HB21-1189 Community Monitoring: Quarter 2 2026

Scope and Applicability

To fulfill the community monitoring requirements outlined in The Regulate Air Toxics Act (HB21-1189), the Air Pollution Control Division (APCD) Air Toxics and Ozone Precursors Program (ATOPs) utilized the Community Air Toxics (CAT) mobile laboratory in accordance with the state of Colorado, Department of Public Health and Environment (CDPHE) mission. The CAT was designed and developed by TofWerk and includes three instruments incorporated into a Mercedes Sprinter van for "real-time" measurement of ambient air while driving in communities. A duplicate of the CAT mobile lab, called the Emissions Monitoring Utility (EMU), was put into service on *December 8, 2023*.

The Colorado Regulate Air Toxics Act specifies monitoring of three toxic trace gasses (benzene, hydrogen cyanide, and hydrogen sulfide) in the communities surrounding four covered facilities to better understand how people in those communities are impacted by air quality. These air toxics are pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. HB21-1189 also directs Colorado's Air Quality Control Commission to identify additional covered air toxics over time. This mobile monitoring platform allows for measurement of hydrogen cyanide, hydrogen sulfide, benzene, and several "non-covered" volatile organic compounds (VOCs).

Method Overview

The CAT and EMU mobile laboratories both consist of two mass spectrometers and one optical spectrometer. Ambient air is introduced to the instruments through tubing on the roof of the van. In addition, a MaxiMet weather station collects location, and meteorological data (temperature, relative humidity, barometric pressure, wind speed, and wind direction).

The Vocus Eiger Proton-Transfer Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS) instrument operates using proton-transfer reaction mass spectrometry. This process uses hydronium ions (H_3O^+) to measure volatile organic compounds (VOCs). In the first step, the primary (or "reagent") ions react with trace gasses in air, ionizing them. The resulting analyte ions are separated and quantified with a time-of-flight mass spectrometer.

The Vocus Aim Chemical Ionization Time-of-Flight Mass Spectrometer (CI-ToF-MS) instrument operates using chemical ionization mass spectrometry. This is a two-step ionization technique. In the first step, the primary (or "reagent") ions are made by illuminating a reagent gas stream with a vacuum ultraviolet (VUV) lamp. The resulting ions are mixed with ambient air in a reaction cell. There, the reagent ions interact with trace gases in air, ionizing them. The resulting analyte ions are separated and quantified with a time-of-flight mass spectrometer.

The Picarro Cavity Ring-Down Spectrometer (CRDS) analyzer uses light from a single-frequency laser that enters a cavity where three mirrors reflect the laser light. When the laser is on, the cavity quickly fills with laser light. A small amount of the laser light is transmitted through the mirror closest to the photodetector, which turns the incident light into a

signal that is directly proportional to the light intensity in the cavity. As the light circulates in a cavity with a gas sample, the molecular absorption by the gas results in a decrease of the light intensity. Plotting the absorbance at each measured wavelength generates an optical spectrum. This spectrum contains absorbance peaks that are unique to each molecule in the sample. The height of a particular absorption peak is proportional to the concentration of a molecule that generated the signal.

Table 1. Instruments in CAT and EMU mobile monitoring laboratories with the respective compounds that each instrument reports.

CAT/ EMU Instruments	**Compounds reported**
Vocus Eiger PTR-TOF-MS	Benzene, Toluene, Xylenes, Trimethylbenzene
Vocus Aim CI-TOF-MS	Hydrogen Cyanide (HCN)
Picarro CRDS	Hydrogen Sulfide (H_2S), Methane (CH_4)

Quarterly Data Summary Notes for Q2 2026

Relevant links:

- Community Air Toxics Mobile Lab (CAT) Flyer – ENG
- Community Air Toxics Mobile Lab (CAT) Flyer – ESP
- Emissions Monitoring Utility (EMU) Flyer – ENG
- CDPHE- Regulate Air Toxics Act
- Stationary Wind data resources:
    - CDPHE Air Quality Dashboard
    - CDPHE Meteorology Data Selector Map

I. Method Detection Limit

The reported Method Detection Limits (MDLs) were determined during the instrument audits following a procedure defined by the U.S. Environmental Protection Agency as the "minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results". The table of MDLs for each compound and asset are reported on the Quarterly Summary tab of the Data Summary.The "MD" flag was used to flag data that is less than the MDL.

II. Hydrogen Cyanide and Benzene Concentration Analyses

Hydrogen cyanide and benzene measurements were analyzed using Tofware high resolution analysis software. This software uses high resolution peak fitting to better isolate benzene ($C_6H_6^+$) and hydrogen cyanide ($HCNI^-$) signals from interfering species.

III. Computing Statistics

Data with the flag "BR" (indicating negative values less than –MDL) are replaced with zeros for computing statistics and data within ± the value of the MDL are flagged "MD" and replaced with 0.5*MDL for statistics.

The quarterly pollutants stats table was computed at the end of the quarter for the specific region.

IV. Instrument Time Delay

There are sampling time delays between the different instruments due to differences in sample line tubing length and sampling flow rates. Currently, this time delay is not corrected for in the quarterly data packets. These sampling delays were measured directly during the audits and were determined from bump tests at the inlet lines located at the top of the van. Instrument sampling

delay time is defined as the time it takes for the measured instrument signal to increase by 10× the baseline signal after initiating sampling with calibration gas.

Table 2. Mobile monitoring van instrumentation with the sampling time delays for each CAT & EMU mobile monitoring laboratories.

Instruments	**Compounds reported**	**Time Delay of Sampling (CAT)**	**Time Delay of Sampling (EMU)**
Vocus Eiger PTR-ToF-MS	Benzene, Toluene, Xylenes, Trimethylbenzene	4 seconds	5 seconds
Vocus AIM CI-ToF-MS	Hydrogen Cyanide (HCN)	6 seconds	3 seconds
Picarro CRDS	Hydrogen Sulfide (H_2S)	21 seconds	17 seconds
Picarro CRDS	Methane (CH_4)	24 seconds	25 seconds

V. Meteorological Data

A large amount of MetData has the flag "QW", indicating questionable wind data.
When the vehicle is moving quickly and wind speeds are low, it can be challenging to accurately measure true wind.
Wind data are flagged if:

1. True wind cannot be distinguished from the wind generated by the vehicle's motion while driving.
2. The difference between the wind speed (direction) and the vehicle's speed (direction) is less than the error of the MaxiMet.

If the MetData are flagged "QW", we encourage the user to use external sources to verify wind speed and direction:

CDPHE Air Quality Dashboard
CDPHE Meteorology Data Selector Map

VI. GPS Data

GPS measurements were collected using a VectorNav GNSS-Aided Inertial Navigation System (GNSS/INS) and supplemented by Gaia GPS, a digital mapping and navigation cellular

application, and a MaxiMet meteorological station. Beginning in Q3 of 2024, new procedures were implemented for quality-correcting and post-correcting GPS data. Data points that are flagged only as ‘QG’ indicate that the point strayed from the deployment route, making the data point questionable. Data points that are flagged ‘QG’ and ‘AQ’ were nulled because the GPS location was too far from the standard route to confidently be post-corrected.

VII. Quarter Specific notes

A. Vocus “B” AIM CI-ToF-MS Sensitivity Calibration and Auto-Zero Carrier Gas

Beginning May 11, 2026 in the CAT mobile laboratory and May 8, 2026 in the EMU mobile laboratory, the sensitivity calibration carrier gas and auto-zero supply was changed from an ultrahigh purity (UHP) nitrogen gas cylinder to a Tofwerk VZA-105 catalytic zero air generator.

The Vocus “B” AIM instrument is highly sensitive to humidity. Generally, as humidity increases, the sensitivity of the instrument to a species decreases. Thus, changing the carrier gas used for sensitivity calibrations from a dry (~0% RH) UHP nitrogen cylinder to a zero air generator that supplies ambient humidities improves the accuracy of species quantitation in the Vocus “B” AIM.

Similarly, the change from UHP nitrogen gas to a catalytic zero air generator to perform auto-zeros every 30 minutes throughout a deployment allows for improved background corrections that better represent hydrocarbon-free air.

B. Vocus “B” AIM CI-ToF-MS Interchanged between CAT & EMU Mobile Monitoring Laboratories

On deployments performed from May 1 to May 14, 2026, the Vocus “B” AIM traditionally installed in the CAT mobile monitoring laboratory was installed in the EMU mobile monitoring laboratory. This change was implemented due to maintenance needed for both the CAT mobile monitoring van and the Vocus “B” AIM traditionally installed in the EMU mobile monitoring laboratory. This change ensured the continuation of deployments necessary to satisfy the statutory requirements in HB21-1189.

On May 19 and May 20, 2026, the Vocus “B” AIM traditionally in the EMU mobile monitoring laboratory was installed in the CAT mobile monitoring laboratory.

Deployments performed prior to May 1, 2026 and after May 20, 2026 have the traditional instruments installed in each van.

C. Incomplete Hydrogen Cyanide Measurements on May 28, 2026

In the deployment to Collins Aerospace and the residential areas around this facility on May 28, 2026, hydrogen cyanide (HCN) was not continuously measured throughout the entire deployment. Due to corrupted data files likely caused by an unstable USB port, hydrogen cyanide (HCN) measurements are reported only for the first ~50% of the deployment. These measured data do include the areas immediately surrounding the property of Collins Aerospace and the residential areas to the west of the facility. They do not include measurements collected in the residential areas to the south of the facility or the drive north along I-25 from Pueblo to the Denver metro area.