**Small scale plume dispersion study**

**Approach**

Use methane as a tracer to do small scale short term dispersion tests. Release methane from a point source at a steady rate, measure ambient levels downwind at one point using the LGR analyzer and also measure 3 d winds and turbulence with a sonic anemometer at the release point. If possible record all data at 10 Hz in a single file. Run tests for 10 min each, use different distances (10 m, 15 m, 20 m) and different test conditions (light to strong winds, sunny/cloudy). Initially do all tests during the daytime.

**Equipment**

Methane tank and regulator

Mass flow controller for methane (40 to 60 sccm approx. to obtain 200-300 ppb @ 30m, up to 800 sccm (max for safety reasons), see attached spreadsheet)—release point a few cm above the surface, 1/4 in OD release tubing could be could be fixed near the base of the sonic tripod

LGR with sample pump and sample tubing (~ 30 m) arrange for rapid flush of sample tubing with tee to analyzer (could be downstream of pump if needed). Sample inlet can be moved to different locations (small tripod) to be downwind of the source. Could we use the old tracer profile sampling manifold tubing and pump?

The LGR is ready to run on a car battery. One possibility is mounting the analyzer & battery on a hand truck or cart. It consumes 80W so 100AH car battery might last 6+ hours. That eliminates tubing delay and the external sample pump. In this scenario, the sonic data cable would be extended with a 100’ Ethernet cable ($50-60) so it can reach the logger at the LGR. Paccar 125 has ~10 car batteries to use. For tracking inlet location in this scenario, we have GPS receivers or the Airmar WX+GPS unit.

3 d sonic on a tripod (1 m) and Campbellsci logger

There are several CSAT3B sonics in 423 for general research that we can use. They require a Campbell logger.

I will look around for a suitable tripod.

Datalogger and pc for display of data (what are the options for this?)

Heping’s lab loaned us a CR6+Wifi unit. This is our best option because we can connect directly to the logger’s wifi network with a tablet or phone and use the [mobile app LoggerLink](https://www.campbellsci.com/loggerlink) for monitoring data.

The LGR also has a built-in wifi network and you can login to control it with a VNC viewer app. This removes the need for a computer monitor, keyboard and mouse.

I routinely did both of these things during the IAQ campaign with an [8” Lenovo Tab 4](https://www.amazon.com/Lenovo-Android-Quad-Core-Processor-ZA2B0009US/dp/B07193VPNF/ref=sr_1_3?s=pc&ie=UTF8&qid=1548373940&sr=1-3&keywords=lenovo+tab+4+8). They also have a 10” model for ~$150. They are pretty rugged with a glass screen protector and flip cover.

Power from AC on rooftop or from small generator (parking lot or field locations)

The Paccar roof has some GFI outlets, or run an extension cord inside. For the field the 2kw Honda generator is portable – or there are many car batteries in Paccar 125A.

I estimate a full car battery could run the LGR for at least 6 hours. Adding the sonic, GPS and logger doesn’t change that estimate much.

This should be set up for PACCAR rooftop and/or open ground-level (parking lot) test locations

The rooftop is no problem to use. Narrow, but just fine for E-W winds. Try signing up for alerts from <windy.com> or similar service to track best days for experiments.

Instead of a parking lot, maybe we can use the Grimes Way Playfield across the street? – I’m waiting for more info from UREC on this.

Note safety limit for methane is approx. 5% combustion limit. The release rate is low enough that the atmospheric dilution reaches 5% within inches of the release point. We shouldn’t need to worry about the combustion issue, but should be careful with static sparks at the release.

Yes, there will be a very small but unavoidable area that is above the combustion limit. I included a flash arrestor in the regulator quote. It’s a simple screw-on device with a check-valve and flame extinguisher to keep oxygen & flames out of the tank.

We will need to measure the lag time between the sample inlet and the LGR response. This can be done by diluting methane (multiple dilutions) in a large syringe and then injecting past the sample inlet. Time it with a stopwatch to the first indication of response from the LGR.

We even have some low-quality calibration gas that can be used up for this purpose. On the order of 1-2 ppm CH4, I think.

Tests will be conducted during spring semester beginning as soon as possible.