle (BD PrecisionGlide™ Needle, 23G x 1)
- 12 mL Exetainer vial



Procedure

- 1) Ensure the plunger is fully depressed in the barrel of the syringe
 - a. Grab a new syringe if the plunger does not move easily within the barrel or the 20mL mark is not clear
- 2) Use a fresh needle (i.e. less than 10 uses and not bent) to pierce the rubber septum of the chamber lid
 - a. If it is difficult to pierce the septum it is likely that the needle has dulled from repeated use and needs to be replaced
- 3) Mix the gas that has collected in the chamber
 - a. Draw the plunger until it can go no further
 - b. Fully depress the plunger to empty the gas in the syringe back into the chamber
 - c. Repeat three times to mix the gas inside the chamber
- 4) Draw a gas sample into the syringe
 - a. Slowly draw the plunger until it can go no further
 - b. *Wait two seconds* to allow the syringe to fill with sample gas
- 5) Remove the syringe from the chamber lid
 - a. Place one hand on the lid to hold it in place and lift the syringe out with the other hand, being careful not to bend the needle
- 6) Discard excess sample gas to obtain a final volume of 20mL
 - a. Carefully depress the plunger with your thumb until the leading ring of the seal is in line with the 20mL mark
 - b. If you pass the 20mL mark *do not draw out the plunger* as this will mix atmospheric gas with the sample in the syringe
 - i. If the leading ring is between 20mL and 15mL, deposit the sample into the vial as usual
 - ii. If the leading ring has passed 15 mL, expel all gas by fully depressing the plunger and restart from Step 4
- 7) Insert the needle into the appropriate Exetainer vial (consult your datasheet to confirm the vial number)
 - a. If the vial was properly evacuated to create a vacuum, a portion of the sample should automatically be drawn into the syringe (i.e. the plunger will partially depress on its own)
- 8) Deposit the sample into the vial
 - a. Fully depress the plunger to empty the sample into the vial

- i. It will be difficult to empty the syringe, but if it is not possible to fully depress the plunger it is likely that the vial was not properly evacuated. If this is the case, use one of the extra vials from the sample box or, if no extra vials are available, manually evacuate a vial.
 - b. *Maintain pressure on the plunger* to keep it fully depressed and remove the syringe
 - i. Continued pressure is necessary because the vial is now overpressurized, as the sample volume (20 mL) exceeds the vial volume (12 mL)
- 9) Return the vial to the sample box
 - a. Place filled vials upside down in the sample box to clearly indicate which vials contain a sample and which do not, as well as indicate which vial is to be used next.

Part II – Conducting a Gas Sampling Run

Equipment

- Data sheets (project/site-specific) and corresponding sample boxes
- Static Vented Chambers (usually already installed at the site) (either box or cylinder)
- Chamber Lids (stored in the Shed)
- VMC probe / WET Sensor and extra batteries
- Gas Sampling Kit (1 per sampler)
 - Clipboard
 - Pencil (2-3)
 - Short stem thermometer
 - Stopwatch
 - Rubber bands (1 bag)
 - Syringes (2-3)
 - Needles (1 box)
 - Scissors
 - Ruler



Figure 2. A fully stocked gas sampling kit



Figure 3. A sealed rectangular static vented chamber



Figure 4. A round static vented chamber/collar

Procedure – Preparing to Conduct a Sample Run

Before Leaving the Lab

- 1) Obtain the necessary number of *evacuated* sample boxes
- 2) Enter the sample box Prefix / Serial information into the correct Excel GHG Data Sheet file and print the datasheets
- 3) Gather together all necessary equipment, complete the Vehicle Pre-Use Inspection, etc.

In the Field

- 4) Cut down any vegetation in the chamber as it may prevent a proper seal when the lid is attached

- 5) Distribute your chamber lids in your assigned plots by placing one *on top* of each chamber, perpendicular to the chamber such that it is still open and not yet accumulating emissions (see photo below)
 - a. DO NOT PLACE THE LIDS ON THE GROUND; any lid that comes into contact with soil must be washed and sterilized as per the Faculty's biosecurity protocol
 - b. DO NOT WALK THROUGH PLOTS; use the buffer zones and alleys to move between plots and reach chambers while collecting samples



- 6) Go to your starting plot and identify the first chamber to be sampled
- 7) Confirm the following:
 - c. You have a fully stocked sample kit and all equipment is functioning properly (see Figure 2)
 - d. You have the correct sample box(es) and datasheets (i.e. the sample box Prefix and Series match your datasheet and the plots you are about to sample)
 - e. A fresh needle is firmly attached to the syringe, which should have a clear 20mL mark
 - f. Your stopwatch is reset
- 8) Make sure you fully understand the following:
 - g. The order in which chambers are to be sampled within each plot as they are *not* labelled and different projects have different plot layouts
 - h. When *0 min* sampling occurs for each chamber and the sampling interval length, as different projects may have different sampling schedules according to the number of chambers per plot, number of plots per sample run, and the distance between chambers
 - i. E.g. The SoyRes project had 4 chambers per plot and a new plot was started every 5 minutes, with chambers sampled at 1 minute intervals. *0 Min* samples were collected from chambers in the first plot at the 0:00, 1:00, 2:00, and 3:00 minute marks, and from chambers in the second plot at the 5:00, 6:00, 7:00, and 8:00 minute marks, and so on. *20 Min* samples were collected from the first plot at the 20:00, 21:00, 22:00, and 23:00 minute marks, and from chambers in the second plot at the 25:00, 26:00, 27:00, and 28:00 minute marks, and so on.

Procedure – Conduct a Sample Run

Collect Gas Samples

- 1) Seal the first chamber
 - a. Place a lid on the chamber and make sure the weather stripping has created a seal
 - b. Hold the lid in place with one hand and secure it with elastic bands (see Figure 3)
- 2) Collect your first sample
 - a. Start the stopwatch and immediately collect a gas sample (see [Part I – Collecting a Gas Sample](#)) – this is the *0 Min* sample for the first chamber
- 3) Move to the second chamber with your sampling kit
- 4) Collect your second sample
 - a. When the stopwatch reaches the first sampling interval, seal the chamber and immediately collect a gas sample – this is the *0 Min* sample for the second chamber
- 5) Continue the pattern of moving to the next chamber, securing lids and taking samples at the beginning of each sampling interval on the stopwatch, until all *0 Min* samples have been taken and the first round of sampling is complete

- a. It is best to quickly confirm that you have used the correct vial every time you deposit a sample but at the very least it should be confirmed at the first chamber in each plot
- 6) Return to the first chamber in the run and prepare to collect *20 Min* samples (you will usually have several minutes between the last *0 Min* sample and first *20 Min* sample)
 - a. Cap and remove the spent needle and replace it with a fresh needle
 - b. Fully explain any notes if necessary (e.g. issues with a chamber/lid, incorrect vial used, etc.)
- 7) When the stopwatch reaches 20:00, collect a sample from the first chamber – this is the *20 Min* sample for the first chamber as it was collected 20 minutes after the first sample
- 8) Move to the second chamber, wait for the stopwatch to reach 20:00 + sampling interval and take a gas sample. This is the *20 Min* sample for the second chamber as it was collected 20 minutes after the first sample
- 9) Continue sampling until all *20 Min* samples have been collected and the second round of sampling is complete
 - a. If you kept pace with the sampling interval, you will have collected your last *20 Min* sample 20 minutes after you collected that chamber's *0 Min* sample
- 10) Return to the first chamber in the run and prepare to collect *40 Min* samples
 - a. Cap and remove the spent needle and replace it with a fresh needle
 - b. Fully explain any notes if necessary (e.g. issues with a chamber/lid, incorrect vial used, etc.)
- 11) When the stopwatch reaches 40:00, collect a sample from the first chamber – this is the *40 Min* sample for the first chamber as it was collected 40 minutes after the first sample
- 12) Move to the second chamber, wait for the stopwatch to reach 40:00 + sampling interval and take a gas sample. This is the *40 Min* sample for the second chamber as it was collected 40 minutes after the first sample
- 13) Continue sampling from chambers until all *40 Min* samples have been collected
 - a. If you kept pace with the sampling interval, you will have collected your last *40 Min* sample 40 minutes after you collected that chamber's *0 Min* sample
- 14) Return to the first chamber in the run and prepare to collect *60 Min* samples
 - a. Cap and remove the spent needle and replace it with a fresh needle
 - b. Fully explain any notes if necessary (e.g. issues with a chamber/lid, incorrect vial used, etc.)
- 15) When the stopwatch reaches 1:00:00, take a gas sample from the first chamber
- 16) Move to the second chamber, wait for the stopwatch to reach 1:00:00 + sampling interval and take a gas sample
- 17) Continue until all *60 Min* samples have been collected
- 18) Collect the chamber lids and return the elastic bands to your sampling kit

*Collect Supplementary Data**

- 19) Measure the air temperature with the short stem thermometer – record the time the measurement was taken
 - a. Place your body and hold the thermometer relative to the sun and wind such that, to the best of your ability, the measurement is collected in the shade and out of the wind
 - b. Allow approximately 1 minute for the thermometer to provide a correct reading
- 20) Measure the 0-5cm soil temperature with the short stem thermometer and soil moisture content with the WET Sensor – record the approximate time these measurements were collected (e.g. during the *20 Min* round)
 - a. Number of chambers per plot and distance between chambers will dictate how many measurements are to be collected; consult the datasheet to confirm how many are needed as this will differ between projects
 - i. If fewer measurements than chambers are requested, choose a location that is representative of all chambers in the plot from which to collect your measurements but *do not* walk into the plot to obtain the measurements
 - b. Allow approximately 1 minute for the thermometer to provide a correct reading

- c. The WET Sensor prongs are relatively delicate; *do not* risk damaging the prongs by forcing them into frozen or very hard ground (e.g. dry heavy clay soil)

- 21) Measure the depth of any standing water in chambers with your ruler
- 22) Collect any other data requested for that project

*Supplementary Data should be collected during the sampling run, provided you can do so without compromising the timing of gas sample collection. You will likely not have time during the first round of sampling as placing lids requires time, but you will have “spare time” during the second and third rounds; a good strategy is to measure temperature during one round and soil moisture during the other, by inserting the thermometer/probe as soon as you arrive at a new plot and recording the reading once all gas samples have been collected.

Part III – Common Issues

- Avoid walking through plots; use the buffer zones and alleys to move between plots and access chambers
- Make a quick note if samples are collected off schedule but do not allow note-taking to push you further off schedule. Do your best to get back on schedule as soon as possible.
- Active precipitation has an immense effect on GHG values and some sampling equipment. If precipitation is strong enough that you require a rain jacket, then it is raining too hard to continue sampling.
- Dud vials (those that were not properly evacuated) are possible and occasionally occur in bunches. If this is the case, there may not be enough unassigned vials in the sample box and you will have to manually evacuate the dud vials. (See below)

Included on each greenhouse gas datasheet is a section for weather and soil conditions and other comments (see Figure 5). There is also a key indicating how certain common issues should be marked on the datasheet.

26		2927	2957	2987	21
	3	2928	2958	2988	22
122	2	2929	2959	2989	23
	3	2930	2960	2990	24
Weather & Soil Conditions / Other Comments:					
No sample collected (explain why in notes): 3004					
Wrong vial #: 3004 ⁰²					
Issue w sample or chamber (explain in notes): 3075					

Figure 5. Comments section of greenhouse gas datasheets, which provides examples of proper notation.

The main three are: (1) no sample was collected, (2) the sample is not in the correct vial, possibly because the vials were already out of order or you accidentally grabbed the wrong one, and (3) there was an issue with the sample or chamber that needs explanation. *In all cases*, please provide an explanation in the comments section. Your comments should be clear, concise, and self-explanatory.

The following shorthand / abbreviations should be used to simplify your comments:

- PXXX-? to indicate the Plot and Chamber
 - E.g. P122-3 indicates Chamber 3 of Plot 122
- AA##### to indicate a specific vial
 - E.g. AKIN 2930

Manually Evacuating Vials

- 1) Depressurize the vial by fully removing the cap
- 2) Carefully thread the cap back on, but do not over tighten it as this may prevent a proper seal
- 3) Fully depress the plunger and insert the needle into the dud vial
- 4) Draw the plunger until it can go no further
- 5) Keep the plunger fully withdrawn and remove the needle from the vial
- 6) Discard the “sample” into the air by depressing the plunger until it can go no further
- 7) Repeat Steps 2 through 6
- 8) The vial should now be evacuated sufficiently to accept a sample
- 9) Record on the data sheet that the vial was evacuated manually and at what time the sample was actually collected as you will now likely be behind schedule

Vials Out of Order

Vials are removed from and returned to sample boxes in batches during analysis and it is possible for the vials to become disordered during this process. If while sampling, you notice that the vials in your sample box are not in the correct order and you consequently used the wrong vial according to the label and datasheet,

- 1) Correct the vial number written on your datasheet to indicate clearly which vial contains the sample,
- 2) Return vials to the sample box *in the order in which samples were collected* (i.e. do not try to sort the vials after they contain samples and/or during a sampling run as this will push you off your sampling schedule), and
- 3) Make a note in the Comments box indicating that vials were out of order but *DO NOT* allow detailed note-taking to push you off your sampling schedule

Part IV: Submitting Gas Samples for Analysis

- 1) Make a digital copy of all datasheets
 - a. Use the staff printer/scanner in Room 368 (near the main office)
 - b. Access the copier using the Applied Soil Ecology Lab Account ID [8735](#)
 - c. Remove any dirt from the datasheets and place them face-up in the top loading tray
 - d. Select “Send” and choose “Brad Sparling” as the recipient
 - e. If any sheets have data on both sides, use Quick Set-up to choose 2-sided scanning
- 2) Tuck the original data sheets into the boxes with the corresponding vials
- 3) Label each box with the Project/Location and sampling date
 - a. Make sure to use the correct colour of label tape
 - b. *Do not* use white label tape; this is reserved to mark sample boxes as evacuated
- 4) Place the labelled sample boxes on the shelves in Room 310 (GHG Lab) (see Figure 6)
 - a. Do your best to put all boxes together on one shelf
- 5) Log the samples using the Exetainer Vial Log-In sheets (see Figure 6)



Figure 6. Room 310 gas sample storage shelves containing labelled sample boxes and the Extainer Vial Log-In sheets.