Ambient air monitoring data summary report

KPK – Martin T. Hard

Air Toxics and Ozone Precursor Program [ATOPs]

1.27.2026

COLORADO
Air Pollution Control Division
Department of Public Health & Environment

1. Executive Summary

1.1. Report Purpose

The purpose of this report is to summarize the air data observed by the Colorado Department of Public Health and Environment (CDPHE) in response to general community concern surrounding a pump jack and storage tank, operated by KPK. The facility operates near a community in Fort Lupton, Colorado.

1.2. Background Information

- The MOOSE (Mobile Oil & Gas Optical Sensor for Emissions) reported emissions from the KPK Martin T. Hard facility on September 19, 2023.
- A Pyxis micro gas chromatograph (mGC), deployed as a stationary air quality monitor, was positioned about 75 feet to the south of the KPK pump jack and about 60 feet to the north of the KPK Unit #1 crude oil storage tank (Fig. 1). The Pyxis mGC was accompanied by an Airmar meteorological station, which sampled from 10/4/24 to 9/24/25.

1.3. Air Monitoring Objective:

- The Air Toxics and Ozone Precursors Program (ATOPs) within the Air Pollution Control Division (APCD) of the CDPHE deployed two air monitoring assets (Table 1) in response to the request of the OGHIR (Oil & Gas Health Information and Response) Program.
- Stationary monitoring was performed with a Pyxis mGC and Remote Air Tracking Trailer for Localized Emissions Recording (RATTLER) in order to evaluate the air concentration of compounds that may be harmful to nearby communities.

Table 1. Summary table showing air monitoring deployments conducted by CDPHE at the KPK Martin T. Hard facility.

Monitoring Asset	Monitoring Type	Compounds Measured	Deployment Dates	Sampling Duration
RATTLER[a]	Stationary	Benzene	October 4, 2024 – September 24, 2025	10 minutes
Airmar[b]	Stationary	Meteorology	October 4, 2024 – September 24, 2025	1 second

(a) Remote Air Tracking Trailer for Localized Emissions Recording
(b) A meteorological station, which measures wind speed and wind direction.

1.4. Key Findings

- The Pyxis mGC measurements, between October 4, 2024 and September 24, 2025 showed a deployment average benzene concentration of 0.60 pbbV, similar to the typical background benzene concentration for this region.
- The maximum deployment 10-minute value observed was approximately 17.27 ppbV and was not from the direction of the pump jack or storage tank; however, the wind speed was low (2.57 mph), indicating possible accumulation from a nearby source.
- The highest deployment 10-minute benzene concentration recorded by the Pyxis mGC from the direction of the pump jack was 15.68 ppbV and occurred on January 29, 2025 at 17:48. The wind speed was recorded at 0.89 mph during this measurement, also indicating accumulation from a nearby source.

2. Introduction

Figure 1. Aerial image of KPK Martin T. Hard facility. Pump jack (orange rectangle), crude oil storage tank (Unit #1) location (yellow rectangle), and Remote Air Tracking Trailer for Localized Emissions Recording (RATTLER) deployment location (blue pin).

CDPHE-APCD-ATOPS deployed the MOOSE on September 19, 2023 which observed emissions coming from the storage tank (Unit #1), located at the KPK Martin T. Hard facility caused by a manual pressure release. Because this location is approximately 70 feet southeast of a neighboring community, the CDPHE-APCD-ATOPS deployed a stationary monitor, the RATTLER, to investigate. The RATTLER was deployed approximately 75 feet to the south of the KPK pump jack and 60 feet to the north of the KPK crude oil storage tank (Unit #1) on October 4, 2024 (Fig. 1).

The RATTLER was equipped with a Pyxis mGC to measure benzene emissions and an Airmar anemometer to measure wind speed and wind direction. The RATTLER was deployed for year-long monitoring from October 4, 2024 to September 24, 2025. During this time period, the RATTLER was removed for a brief period of time from April 11 to May 22, 2025, due to logistical needs.

3. Methods

3.1. Stationary Measurements

The Pyxis mGC was deployed on October 4, 2024 through September 24, 2025, for continuous monitoring at the KPK Martin T. Hard facility. The RATTLER was located approximately 75 feet to the south of the KPK pump jack and 60 feet to the north of the KPK crude oil storage tank (Unit #1).

3.1.1. Micro Gas Chromatography

The Pyxis mGC has the ability to separate benzene from other compounds within an air sample on a near real-time resolution of approximately 10 minutes. It operates similarly to a gas chromatograph, but on a much smaller scale. The system uses a preconcentrator to adsorb VOC compounds and then separates these compounds with a column. As each compound emerges from the column, it passes over a photoionization detector (PID) to identify VOCs through high-energy photons of light produced by a 10.6 electron volt (eV) lamp to determine the concentration of the individual compound.

This Pyxis mGC offers continuous measurements and versatility in monitoring location. This instrument is powered by a mobile, solar-powered trailer, the RATTLER, which contains an onboard battery bank and two 365-watt (W) solar panels, allowing for enough power for the Pyxis mGC and its temperature-regulated case to operate without interruption. This means the Pyxis mGC is not limited by where it can be deployed.

The Pyxis mGC monitoring objectives for this deployment were:

1. Continuously measure benzene concentrations surrounding the KPK Martin T. Hard facility, which includes the pump jack and crude oil storage tank.
2. Determine if any period of measurement increases above values typically observed in this region (background levels).

These measurements consist of downwind emissions from the pump jack and crude oil storage tank when the winds pass over either the pump jack or crude oil storage tank locations and towards the direction of the monitor.

3.1.2. AIRMAR Weather Station 110WX

The AIRMAR Weather Station is a sensor that measures meteorological parameters on a continuous 1-second time resolution. The measured meteorological parameters include wind speed, wind direction, barometric pressure, humidity, and temperature. The weather station operates by continuously emitting a series of electronic outputs. Multiple pairs of receiving sensors are arranged around a central mast and measure the

wind speed and wind direction based upon the time of flight difference between when those ultrasonic pulses are received. Additional sensors within the anemometer record temperature, humidity, and barometric pressure. The weather station is powered through the use of a 50W solar panel to offer continuous measurement without interruption and expand the capability of the weather station to operate in remote locations.

3.2. Data Processing

Data processing was performed for the measurements collected during this monitoring period to organize the data into a useful format. One species of interest is provided in this report: benzene. The Pyxis mGC measurements occurred continuously while deployed throughout the sampling period (October 4, 2024 – September 17, 2025). Data collected includes benzene concentrations at a 10-minute time resolution along with meteorological parameters, including temperature, humidity, wind speed, and wind direction, at a 1-second time resolution. The meteorological data was averaged to match the benzene measurement sample times. Any invalid data was removed from the dataset. This was identified if the Pyxis mGC did not pass its routine calibrations.

3.3. Data Evaluation

All data are managed with the same method for statistical analyses. Any negative values are replaced with zero to indicate that the compound was not detected at that time. Values that are greater than zero but less than the detection limit, the lowest value the instrument can reliably detect, are replaced with half of the detection limit value. These values are filtered in this way to account for variability within an instrument response and to limit bias from being overly high or low. The detection limit for benzene is 0.05 ppbV.To assess emissions from the KPK Martin T. Hard facility, only measurements collected when the wind direction was coming from the direction of either the pump jack or storage tank relative to the location of the instrument are included in the following analyses.

3.4. Quality Control & Assurance

To ensure reliability and validity of field measurements, proper quality control (QC) and quality assurance (QA) must be carried out before, during, and after data collection. QC processes ensure instruments are operating under the same parameters throughout a measurement period to maintain consistency. QA processes implement checks and validation of the collected data to ensure completeness and accuracy. By carrying out proper QC and QA, confidence in the data is established. QC/QA procedures for individual monitoring assets are briefly described in the sections below.

3.4.1. Pyxis mGC

Manual bump checks occur bi-weekly in which a known concentration of benzene gas is flowed to the Pyxis mGC. After the instrument response is received, a percent error is calculated to ensure that benzene is within +/-30% of the expected value for all bump checks and calibrations. If the error is greater than 30%, a full multi-point calibration is performed and any previous data is flagged accordingly. In addition, routine evaluations are performed bi-weekly to ensure proper flow rates and adequate temperatures are achieved. Data is downloaded from the Pyxis mGC on a weekly basis and assessed for validity.

3.4.2. AIRMAR Weather Station 110WX

Prior to sampling, the anemometer is manually oriented due north by referencing a compass. This ensures accurate wind direction data throughout the sampling period.

4. Results

4.1. Pyxis mGC

Measurements from the Pyxis mGC were conducted south of the KPK Martin T. Hard pump jack and north of the KPK Martin T. Hard crude oil storage tank from October 4, 2024 to September 24, 2025. There was a brief period of downtime in which no benzene data was collected, April 11 – May 22, 2025, due to logistical needs. Other minimal periods of missing benzene data are attributed to when the Pyxis mGC required maintenance, and when the RATTLER trailer lost power and needed a supplemental power source to charge its batteries. The Pyxis mGC experienced more background noise from November 2024 to March 2025, compared to June 2025 to September 2025 (Fig. 2). Background noise is measured by the stability of the PID millivolt signal. As a PID nears the end of its lifespan, the millivolt signal can become less sensitive. After a new PID is installed, the baseline is much more stable.

The deployment average of 0.44 ppbV is similar to values typically observed for benzene concentrations for this region. The highest 10-minute concentrations of benzene recorded during the measurement period are as follows: 17.27 ppbV, 15.68 ppbV, 10.5 ppbV, 10.21 ppbV, 8.56 ppbV and 8.13 ppbV (Table 2, Fig. 2). All but one of these elevated readings occurred during warmer months of the year and at warmer times of the day. Combining this with the more frequent emissions observed between 2 - 5 ppbV during the summer months indicates a seasonality of the emissions in which there is a higher likelihood of increased concentrations from the background during periods of warmer temperatures (Table 2). The maximum 1-hour rolling benzene

average observed throughout the deployment was 5.26 ppbV and occurred from the direction of the pump jack.

Table 2. Summary table showing notable benzene concentrations, when they occurred, and what the wind direction and wind speed were at the time of the observation.

Date/Time	10-minute benzene concentration (ppbV)	Wind Direction	Wind Speed (mph)
1/29/25 17:48	15.68	North	0.89
5/31/25 18:37	17.27	Northwest	2.57
6/7/25 18:38	10.21	Northeast	1.16
6/7/25 21:06	8.13	Southwest	1.98
9/9/25 14:28	10.5	Northeast	2.21
9/9/25 14:38	8.56	Northeast	2.81

These benzene concentrations above 5 ppbV were observed intermittently throughout the measurement period. The highest benzene concentration observed coming from the direction of the pump jack was 15.68 ppbV (Fig. 3). The remaining higher benzene concentrations showed wind directions that suggest the emissions did not come from the direction of the pump jack or the storage tank, indicating a potential alternative source. However, the wind speeds were low at the time of these measurements, ranging from 0.89 to 2.81 mph and considered calm wind to light air. Because the direction of low wind speeds is more uncertain, during periods of calm winds, this could indicate periods where pollution accumulated in the region.

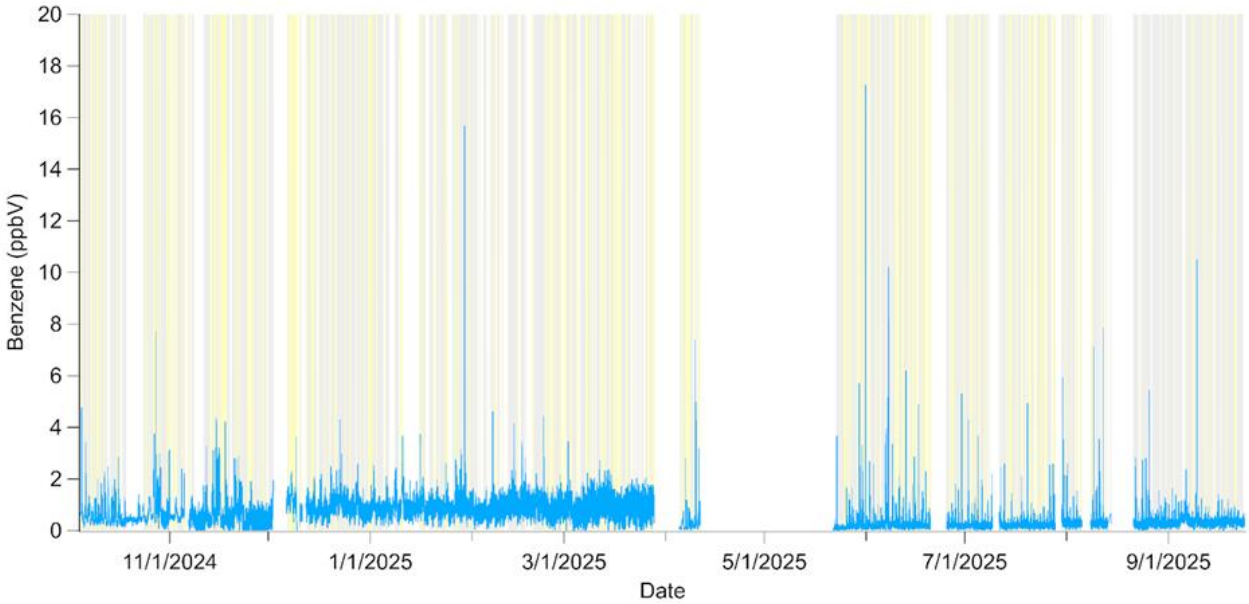

Figure 2: Time series showing 10-minute Pyxis mGC benzene concentrations in ppbV observed throughout the measurement period (October 4, 2024 - September 24, 2025). Grey vertical lines indicate the periods of time when the wind direction was coming from the KPK Martin T. Hard pump jack direction relative to the instrument. Yellow vertical lines indicate periods of time when the wind direction was coming from the KPK Martin T. Hard storage tank relative to the instrument.

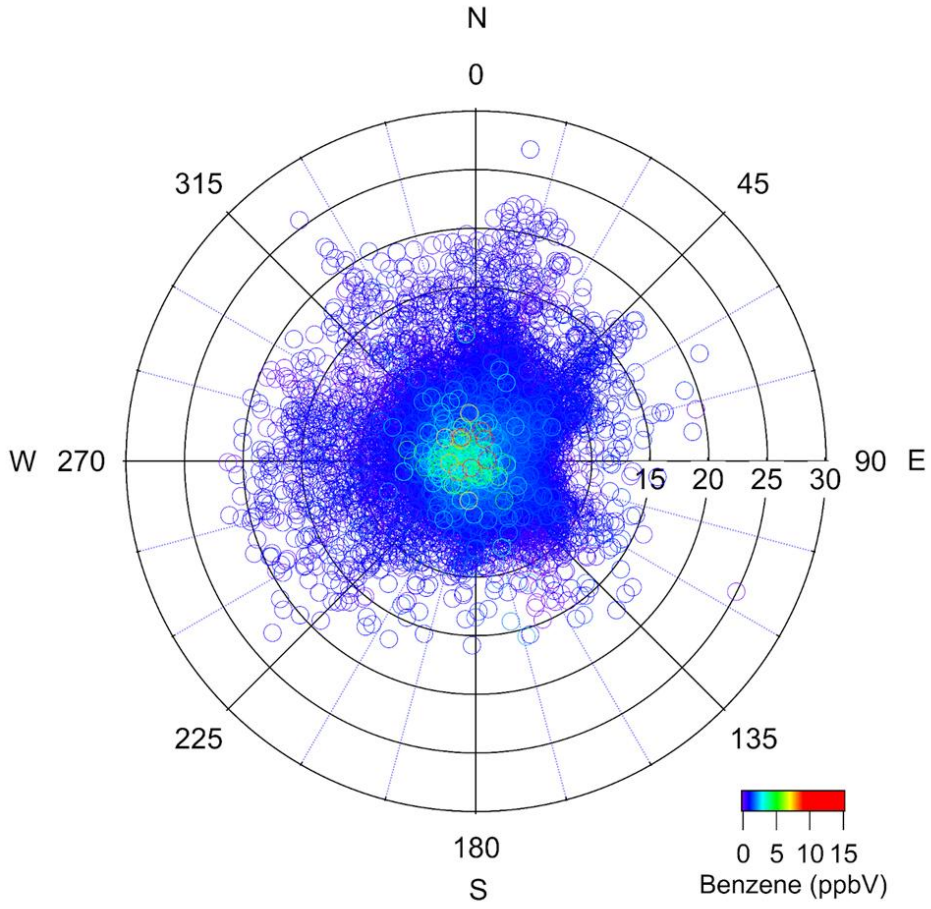

Figure 3: Polar plot showing 10-minute averaged wind speed and wind direction data collected from the AIRMAR weather station. The wind direction is identified by the angle (degrees, where 0 degrees indicates North) and the wind speed is indicated by the radial value (mph). Each marker is colored by the benzene concentration observed from the Pyxis mGC at the time of a given wind speed and direction measurement to demonstrate the potential source winds of the pollution.

5. Summary

CDPHE-APCD-ATOPs began monitoring in the proximity of the KPK Martin T. Hard facility, which includes a pump jack and storage tank in Fort Lupton, CO on October 4, 2024 and concluded September 17, 2025. This deployment was in response to an initial MOOSE deployment, which measured emissions from the KPK Martin T. Hard facility. A stationary asset (Pyxis mGC) was deployed in order to evaluate the air concentrations of benzene that may be harmful to nearby communities.

Measurements from the stationary Pyxis mGC instrument conducted from the KPK facility found deployment average benzene concentrations to be 0.44 ppbV, which is consistent with typical concentrations observed within this region. The maximum 1-hr deployment rolling average concentration of benzene was 5.26 ppbV. Increased benzene concentrations above typical values were observed throughout the sampling period, but were not consistent, indicating intermittent releases and likely related to warmer temperatures.

The highest benzene concentration was recorded at 17.27 ppbV, but the source of the emissions is unclear because the winds were observed to be coming primarily from the northwest and were recorded at a low wind speed of 2.57 mph. Similarly, the maximum benzene concentration observed coming from the direction of the pump jack was recorded at 15.68 ppbV, but also had a low wind speed of 0.89 mph. The direction of low wind speeds is more uncertain and could indicate periods where pollution is accumulated in a given region.

Appendix A

Table A1: Benzene (ppbV) statistics collected by the Pyxis mGC from all measurements collected at the KPK RV Park site from 10/4/24-9/24/25.

	Benzene (ppbV)
Maximum	17.27
Minimum	0.00[a]
Average	0.60
Median	0.49
Standard Deviation	0.48
Number of Observations	40,012

(a) Non-detect

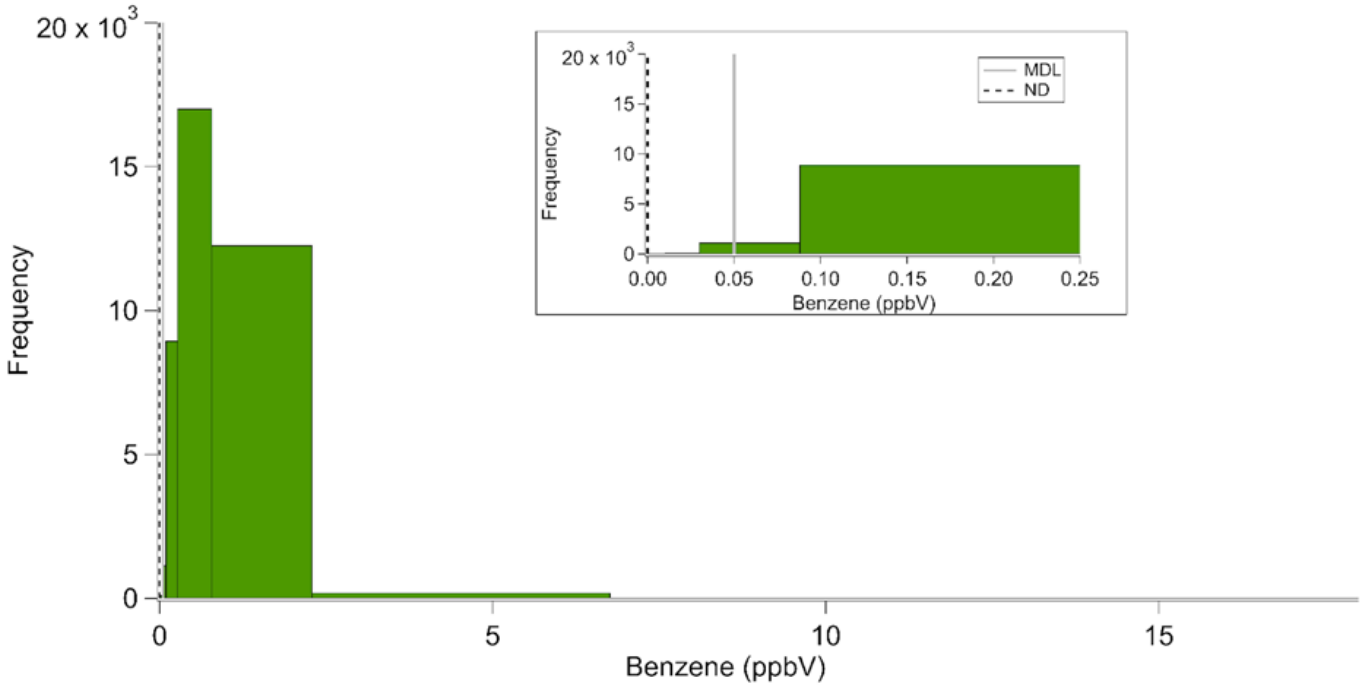

Figure A1: Histogram of benzene (ppbV) observations from the Pyxis mGC from October 4, 2024 to September 17, 2025. Data shows that 0.7% of the total observations are non-detects (ND, black dashed line) and 1.56% are below the detection limit (MDL, grey dotted line).