Building a vented static chamber and collar
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Detailed, diagrammed instructions with photos

This is a vented static chamber made from the endcap of an 8" (20cm) diameter PVC sewer pipe.

For more details on vented static chambers, their methodology, and their use, read Hutchinson and Mosier (1981), Livingston and Hutchinson (1995), and Holland et al. (1999).

This endcap was purchased from Western Nevada Supply, product # WFI1912271, description 8 SG PVC SWR CAP. Each endcap costs approximately $43. This endcap was selected because it has a built-in airtight seal that will fit on the collar, described below, provided the collar has been beveled.

In the field, the vented static chamber rests on a "collar" inserted ~2 cm into the soil. The collar is cut from 8" (20cm) diameter PVC sewer pipe. This is a collar, with one side ground.

Note: grind both sides of the collar to insert collar into soil and allow for a better fit with the endcap.

The collar can be cut using a sufficiently large compound mitre saw or a table saw. However, most plumbing supply companies will cut these collars for you for a reasonable price. Cut the collar to 4.5 inches wide.

Grind the collar using a bench grinder. An example of a bench grinder is HERE:
http://www.homedepot.com/p/Ryobi-6-in-Grinder-with-LED-Lights-BG612G/205216320
I recommend using a coarse grinding wheel for maximum efficiency. Again, bevel both sides of the collar for best results using the chambers described here.

Cutting and grinding PVC makes a mess. Wear a respirator, eye and ear protection, and be prepared for a major cleanup effort with a good shop vacuum, brooms, dustpans, etc. The PVC dust has such high surface area to volume ratios that it becomes electrostatically charged, so be prepared to be shocked and avoid touching electrical outlets. Do not do this in an area with children or pets, or valuable electronics or other precious equipment.

To construct the chamber, you will need
1) A drill (either cordless or corded):

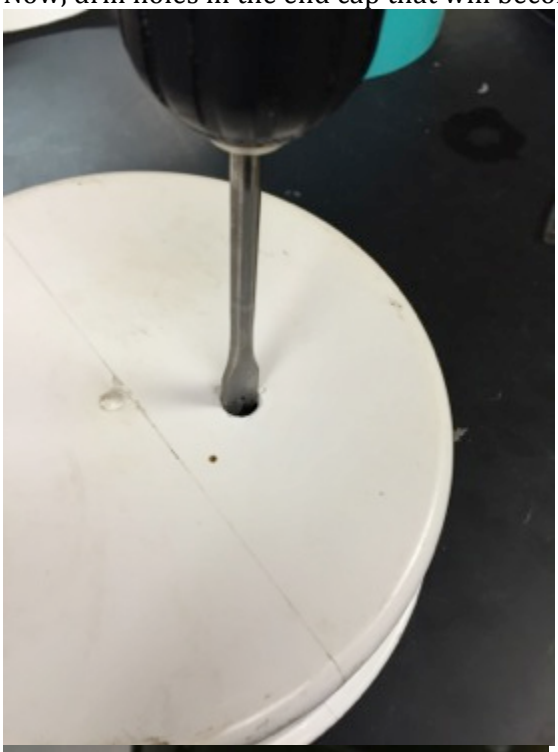
2) A ½” spade bit, available from any hardware store:

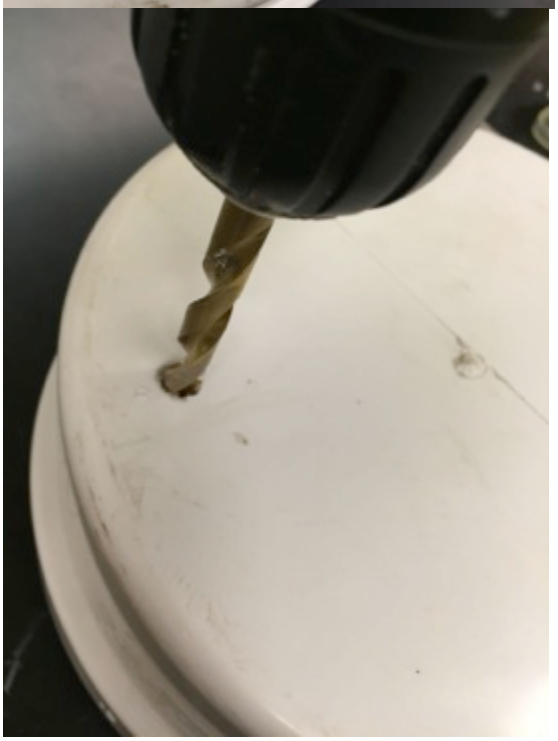
3) A 11/32” common twist bit, available from any hardware store:

4) A vent tube, cut to 13 cm long and with a 7mm inside diameter. These dimensions are specific to the volume of this chamber. Changing the volume for some reason? Change the vent. This vent tube is made from Tygon tubing with an outside diameter of 3/8" and an inside diameter of ¼". Tygon tubing is available from many locations, but can be found at Fisher Scientific, where the part number is 14-171-104. One of these items provides 50 feet of Tygon tubing, which is enough to make approximately 117 vents. That's likely more than enough. You only need one vent per vented static chamber, so that would be 117 chamber tops. This is a vent tube, cut to length:

5) A septum. This septum will allow a needle to go through it, but not allow gas exchange. Good septa have a snug fit into the chamber, will not pull out when the needle is withdrawn, and will allow for many punctures. I recommend a 20 cm Blue Butyl Rubber Septum stopper from Bellco Glass, Inc. The part number is 2048-11800A. This is a septum stopper, viewed from the side:

Now, drill holes in the end cap that will become the chamber.



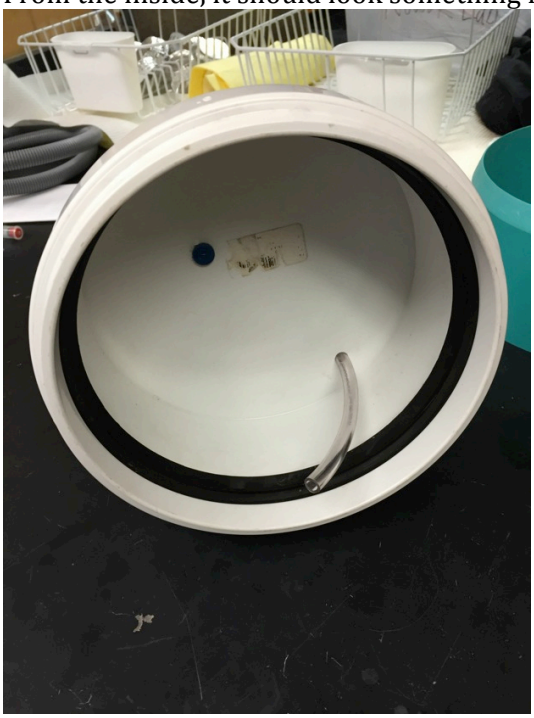


Note: The Bellco septa seem to have slightly different diameters among batches. The spade bit may need to be turned at an angle slightly to widen the hole just slightly to allow an easier insertion of the septum. Not too much, or else the septum will be loose and the chamber will be ruined.

On the outside of the chamber, insert the septum stopper into the chamber top. I recommend using your thumb.

Insert the vent tube from the inside of the chamber. Note the hole we drilled (11/32" is slightly smaller than the outside diameter of the tubing (3/8", or 12/32"). This is intentional, and is designed to create a tight fit between the vent and chamber. Twist the vent tubing slightly to insert it into the hole you drilled.

Your chamber is now complete.
From the inside, it should look something like this:



Insert the collar into the ground using a one-foot long board cut from Trex brand or similar decking material and a 3 lb metal mallet. Place the chamber on the collar, and measure GHG fluxes.

References

Holland, E.A., Robertson, G.P., Greenberg J., Groffman, P.M., Boone R.D., Gosz, J.R. 1999. Soil CO2, N2O, and CH4 exchange. In: Standard Soil Methods For Long-Term Ecological Research. Robertson, G.P., Coleman, D.C., Bledsoe C.S., and Sollins P., eds. Oxford University Press, NY. Pages 185-201.

Hutchinson, G.L., Mosier A.R. 1981. Improved soil cover method for field measurement of nitrous oxide fluxes. Soil Science Society of America Journal, 45(2), 311-316.

Livingston, G.P., Hutchinson G.L. 1995. Enclosure-based measurement of trace gas exchange: applications and sources of error. In: Biogenic trace gases: measuring emissions from soil and water. Matson, P.A and Harriss, R.C., eds. John Wiley and Sons, NY. Pages 14-51.