

Community Air Quality Investigations Mobile Air Monitoring Van Instrumentation

The following instruments and components are installed in the Community Air Quality Investigations Mobile Air Monitoring Van and record data at a 1-second sampling rate (1-Hz).

Community Mobile Air Monitoring Van			
Exterior			
Number	Component or Instrument Make and Model	Pollutant(s) or Data Measured	Description
1	Sampling Inlets	Gas-phase and particulate matter-phase pollutants	The gas inlet is a stainless steel tube, which is non-reactive to gas pollutants, and fashioned so that it reduces pressure fluctuations while in motion. The PM inlet is an aluminum shrouded design to restrict particle size bias and capture particle sizes of interest for human health.
2	Airmar 200WX Weather Station	Ambient temperature, barometric pressure, wind speed, wind direction, latitude, longitude, vehicle speed, vehicle direction, compass heading, elevation	Ultrasonic anemometer, solid state temperature and pressure sensors, GPS, and an electronic compass
3	Garmin 16x-HVS GPS	Latitude, longitude, vehicle speed, vehicle direction	GPS
Interior			
Number	Component or Instrument Make and Model	Pollutant(s) Measured	Description
6	Magee Scientific AE33 Aethalometer	Black Carbon	An aethalometer measures black carbon particle mass concentrations by analyzing selective light transmissivity and absorption qualities of aerosols collected on quartz filter tape. A PM _{2.5} cyclone is installed with the instrument.
7	TSI Optical Particle Sizer (OPS) 3330 TSI Water Condensation Particle Counter (WCPC) 3789	Particle Size Range: 2 nm – 10 µm PM Number Counts/Concentrations, PM Mass Concentrations (PM ₁ , PM _{2.5} , PM ₁₀)	An optical particle sizer uses light scattering techniques to count and determine the size of particles. A water condensation particle counter contains a chamber in which a series of controlled environments grow small particles to a size they can be detected by light scattering techniques. A PM ₁₀ cyclone is installed with the OPS and a PM _{1.4} cyclone is installed with the WCPC.

8	Ionicon 6000x2 Proton Transfer Reaction Mass Spectrometer Time of Flight (PTR-MS-ToF)	Speciated Volatile Organic Compounds (VOCs): 1,3-Butadiene, 1,3-Dichloropropene, Acetaldehyde, Acetone, Acetylene, Acrolein, Acrylonitrile, Benzene, Benzo[a]pyrene, Carbon Tetrachloride fragment, Dichlorobenzene, Ethylbenzene, Ethylene, Ethylene Oxide, Formaldehyde, Methyl ethyl ketone, Methylene Chloride, Naphthalene, Parachlorobenzotrifluoride fragment, Parachlorobenzotrifluoride, Styrene, tert-Butyl acetate, Tetrachloroethylene, Toluene, Trichloroethylene, Trimethylbenzene, Xylene	A mass spectrometer measures the mass of gas-phase compounds in the air, allowing them to be identified. In the PTR-MS-ToF, these gas-phase pollutants get ionized and then go through a detection chamber using time-of-flight technology, measuring VOC data once every second!
9	Picarro G2401 Analyzer	Carbon Monoxide (CO), Carbon Dioxide (CO ₂), Methane (CH ₄)	This greenhouse gas analyzer rapidly detects CO, CO ₂ , and CH ₄ through a measurement technique known as Cavity Ring-Down Spectroscopy. The unique physical properties of these pollutants absorb light at specific wavelengths, allowing each species to be identified and measured.
10	Thermo Scientific 42iQ Analyzer	Nitrogen Oxides (NO _x)	NO _x is a combination of nitric oxide (NO) and nitrogen dioxide (NO ₂). NO _x is measured by converting NO ₂ to NO through a molybdenum converter. NO is then combined with ozone to form NO ₂ , a chemical reaction that generates an infrared light signal proportional to the amount of NO in the sample that can be measured. This technique is known as chemiluminescence. The 42iQ is operated in NO _x -only mode to achieve 1-second sample intervals.
11	Sampling Manifolds and Conditioning	Gas-phase and particulate matter-phase pollutants	The gas sampling system uses a mixture of stainless steel, Teflon tubing, and a borosilicate glass manifold. Some sections of the tubing and glass manifold contain heated sample conditioning systems to keep condensation from forming and to restrict pollutants from adsorbing to tubing walls. A 47-mm Teflon inlet filter is installed upstream of the gas instruments to protect against contamination (not pictured). An auxiliary pump and mass flow controller are installed to decrease residence time and maintain stable performance during changing environmental conditions (not pictured). The PM sampling system uses a mixture of stainless steel, anti-static silicone tubing, and other non-reactive materials. A one-way overflow check valve is installed on the main sample tubing to restrict over pressurization when the van is travelling on highways (not pictured).