Air monitoring data summary report

Noble/Chevron Bishop

Air toxics and ozone precursor program [ATOPs]

07.15.2025

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 an incident that occurred at the Noble/Chevron Bishop well pad, near the town of Galeton, CO in Weld County on April 6, 2025.

1.2. Background Information:

- On April 6, 2025 a well control incident occurred at the Noble/Chevron Bishop well pad resulting in an uncontrolled flow of fluids (blowout) until it was capped on April 10, 2025 at 15:30.
- The Unified Incident Command team oversaw the emergency response to this incident, and was composed of the Weld County Office of Emergency Management, Galeton Fire Protection District, and Chevron.
- The Galeton Fire Protection District evacuated the area within 0.5 miles of the incident location on April 6, 2025 and established this as the containment zone.

1.3. Air Monitoring Objective:

- The Air Toxics and Ozone Precursors Program (ATOPs) within the Air Pollution Control Division (APCD) of the CDPHE deployed several air monitoring assets (Table 1) after approval from the Unified Incident Command team.
- Mobile and stationary monitoring was performed in order to evaluate the air concentration of compounds that may be harmful to nearby communities before and after the well was capped.
- This data was intended to provide the Unified Incident Command team with additional information to assist in their decision making processes.
- The stationary monitoring was intended to protect staff and students at the Galeton Elementary School after the incident was contained and staff and students returned to school.

Table 1. Summary table showing air monitoring deployments conducted by CDPHE at the Noble/Chevron Bishop well pad in response to the well blowout incident.

Monitoring Asset	Monitoring Type	Compounds Measured	Deployment Dates	Sampling Duration	Deployment Location
MOOSE[a]	Mobile	Benzene, methane	April 9-11, 18, 21, 2025	1-10 Seconds	<3 miles from well pad

RATTLER[b]	Stationary	Benzene	April 11 - May 22, 2025	10 minutes	Galeton Elementary School
SPOD[c]	Stationary	Total VOCs[d], meteorology	April 11 - May 22, 2025	1 second	Galeton Elementary School

(a) Mobile Oil & Gas Optical Sensor of Emissions
(b) Remote Air Tracking Trailer for Localized Emissions Recording
(c) Sensor Pod
(d) Total VOCs = sum of all volatile organic compounds (VOCs) present that ionize at ≤ 10.6eV

1.4. Key Findings

- MOOSE measurements performed before the well was capped showed a maximum benzene concentration of 9.35 parts per billion by volume (ppbV) over a 1 minute and 24 second sampling period approximately 1.12 miles from the well pad.
- After the well was capped, the maximum benzene concentration observed by the MOOSE at a closer proximity to the site was 1.38 ppbV showing a 90% reduction.
- The RATTLER measurements showed 6.9% of concentrations from the direction of the well pad to have increased concentrations throughout the measurement period, in which the maximum was approximately 38.9% greater than typically observed values.
- The highest benzene concentrations recorded by the RATTLER between April 11 and May 22 were from winds not coming from the direction of the well pad, indicating alternative sources. The highest recorded concentration from the direction of the well pad was 0.16 ppbV.

Table 2. Summary table showing the maximum and average benzene values (ppbV) collected by the MOOSE and RATTLER from the Noble/Chrevon Bishop well pad before (pre) and after (post) the well cap was set. Distance from the well pad is indicated in miles.

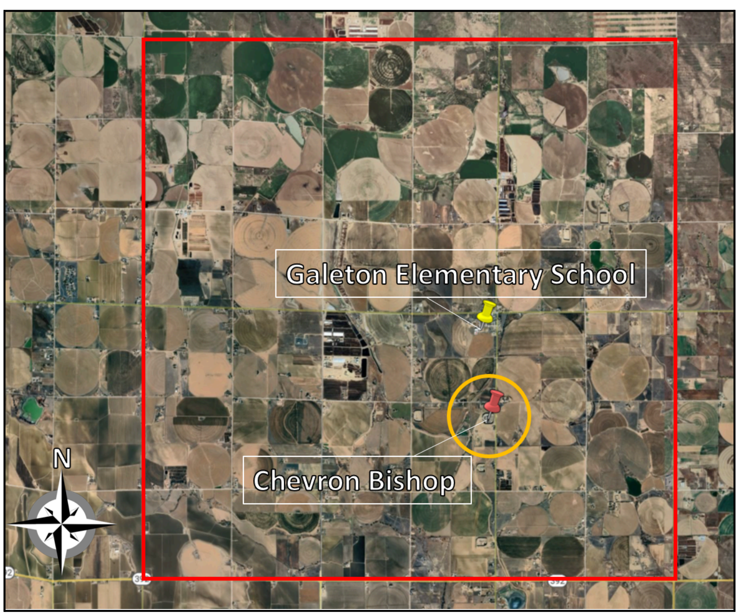
	Pre Cap Maximum (ppbV)	**Pre Cap Average (ppbV)**	**Post Cap Maximum (ppbV)**	**Post Cap Average (ppbV)**	**Distance from site (mi)**
MOOSE	9.35	3.15	1.38	0.31[a]	0.20 - 2.17
RATTLER	–	–	0.16	0.05	1.00

(a) Values below detection limit (Table A3) cannot be validated.

2. Introduction

On the evening of April 6, 2025, the Noble/Chevron Bishop well pad experienced a blowout resulting in a continuous release of contaminated water and gases into the air prompting an emergency evacuation for residents within a 0.5 mile radius. The root cause of the blowout was identified to be due to an improper assembly of the installation equipment for the production tree by the on-site wellhead technician contractor and an inadequate setting of the barrier designed to prevent the flow of liquids[1]. A Unified Incident Command team, composed of the Weld County Office of Emergency Management, Chevron, and the Galeton Fire Protection District, managed the initial response.

After receiving approval from the Unified Incident Command team, CDPHE-APCD-ATOPs began monitoring the area (Fig. 1) on April 9 with the Mobile Optical Oil & gas Sensor of Emissions (MOOSE). The MOOSE mobile laboratory was deployed to evaluate air concentrations of gas compounds that may be harmful (benzene and methane) to nearby communities at multiple locations around the Noble/Chevron Bishop well pad and to provide the Unified Incident Command team with additional information to assist in their decision making process. Methane and benzene, often added to drilling fluid for stabilization, are of particular concern due to their impacts on health. Methane can lead to ozone formation which is known to create respiratory illness and benzene exposure is associated with problems with the central nervous system and respiratory problems.



[1] https://colorado.chevron.com/bishop-well-incident

Figure 1: Aerial view of the Noble/Chevron Bishop well pad (red marker), Galeton Elementary School (yellow marker, 1 mile north of well pad), approximate containment area (orange circle, 0.5 mile around well pad), and the area where mobile measurements were conducted (red square).

During this time, a containment area (Fig. 1) was established which limited access to the site while the well was still releasing liquids and gases into the air. As a result, the MOOSE performed measurements approximately 1-3 miles from the Noble/Chevron Bishop well pad on both days of April 9 and April 10. On April 10, at approximately 3:30 pm MST, the well was contained and fluids were no longer being released from the well. Chevron estimates that the total volume of fluid released was between 20,000 and 30,000 barrels (840,000 - 1,260,000 gallons)[2].

The MOOSE returned for additional measurements following the capping of the well on April 11, 18, and 21. To protect staff and students at the Galeton Elementary School, the Remote Air Tracking Trailer for Localized Emissions Recording (RATTLER) with a Pyxis micro Gas Chromatography (Pyxis mGC) instrument and a Sensit Technologies Sensor Pod (SPOD) were deployed at the school (Fig. 1) for continuous monitoring, approximately 1 mile directly north of the Noble/Chevron Bishop well pad. These instruments allowed for measurements of benzene from the Pyxis mGC and total volatile organic compounds (tVOCs) from the SPOD.

On April 28, Chevron transitioned from an Incident Management Team (IMT) to a Project Management Team (PMT) which is performing ongoing efforts of soil sampling and air monitoring with 5 stationary monitoring stations surrounding the site and the community.

3. Methods

3.1. Mobile Measurements

The MOOSE is a van customized with cutting-edge scientific optical instrumentation to measure near real-time ambient air pollution concentrations while driving. Inside the MOOSE mobile laboratory are two optical instruments that measure compounds using ultraviolet (UV) and infrared (IR) light. These respective instruments are the Mobile extractive Differential Optical Absorption Spectroscopy (MeDOAS) instrument, and the Mobile extractive Fourier Transfer Infra-Red (MeFTIR) instrument. Different air pollutants absorb light better from different wavelengths of the light spectrum (e.g. IR or UV). Therefore, having different instrumentation that uses IR or UV allows us to

[2] https://colorado.chevron.com/bishop-well-incident

accurately measure more compounds potentially present in the air at lower concentrations.

The MOOSE is a powerful monitoring tool and can be used to accomplish different monitoring objectives. For this deployment the monitoring objectives were to:

1. Locate and measure the emission plume influenced by the well incident for benzene and methane in order to evaluate concentrations of compounds that may be harmful to nearby communities.
2. Measure outside of the emission plume influenced by the well incident in order to determine what background concentrations (emissions transported to this area from other sources) are within this area.
3. Measure before and after the well was capped in order to determine when the emissions resulting from the incident have returned to background levels.

To accomplish these measurement objectives three sampling methods were performed:

1. upwind transects - used to determine background levels
2. downwind transects - used to determine levels within the plume
3. downwind dwelling - used to estimate longer exposures of the measured compounds

Transect measurements are performed by driving 10-15 mph while crossing through the emission plume. This also allows for background (typical air concentration) measurements before and after the plume. The plume is identified by the presence of VOCs or by prevailing wind direction and proximity to the site. Each transect measurement occurs for about 10-60 seconds, the amount of time it takes to pass through the plume. Dwelling measurements occur when the MOOSE is stationary and downwind of a suspected source allowing for a longer sampling period. However, due to wind shifts and the distance from the source, dwell periods may have periodic measurements that are at the edge of or outside the plume.

In order to identify when an intersected plume is influenced by a targeted source, accurate measurements of wind direction and speed are necessary. During MOOSE deployments both a weather station mounted on the roof of the van as well as a deployable wind mast are used to help with this identification.

Links to additional technical details and data about the MOOSE can be found on the CDPHE air toxics website.

3.2. Stationary Measurements

Two additional monitoring assets, the Pyxis mGC and SPOD, were deployed on April 11 through May 22 for continuous monitoring in the Galeton Elementary parking lot, located approximately 1 mile to the north of the Noble/Chevron Bishop well pad.

3.2.1. 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 reaching Galeton Elementary School from the Noble/Chevron Bishop well pad.
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 well pad when the winds pass over the incident location and towards the direction of the school. All Pyxis mGC measurements were conducted following the capping of the well.

3.2.2. Sensor Pods

The SPOD is a sensor that measures total VOC concentrations and meteorological parameters on a continuous 1-second time resolution. For simplicity, we identify the output of the SPOD as total VOCs, but please note that this output only represents the concentration of those VOCs present that are ionized at or below 10.6 eV. There may be other VOCs present that are not captured by these measurements. The SPOD operates using a PID similar to the Pyxis mGC. VOCs enter the detector as an air mass moves across the sensor and are bombarded by the high-energy photons. Through the process of ionization, the VOCs absorb the light energy and the molecules break apart into positively and negatively charged ions. The positively charged ions create an electric current which is read by the detector as the signal output. The more VOCs there are, the more ions are created, and consequently, the greater the electric current produced. The strength of the current determines how many VOCs are present in the air.

While this sensor cannot identify specific VOCs within an air mass, it allows for alerts to be sent when the tVOC concentration is larger than a set threshold concentration of 1 ppmV for more than 1-minute in duration. It is above this threshold that health guideline value exceedances are more likely to be observed. The SPOD is powered through the use of a 50W solar panel to offer continuous measurement without interruption and expanding the capability to operate in remote locations.

The SPOD monitoring objectives for this deployment were:

1. Continuously measure tVOC concentrations reaching Galeton Elementary School from the Noble/Chevron Bishop well pad.
2. Send alerts to monitoring personnel if any period of measurement surpasses the tVOC threshold.
3. Provide meteorological parameters, specifically wind speed and direction.

These measurements occurred following the capping of the well. Links to additional technical details and data about the SPOD can be found on the CDPHE air toxics website.

3.3. Data Processing

Data processing was performed for the measurements collected during this monitoring period in order to organize the data into a useful format from the respective transect, dwell, and stationary periods. Two species of interest are provided in this report, benzene and methane. MOOSE measurements are split into three categories: (1) upwind transect for source separation both before (pre cap) and after (post cap) the well was capped, (2) pre cap downwind measurements (includes transect and dwell periods), and (3) post cap downwind measurements (includes transect and dwell periods). Pyxis mGC and SPOD measurements are all post cap. The measurements are split into these categories to limit the contribution of air toxics from additional sources, and to understand the air concentrations before and after repairs were carried out on the well.

3.4. Data Evaluation

All data from measurements performed by the three monitoring devices 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 limits for each compound measured by a given instrument are listed in Table A3. For the purposes of assessing emissions from the Noble/Chevron Bishop well pad, only measurements collected when the wind direction was coming from the direction of the Noble/Chevron Bishop well pad relative to the location of the instrument are included in the following analyses.

3.5. 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.

3.5.1. MOOSE

The MOOSE is equipped with multiple instruments used for measuring specific compounds in the air. QC processes are similar for each instrument and are performed following measurements to ensure the plume was fully captured and appropriate wind conditions were present. However, QA processes are specific to each instrument and must meet the specifications as defined by the manufacturer at the start of measurements to ensure the instruments are functioning properly.

3.5.1.1. MeDOAS

The MeDOAS uses ultraviolet (UV) light to detect various UV absorbing compounds within the instrument sampling chamber. The intensity of the UV light through the chamber is verified to meet the manufacturer recommendations through the use of a calibration lamp with a known intensity. Daily wavelength calibrations are performed to identify the UV absorption spectrum for compounds typically found in background air. The internal temperature is maintained around 30°C to avoid condensation on the mirrors which direct the light source through the sampling chamber. The pressure within the sampling chamber is maintained around 845 Torr to ensure proper flow of the sample through the instrument. To ensure the detector does not overheat during measurements, the detector temperature is maintained around -50°C using liquid nitrogen. Data is processed after sampling and analyzed to confirm validity.

3.5.1.2. MeFTIR

The MeFTIR uses infrared (IR) light to detect various IR absorbing compounds that are collected in the instrument sampling chamber. The intensity of the IR light through the chamber is verified to meet the manufacturers recommendations before monitoring and throughout the deployment. Quarterly checks are performed by the manufacturer to ensure correct identification of a reference compound. The internal temperature is actively maintained at approximately 30°C to avoid condensation on the mirrors which direct the light source through the sampling chamber. The pressure within the sampling chamber is maintained around 845 Torr to ensure proper flow of the sample through the instrument. The detector is cooled throughout monitoring to ensure no overheating occurs of the detector components. Data is processed after sampling and analyzed to confirm validity.

3.5.2. Pyxis mGC

Manual bump checks occur bi-weekly in which a known concentration of benzene gas is flowed to the mGC. After the instrument response is received, a percent error is calculated to ensure that benzene is within 30% of the expected value. 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 mGC on a weekly basis and assessed for validity.

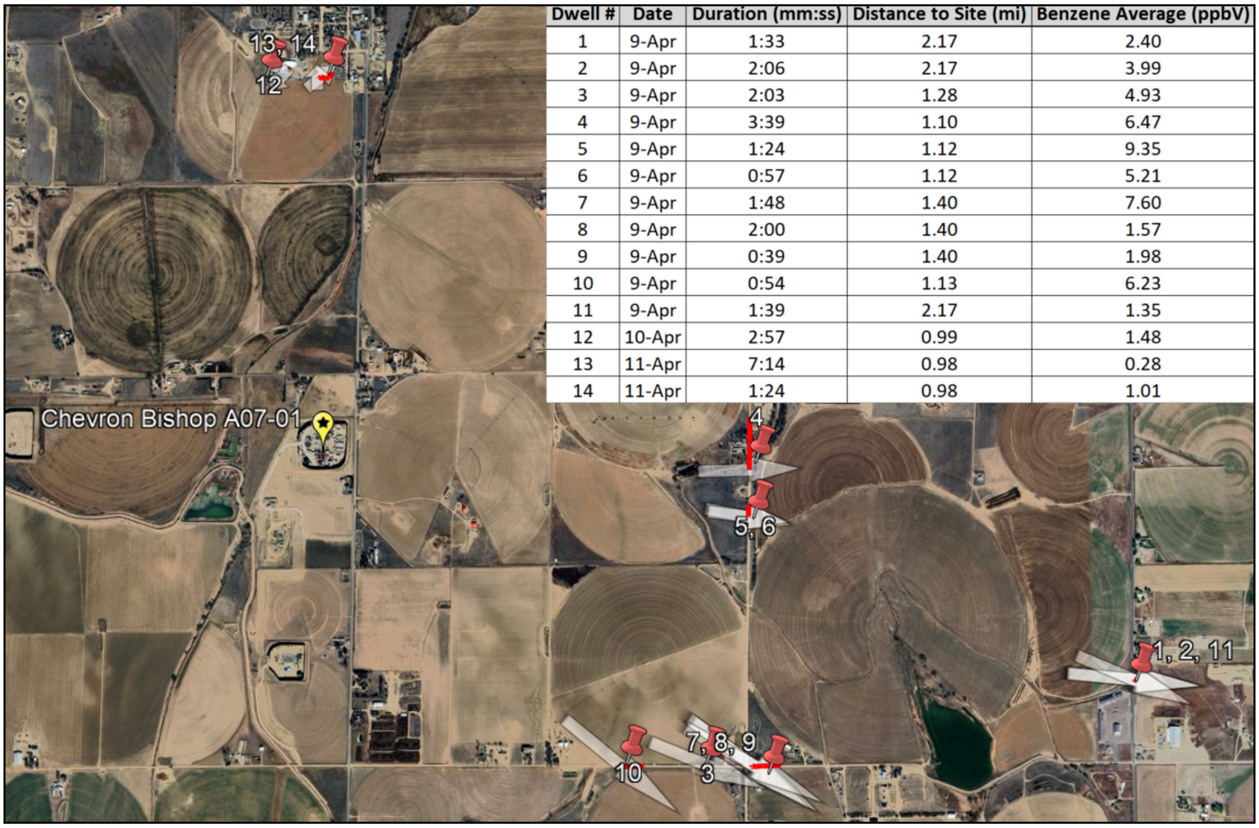
3.5.3. SPOD

Manual bump checks are performed monthly in which a known concentration of isobutylene gas is flowed directly to the PID. A comparison of the instrument response is performed to ensure that the concentration is within 20% of the expected value. If the error is greater than 20%, a full multi-point calibration is performed and any impacted data is flagged accordingly. Data is downloaded from the SPOD on a weekly basis and assessed for validity.

4. Results

4.1 MOOSE

Upwind measurements performed by the MOOSE indicated minimal contributions from additional sources outside of the Noble/Chevron Bishop well pad location. These upwind observations had average transect concentrations of 0.11[3] ppbV benzene and 40.35 ppbV methane (Tables A1-A2) which align with previously recorded background concentrations measured by the MOOSE in this region.



Dwell #	Date	Duration (mm:ss)	Distance to Site (mi)	Benzene Average (ppbV)
1	9-Apr	1:33	2.17	2.40
2	9-Apr	2:06	2.17	3.99
3	9-Apr	2:03	1.28	4.93
4	9-Apr	3:39	1.10	6.47
5	9-Apr	1:24	1.12	9.35
6	9-Apr	0:57	1.12	5.21
7	9-Apr	1:48	1.40	7.60
8	9-Apr	2:00	1.40	1.57
9	9-Apr	0:39	1.40	1.98
10	9-Apr	0:54	1.13	6.23
11	9-Apr	1:39	2.17	1.35
12	10-Apr	2:57	0.99	1.48
13	11-Apr	7:14	0.98	0.28
14	11-Apr	1:24	0.98	1.01

Figure 2: Aerial view of all downwind MOOSE dwell periods with dwell duration (mm:ss), distance to site (mi), and average benzene concentration (ppbV) presented in the top right. Arrow directions indicate the average wind direction during the dwell period and arrow length indicates average wind speed.

Due to the restricted access, the MOOSE was limited to measuring emissions from the Noble/Chevron Bishop well pad at a distance of 1.1 to 2.2 miles from the source on April 9. The average of all the dwell periods before the well was capped resulted in an average benzene concentration of 4.62 ppbV (median = 4.93 ppbV) and methane concentration of 1169.81 ppbV (median = 920.89 ppbV) (Fig. 3). Longer duration dwell periods were attempted on April 10 and 11 at the Galeton Elementary School (0.98 miles from the well pad) before and after the well was capped; however, the wind direction was inconsistent throughout each day which limited the dwell periods to 1-7 minutes. After the well was capped, a benzene value of 1.01 ppbV was observed from

[3] Value is below the respective compound's detection limit (Table A3) and, therefore, cannot be validated.

the direction of the well pad. While visible in Figure 2, the wind direction for dwell numbers 12 and 13 were not from the direction of the Noble/Chevron Bishop well pad and, therefore, are excluded from the statistical analysis used in this report.

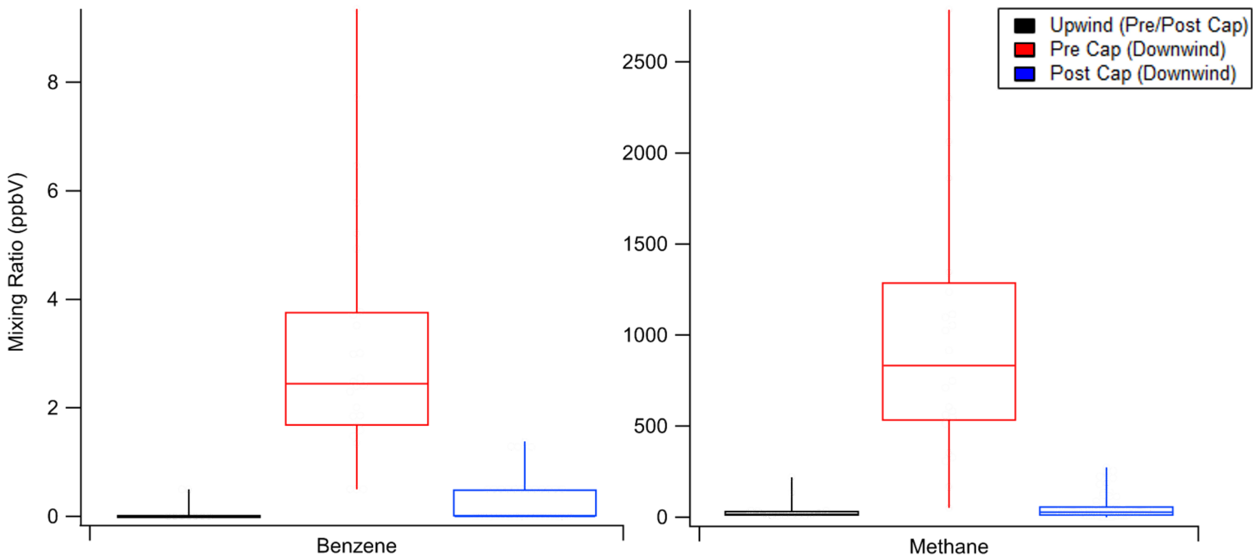


Figure 3: Benzene (left) and methane (right) mixing ratios (ppbV) for upwind (black), pre cap downwind (red), and post cap downwind (blue) measurements from the MOOSE. Upwind measurements include upwind periods from all measurement days while pre cap data comprises measurements from April 9 and 10, and post cap data comprises measurements from April 11, 18, and 21. The boxes represent the upper and lower quartiles of the data with the middle line indicating the median values. The "whiskers" represent the minimum and maximum values observed.

An analysis of the trends observed before and after the well was capped show a significant decrease in emissions following the capping of the well (Fig. 3). Maximum benzene and methane values before the cap was set (April 9 and 10) were 9.35 and 2786.74 ppbV, respectively. Of the 24 - 26 measurement periods conducted over these days, average concentrations for benzene and methane were observed to be 3.15 and 1030.60 ppbV. It is important to note that all of these pre cap downwind measurements were conducted over a mile from the Noble/Chevron Bishop well pad with all downwind transects on April 9 performed in similar locations to the dwell locations #1 - 11 in Figure 2. Data was collected at similar distances on April 10, but to the north near the town of Galeton (Fig. 2).

Maximum downwind values after the cap was set (April 11, 18, and 21) were 1.38 ppbV for benzene and 273.68 ppbV for methane. Of the 36 - 58 downwind measurement periods conducted over these days, average concentrations for benzene and methane were observed to be 0.31[4] and 58.41 ppbV (Fig. 3). The majority of the post cap downwind benzene measurements (89%) yielded values that were either below detection limit or non detects. Overall, these post cap downwind results show a deployment average decrease from the pre cap downwind measurements of 90% for benzene and 94% for methane. Some of the post cap downwind measurements were performed much closer to the site due to distance limits being lifted (56% of benzene measurements and 34% of methane measurements). Those measurements were performed at distances of about 0.1 - 0.2 miles from the Noble/Chevron Bishop well pad, indicating that these percent decreases are likely underestimated since the concentrations were likely higher closer to the site pre cap. Compared to the upwind pre/post cap measurements, these downwind post cap average values indicate an increase of 45% for methane in the days immediately following the well cap. Both upwind and downwind post cap averages for benzene are below detection limit, so direct comparison is not possible.

4.2 Pyxis mGC

Measurements from the Pyxis mGC were conducted along the southern perimeter of Galeton Elementary School. Throughout the post cap measurement period, benzene values remained close to typically observed levels within this region (Fig. 4). The maximum 1-hour rolling benzene average observed between April 11 and May 22 was 0.34 ppbV with a deployment average benzene value of 0.05 ppbV. The averages for this deployment are significantly impacted by the number of measurements that are non-detects or below the detection limit (Fig. A2), but represent our best estimate based on the observations. The maximum 10-minute benzene concentration observed from the direction of the well pad was 0.25 ppbV. Benzene data was removed from April 11 - April 18, 2025, due to the instrument not passing its scheduled bi-weekly calibration. All remaining benzene data is valid. Slightly elevated benzene concentrations were observed from the direction of the Noble/Chevron Bishop well pad throughout the post cap measurement period, but these concentrations were not consistently observed. This indicates that minimal intermittent emissions may have been coming from the well pad during this post cap measurement period. The highest 10-minute concentrations of benzene recorded during the post cap measurement period were 0.78 ppbV and 0.61 ppbV (Fig. 5); however, both of these were measured when the wind was not coming from the direction of the well pad, indicating that the Noble/Chevron Bishop well pad was not the source.

[4] Value is below the respective compound's detection limit (Table A3) and, therefore, cannot be validated.

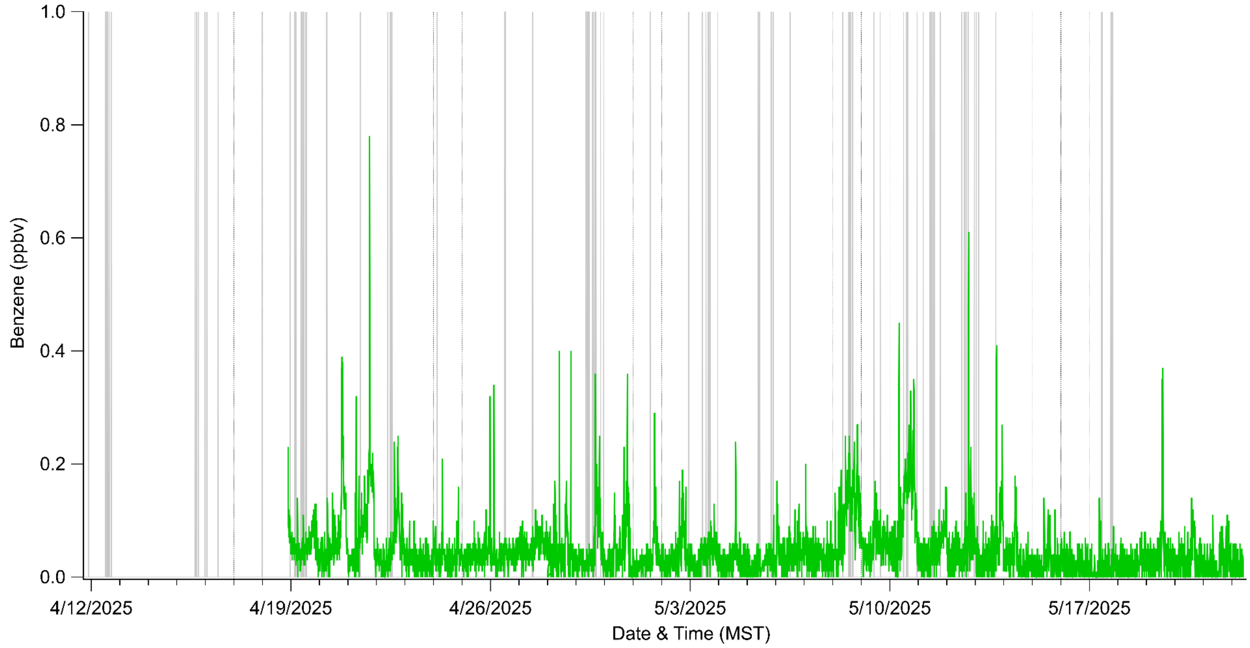


Figure 4: Time series showing 10-minute Pyxis mGC benzene concentrations in ppbV observed throughout the post cap measurement period (April 11 - May 22, 2025). Grey vertical lines indicate the periods of time when the wind direction was coming from the Noble/Chevron Bishop well pad direction relative to the instrument.

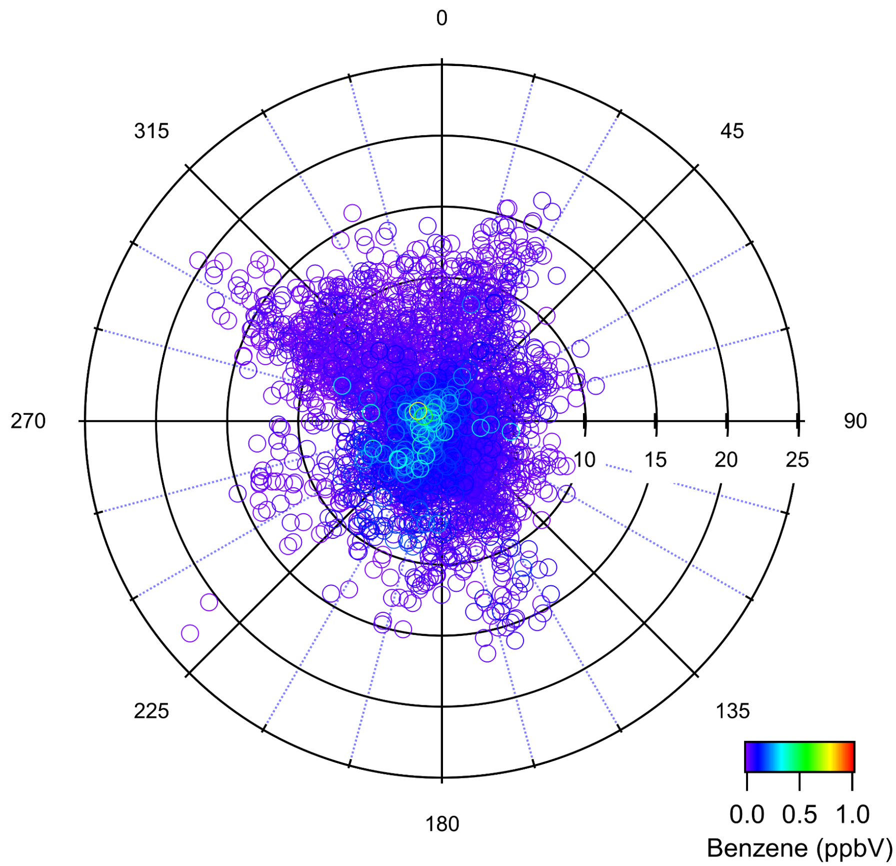


Figure 5: Polar plot showing 10-minute averaged wind speed and wind direction data collected from the SPOD meteorology sensor. The wind direction is identified by the angle (degrees, where 0 degrees indicates North) and the wind speed is indicated by the radial value (mph). Each marker is colored by 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.

4.3 SPOD

SPOD measurements were conducted at the Galeton Elementary School alongside the Pyxis mGC and RATTLER. During this post cap measurement period, a maximum 1-minute tVOC value of 0.17 ppm was observed from the direction of the well pad, resulting in an average value of 0.10 ppm over the post cap measurement period (Fig. 6 and Table 3). Slight tVOC increases were observed from winds coming from the direction of the Noble/Chevron Bishop well pad post cap; however, this increase was not consistently observed. This indicates that minimal intermittent emissions may have been coming from the well pad during this post cap measurement period. The maximum value observed of 0.49 ppm occurred from winds coming from the west, indicating that the Noble/Chevron Bishop well pad was not the source of this plume.

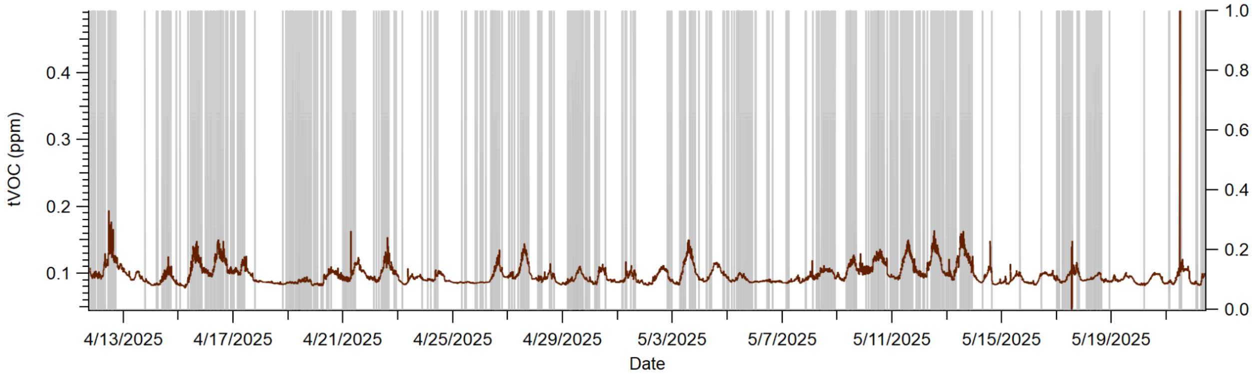


Figure 6: Time series showing SPOD 1-minute tVOC concentrations (ppm) observed throughout the post cap measurement period (April 11 - May 22, 2025). Grey vertical lines indicate the periods of time when the wind direction was coming directly from the Noble/Chevron Bishop well pad relative to the instrument.

5. Summary

CDPHE-APCD-ATOPs began monitoring in the proximity of the Noble/Chevron Bishop well pad near the town of Galeton on April 9, 2025 due to a well blowout. This well was actively emitting fluids from the evening of April 6 to the afternoon of April 10, 2025 when a cap was successfully installed. One mobile asset (MOOSE) and two stationary assets (Pyxis mGC and SPOD) were deployed in order to evaluate the air concentration of compounds that may be harmful to nearby communities before and after the well was capped.

Downwind measurements from the MOOSE before the cap was set showed average concentrations of 3.15 ppbV benzene and 1030.60 ppbV methane. Upwind measurements from the well pad showed lower concentrations of these species and align with previously recorded background concentrations by the MOOSE in this region. Three additional days of measurements from the mobile lab continued after the cap was set. These post cap downwind measurements showed average concentrations of 0.31[5] ppbV benzene and 57.08 ppbV methane. Comparison of these downwind measurements indicate a 90% reduction in benzene and a 94% reduction for methane following the capping of the well.

---

[5] Value is below the respective compound's detection limit (Table A3) and, therefore, cannot be validated.

Measurements from the stationary Pyxis mGC instrument conducted from the Galeton Elementary School found benzene concentrations to remain near typical concentrations observed within this region. The maximum 1-hr rolling average concentration of benzene from April 11 to May 22 was 0.34 ppbV. Slightly elevated benzene concentrations were observed from the direction of the Noble/Chevron Bishop well pad throughout the post cap measurement period, but these elevations were not consistently observed. Measurements from the SPOD were consistent with those seen by the Pyxis mGC with the maximum 1-minute tVOC value during the post cap downwind measurement period being 0.17 ppmV and the resulting average being 0.10 ppmV. Higher values of benzene and tVOC were observed during the post cap measurement period; however, these measurements did not have a wind direction that correlated with the location of the wellpad, indicating an alternative source.

Appendix

Table A1. Benzene (ppbV) statistics collected by the MOOSE from the Noble/Chevron Bishop well pad.

Statistic	Pre/Post Cap Upwind	Pre Cap Downwind	Post Cap Downwind
Minimum	ND[a]	0.50[b]	ND[a]
Maximum	0.50[b]	9.35	1.38
Median	ND[a]	2.45	ND[a]
Average	0.11[b]	3.15	0.31[b]
Standard Deviation	0.21[b]	2.19	0.42[b]
Number of Observations	9	26	36

(a) ND = Non-detect

(b) Values below detection limit (Table A3) cannot be validated.

Table A2. Methane (ppbV) statistics collected by the MOOSE from the Noble/Chevron Bishop well pad.

Statistic	Pre/Post Cap Upwind	Pre Cap Downwind	Post Cap Downwind
Minimum	7.50[b]	52.36	ND[a]
Maximum	219.86	2786.74	273.68

Median	16.26	832.19	28.30
Average	40.35	1030.60	57.08
Standard Deviation	59.14	738.81	72.23
Number of Observations	14	24	57

(a) ND = Non-detect
(b) Values below detection limit (Table A3) cannot be validated.

Table A3. Instrument detection limits by compound.

Compound	Instrument	Detection Limit (ppbV)
Benzene (C_6H_6)	MeDOAS	1
Methane (CH_4)	MeFTIR	15
Benzene (C_6H_6)	Pyxis mGC	0.05
Toluene ($C_6H_5CH_3$)	Pyxis mGC	0.05
tVOC	SPOD	10

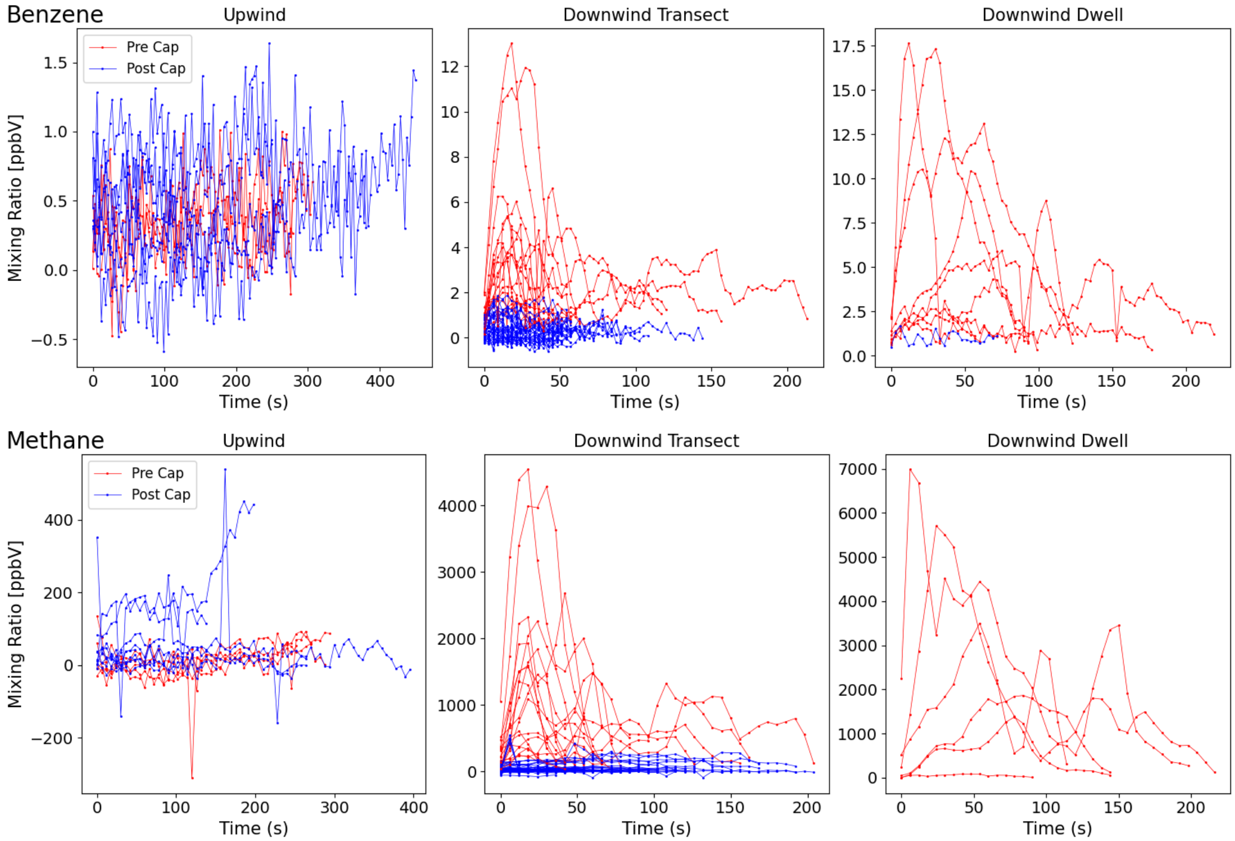


Figure A1. Real-time data for benzene and methane (ppbV) from upwind transects (left), downwind transects (middle), and downwind dwell periods (right). Markers are individual measurements while connecting lines are full plume transects. Pre cap measurements (April 9 and 10) are denoted by the red lines, while post cap measurements (April 11, 18, and 21) are denoted by the blue lines.

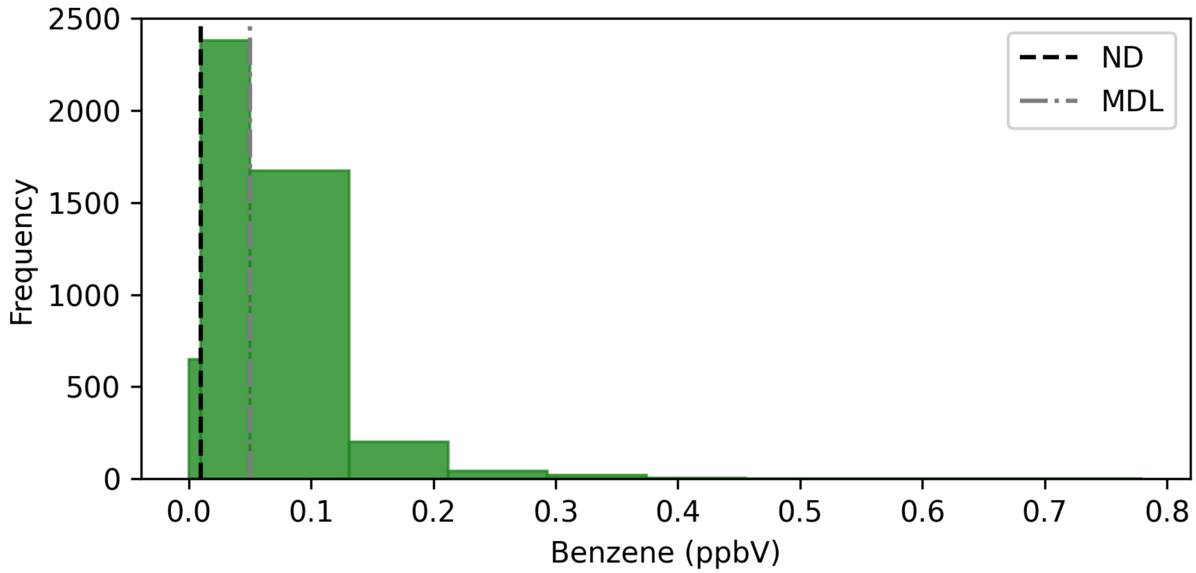


Figure A2. Histogram of benzene (ppbV) observations from the Pyxis mGC from April 11 to May 22, 2025. Data shows that 11.4% of the total observations are non-detects (ND, black dashed line) and 42.9% are below the detection limit (MDL, grey dashed line).