Ambient air monitoring data summary report

Fort Lupton Intersection

Air Toxics and Ozone Precursor Program [ATOPs]

06.09.2026

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 field observations at the Fort Lupton intersection (*40.130846, -104.801122*) and the air data observed by the Colorado Department of Public Health and Environment (CDPHE) from October 30, 2025 to February 15, 2026.

1.2. Background Information

- October 30, 2025-December 10, 2025: Elevated alkane and methane measurements from the incident site (Fig. 1) were first confirmed by the Mobile Optical Oil & gas Sensor of Emissions (MOOSE) and Forward-Looking Infrared (FLIR) imaging (Fig. 2). MOOSE operators were made aware of the proximity of a school bus stop to the location of the emission source.
    - The Public Utilities Commission (PUC) and Colorado Energy and Carbon Management Commission (ECMC) were notified of the issue.
- December 23, 2025: A 6-gas monitor was placed at the outlet of the pipeline which showed an exceedance of the methane lower explosive limit (the upper limit of the monitor's quantifiable range) and a benzene reading over 9 ppmV.
    - PUC and ECMC were updated on the readings.
- January 23, 2026: Two portable stationary assets were deployed to the location.
    - The RATTLER (Remote Air Tracking Trailer for Local Emissions Recording) was deployed approximately 50 feet northwest of the incident site.
    - The EAGLE (Examiner of Atmospheric Gas from Localized Emissions) was deployed next to a residential building approximately 1400 feet to the north of the incident site.
    - A 6-gas monitor reading showed another exceedance of the methane lower explosive limit and a benzene reading of 3.5 ppmV.
        - ECMC and emergency services were notified.
- January 23-27, 2026: Multiple benzene acute health guideline value (HGV) exceedances were observed by the RATTLER closest to the incident site.
- January 27, 2026: The operator performed a consolidation line blowdown.
- February 6, 2026: The EAGLE was replaced with a second RATTLER to minimize electrical costs to the resident.

Figure 1: The MOOSE (Mobile Optical Oil & gas Sensor of Emissions) parked next to the incident site (yellow circle).

Figure 2: Three frames of FLIR footage showing emissions from the severed pipe on October 30, 2025.

1.3. Air Monitoring Objective

The Air Toxics and Ozone Precursor Program (ATOPs) within the Air Pollution Control Division (APCD) of the CDPHE continued mobile monitoring and deployed two portable stationary air monitoring assets in response to these concerns. The two portable stationary assets (the RATTLER and the EAGLE) provided continuous monitoring beginning January 23, 2026. The objective of all deployed assets was to monitor emissions from the incident site and evaluate the amount of those emissions reaching nearby residents.

1.4. Key Findings

- MOOSE monitoring before the consolidation line blowdown showed average plume transect values of 1.2 ppmV for alkanes and 2.9 ppmV for methane approximately 10 feet from the incident site.
- Between January 23-27, 2026, the RATTLER nearest to the incident site observed a maximum 10-minute benzene concentration of 222.4 ppbV and a maximum 1-hour average of 60.5 ppbV with multiple HGV exceedances observed.
- Following the consolidation pipeline blowdown, average benzene concentrations decreased by 87%.
- Benzene and methane concentrations at the residence remained below 2 ppbV and 4 ppmV, respectively, from the direction of the incident site following the consolidation pipeline blowdown.

2. Introduction

On October 30, 2025, during routine monitoring in Weld County, the MOOSE observed elevated alkane and methane measurements approximately half a mile east of Highway 85 on County Road 20 (40.130846, -104.801122). FLIR imaging confirmed the emission source to be a severed pipeline on the northeast side of the intersection, which is adjacent to a school bus stop. Further mobile monitoring confirmed this to be a persistent issue. Through the two months after initial confirmation of the emission source, mobile monitoring continued and stationary assets, the RATTLER and the EAGLE, were deployed next to the emission source and the residential building to the north (Fig. 3).

In early January 2026, Colorado Energy & Carbon Management Commission (ECMC) began investigating upstream energy producing companies operating in the area. Utility locates were called, with none of the respondents claiming ownership of the pipe. Flowline records were reviewed and on January 15, 2026, ECMC contacted KP Kauffman Company (KPK) requesting pressure test data, leak detection, and other surveys for their flowline infrastructure in the area. On January 26, 2026, at ECMC's request, KPK installed a valve on the open end of the orange pipe; monitoring after that valve was installed and closed showed no pressure build up on the pipe, and diffuse emissions were observed in the soils around the pipe. KPK pot-holed in the right of way and identified a 6" consolidation pipeline which carries sales gas after initial processing. On January 27, 2026 at approximately 3:00 PM, the ECMC oversaw a consolidation line blowdown at the Fort Lupton intersection to depressurize and purge the line with an inert gas. Following blowdown, KPK exposed the 6" pipeline at two locations west and east of the orange pipe and sliplined the steel pipe with a high density polyethylene (HDPE) pipe to carry natural gas through the area.

Figure 3: Satellite image of the Fort Lupton intersection showing the incident site (red circle), location of the school bus stop (white star), location of the RATTLER by the pipeline (orange pin), location of the EAGLE by the residence (red pin), location of the RATTLER by the residence (green pin), and excavated oil and gas sites (yellow squares).

3. Methods

3.1. Mobile Measurements

3.1.1. MOOSE

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 three optical instruments that measure compounds using ultraviolet (UV) and infrared (IR) light. 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 accurately measure more compounds potentially present in the air at lower concentrations. These instruments are the Mobile extractive Differential Optical Absorption Spectroscopy (MeDOAS) instrument for measuring benzene concentrations and the Mobile extractive Fourier Transfer Infra-Red (MeFTIR) instrument for measuring total alkane and methane concentrations. The MOOSE also contains an AirMar mobile weather station for real-time observations of wind speeds and directions primarily for source identification.

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

3.2. Stationary Measurements

3.2.1. RATTLER

3.2.1.1. Micro-GC

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.
2. Determine if any period of measurement increases above values typically observed in this region (background levels).

3.2.2. EAGLE

The EAGLE is a customized trailer with cutting-edge scientific instrumentation to measure near real-time air pollution events. The EAGLE is insulated, and temperature-controlled, allowing the scientific instrumentation to run in all weather conditions. It contains a custom calibration system that allows for multi-point and single point calibrations of the scientific instrumentation. All instrumentation and the calibration system can be monitored remotely, allowing the operator to monitor data and respond to outages or issues rapidly.

3.2.2.1. Entanglement AROMA-VOC

The AROMA consists of three main components: traps to collect volatile organic compounds (VOCs) from the air, a thermal separator to separate the sample into individual compounds, and a cavity ringdown spectrometer detector to identify and quantify the concentrations of each compound in air approximately every 10-15 minutes per sample. The cavity ringdown spectrometer measures the absorbance of near infrared (IR) light from each compound, and identifies them based on the time they emerge from the thermal separator and their near IR spectrum (similar to a “fingerprint”). The AROMA-VOC is calibrated for and measures the following VOCs: 1,3-butadiene, 1,2-cisdichloroethylene, isoprene, trichloroethylene, benzene, toluene, ethyl benzene, the sum of xylenes, and styrene.

3.2.2.2. Infrared Absorption Spectroscopy

The Aeris Ultra MIRA CH_4/C_2H_6/H_2O instrument samples air and measures how much mid-infrared light is absorbed by methane (CH_4), ethane (C_2H_6), and water (H_2O) once per second. The instrument is temperature-controlled and pressure-controlled, resulting in little instrument drift. For this report, only methane (CH_4) is reported.

3.2.3. Meteorology

3.2.3.1. Gill Maximet GMX501

The Gill Maximet GMX501 is a sensor that measures meteorological parameters on a continuous 1-second time resolution. It measures wind speed, wind direction, barometric pressure, temperature, relative humidity, and solar radiation. This weather station operates by continuously emitting a series of electronic outputs. Two sets of receiving sensors are arranged orthogonally around a central mast to measure the wind speed and direction based upon the time of flight difference between when the ultrasonic pulses are received. A glass window at the top of the meteorological station measures the light intensity from solar radiation. Barometric pressure, temperature, and relative humidity are obtained through other sensors on the station. This instrument is fixed to a vertical mast approximately 12 feet above ground level to avoid any ground or structural interferences. The Gill Maximet GMX501 was used for meteorological recordings for the RATTLER near the pipeline and the EAGLE.

3.2.3.2. Airmar WeatherStation 110Wx

The AirMar WeatherStation 110Wx is a sensor that allows for ultrasonic measurements of apparent wind speed and direction. The unit is housed on a tripod approximately two feet above the ground. The Airmar WeatherStation 110Wx was used for meteorological recordings for the RATTLER near the residence.

3.3. Data Processing

3.3.1. MOOSE

Data processing was performed for the measurements collected during this monitoring period in order to organize the data into a useful format. Two main measurement practices exist with MOOSE monitoring: plume transects and stationary dwell periods. Plume transects are conducted by slowly driving the mobile lab downwind of the suspected emission source, while stationary dwell periods are conducted by parking the MOOSE, with the engine off, next to the source. The points collected over a respective transect or dwell period are averaged for statistical analysis. Three species of interest are provided in this report: total alkanes, methane, and benzene.

3.3.2. RATTLER

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. Data collected includes benzene concentrations at a 10-minute time resolution. Any invalid data was removed from the dataset. This was identified if the Pyxis mGC did not pass its routine calibrations.

3.3.3. EAGLE

Data collected includes speciated VOC concentrations at a 10 minute time resolution, and methane (CH_4). Background measurements for CH_4 were performed daily, where the Aeris sampled zero air free from CH_4. Background signals were subtracted from the instrument signal, linearly interpolated between background measurements. The CH_4 data was averaged to 1 minute data to reduce instrument noise while still observing trends. Invalidated and calibration data were removed from the dataset. Invalidated was identified as samples that were missing necessary absorbance information from the cavity ringdown spectrometer detector to quantify benzene accurately.

3.3.4. Meteorology

Due to the differences in resolution times between the meteorological instruments and the Micro-GC/AROMA/Aeris Ultra MIRA, the meteorological instruments are vector averaged to match the number of measurements in the respective time range. In the process of vector averaging, the wind measurement (including direction and speed) is broken down into its horizontal and vertical components, which are then averaged separately and calculated into a new vector. The advantage of this method is that it accounts for the dominant wind direction during the respective time period, so slow, stagnant winds do not have an equal influence in the wind direction as higher wind speeds.

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 A1.

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's 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 that 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 manufacturer's recommendations before monitoring and throughout the deployment. Quarterly checks are performed by the manufacturer to ensure the correct identification of a reference compound. The internal temperature is actively maintained at approximately 30°C to avoid condensation on the mirrors that 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 within the detector components. Data is processed after sampling and analyzed to confirm validity.

3.5.2. RATTLER

3.5.2.1. Pyxis Micro GC

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.

3.5.3. EAGLE

3.5.3.1. AROMA-VOC

Quality assurance (QA) processes were performed in the form of multipoint calibrations and regular calibration checks. The deployment was initiated with a 5-point calibration and then followed by calibration checks several times per week to assess instrument response reliability to ensure that it remained within 30% of the expected value for each measured compound. If the calibration check revealed instrument response was outside of 30% of the expected value, a new multipoint calibration was performed.

3.5.3.2. Aeris Ultra MIRA LDS $CH_4/C_2H_6/H_2O$

Quality assurance (QA) processes were performed in the form of multipoint calibrations and regular calibration checks. The deployment was initiated with a 5-point calibration and then followed by calibration checks daily to assess instrument response reliability to ensure that it remained within 10% of the expected value for each measured compound. If the calibration check revealed instrument response was outside of 10% of the expected value, a new multipoint calibration was performed.

3.5.4. Meteorology

Prior to sampling, the Gill Maximet and Airmar WeatherStation 110Wx anemometers were manually oriented due north by referencing a compass to ensure accurate wind direction data throughout the sampling period.

4. Deployment Summary

4.1. MOOSE - Total alkanes, benzene, and methane

Mobile measurements were performed at the Fort Lupton intersection before and after the consolidation line blowdown. These measurements were performed using two methods: transect and dwell measurements (see Section 3.3.1.). Total alkanes and methane were detected at each of these visits, reaching average daily values ranging from 0.1 - 2.4 and 0.2 - 5.3 ppmV (Fig. 4), respectively, during transect measurements before the consolidation line blowdown. The dwell periods, which occurred during time frames of 1 - 60 minutes and at a distance of 10 feet from the incident site, produced similar results to the transect measurements. Benzene remained below the instrument detection limit except for one measurement which reached 1.1 ppbV. Following the consolidation line blowdown, average transect measurements for total alkanes decreased by 58%, and methane decreased by 55%. Statistics for the MOOSE measurements are available in Tables A2 - A5.

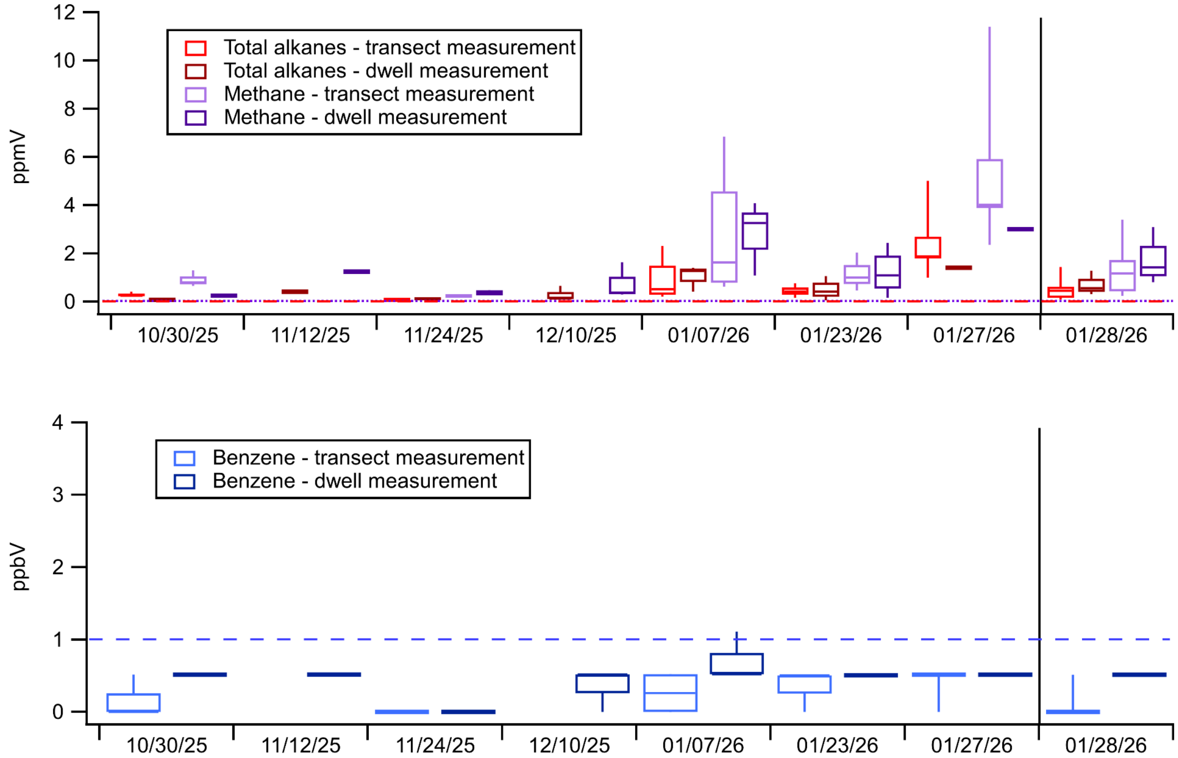

Figure 4: Box plots for all MOOSE deployment days for total alkanes (red), methane (purple), and benzene (blue). The boxes represent the upper and lower quartiles of the data with the middle line indicating the median values, and the whiskers represent the maximum and minimum data values. The lighter and darker box plots represent the transect and dwell measurements, respectively. Units: ppbV. The date of the consolidation line blowdown is indicated by the vertical black line. Detection limits are indicated by the horizontally dashed lines.

4.2. RATTLER with Pyxis mGC - Benzene

4.2.1. Pipeline Location

The results collected from the Pyxis mGC portable stationary monitor occurred from January 23, 2026 to February 15, 2026. Following the consolidation line blowdown on January 27, 2026, the Pyxis observed fewer emissions (Fig. 5).

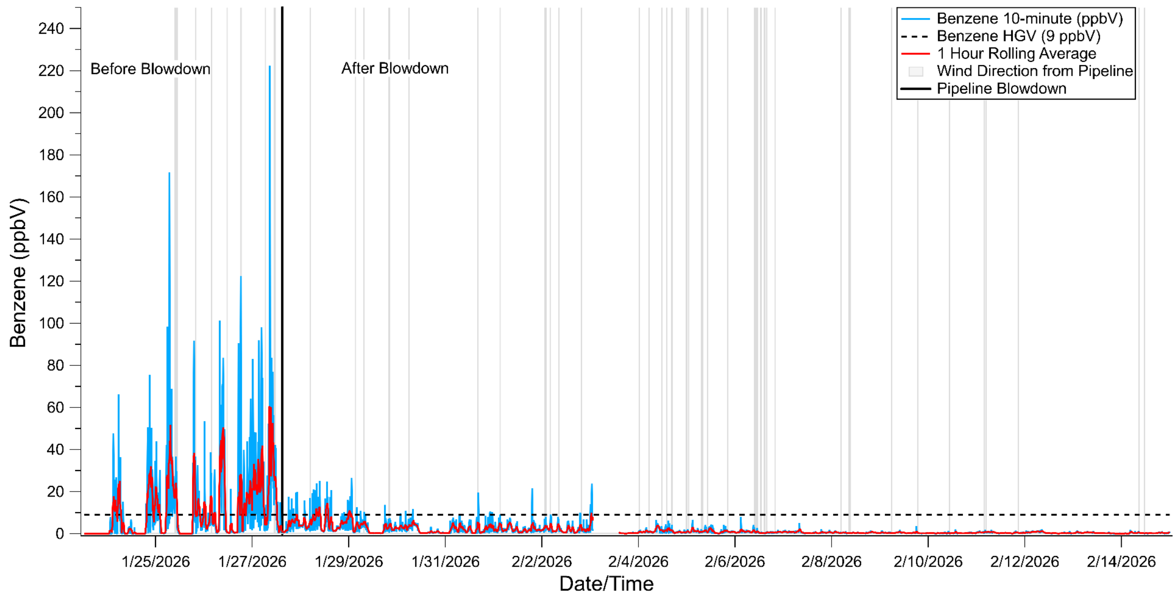

Figure 5: A time series showing the 10-minute benzene measurements (blue line) throughout the measurement period (January 23 - February 15, 2026) at the pipeline location. Two periods, before and after the consolidation line blowdown, are separated and indicated by a vertical black line on January 27, 2026 at 3PM. The health guideline value (HGV) for benzene is 9 ppbV (black dashed line). Any HGV exceedance is dependent upon the benzene 1-hour rolling average (red line) exceeding 9 ppbV. Wind direction coming from the pipeline source is displayed as grey vertical lines.

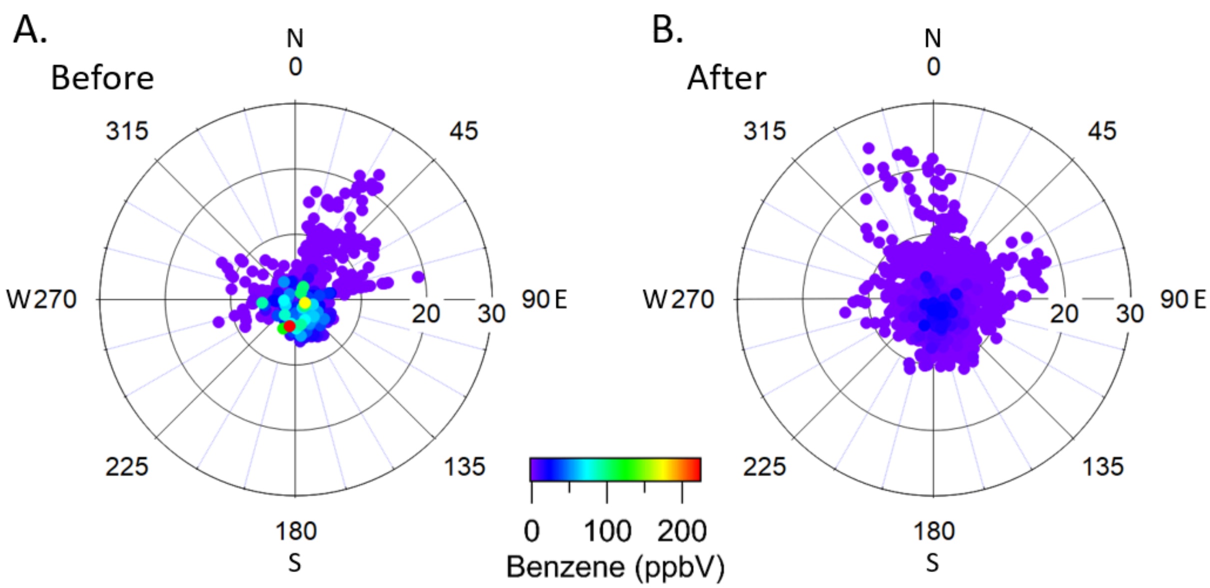

Figure 6: Polar plot showing 10-minute averaged wind speed and wind direction data collected from the Gill Maximet weather station at the pipeline location before (Panel A) and after (Panel

B) the consolidation line blowdown on January 27, 2026 at 3PM. 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.

Initial findings measured by the Pyxis confirmed elevated benzene concentrations from the direction of the incident site (Fig. 6). Measurements conducted between the time of deployment and blowdown of the consolidation line produced an average benzene concentration of 10.7 ppbV and a maximum 10-minute benzene concentration of 222.4 ppbV. Multiple health guideline value (HGV) exceedances occurred between the start of monitoring and the consolidation line blowdown which prompted the relocation of the school bus stop. The measurements after the blowdown of the consolidation line showed an average benzene concentration of 1.37 ppbV which was based on measurements over a longer period of time. Between the two periods, the average benzene concentration decreased by 87%. Statistics for these measurement ranges are available in Table A6.

4.2.2. At Residence

A second RATTLER with Pyxis mGC was deployed to the residence 1400 feet to the north of the incident site and began monitoring on February 8, 2026 (Fig.7) after the consolidation line blowdown. From February 8 - 15, 2026, the Pyxis mGC observed an overall average concentration of 0.18 ppbV with a 10-minute maximum benzene concentration of 2.46 ppbV which occurred from the direction of the incident site.

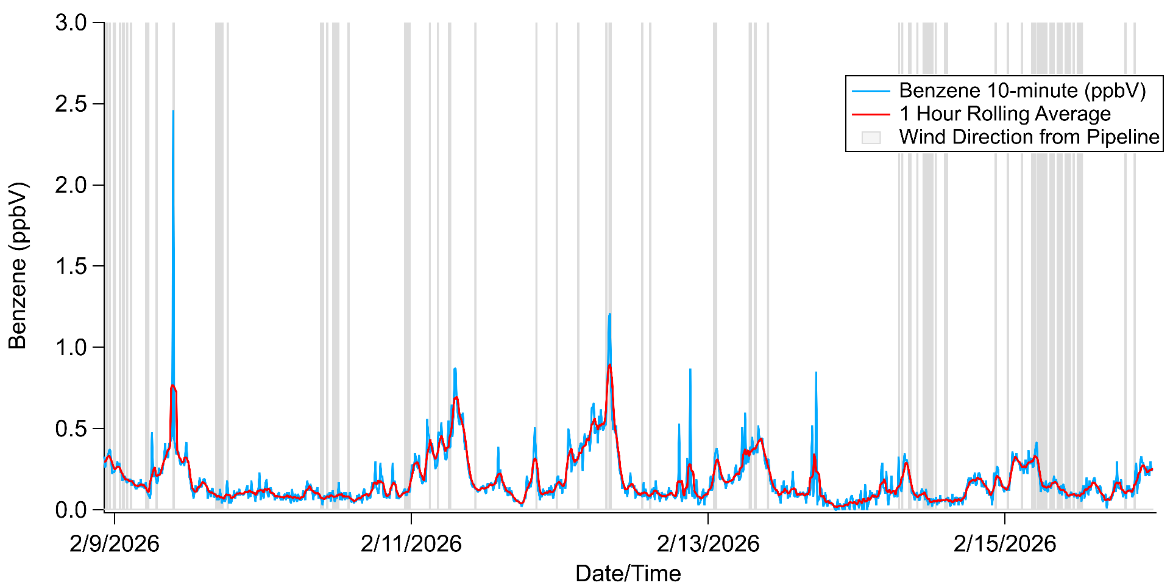

Figure 7: A time series showing the 10-minute benzene measurements (blue line) throughout the measurement period (February 8 - 15, 2026) at the resident location. The red line indicates the 1-hour rolling average. Wind direction coming from the pipeline source is displayed as grey vertical lines.

4.3. EAGLE

The results collected from the EAGLE stationary monitoring platform occurred from January 23, 2026 to February 6, 2026 at the residence to the north of the incident site. The results below for the AROMA-VOC and Aeris MIRA Ultra are separated by instrument, and the results before and after the consolidation line blowdown are compared.

4.3.1. AROMA-VOC - Benzene

The time series of benzene samples collected by the AROMA-VOC in the EAGLE is shown in Figure 8. The average benzene concentration for the deployment was 0.34 ppbV, with a maximum 10-minute concentration of 1.6 ppbV that occurred on January 28, 2026 at 9:33 AM, with winds coming from the southwest (217 degrees) at 1.5 mph. This coincided with a maximum methane concentration of 10.03 ppmV (Section 4.3.2.). This was not from the direction of the Fort Lupton intersection pipeline, but rather from the direction of an oil and gas facility located to the southwest of the residence (Fig. 3). However, the direction of low wind speeds is more uncertain, and could indicate periods where pollution accumulates in a given region. The time series shows that when wind was coming from the direction of the pipeline, benzene concentrations were elevated by roughly 0.5 ppbV relative to baseline. However, the concentrations of benzene remained below acute or chronic health guideline values (HGVs).

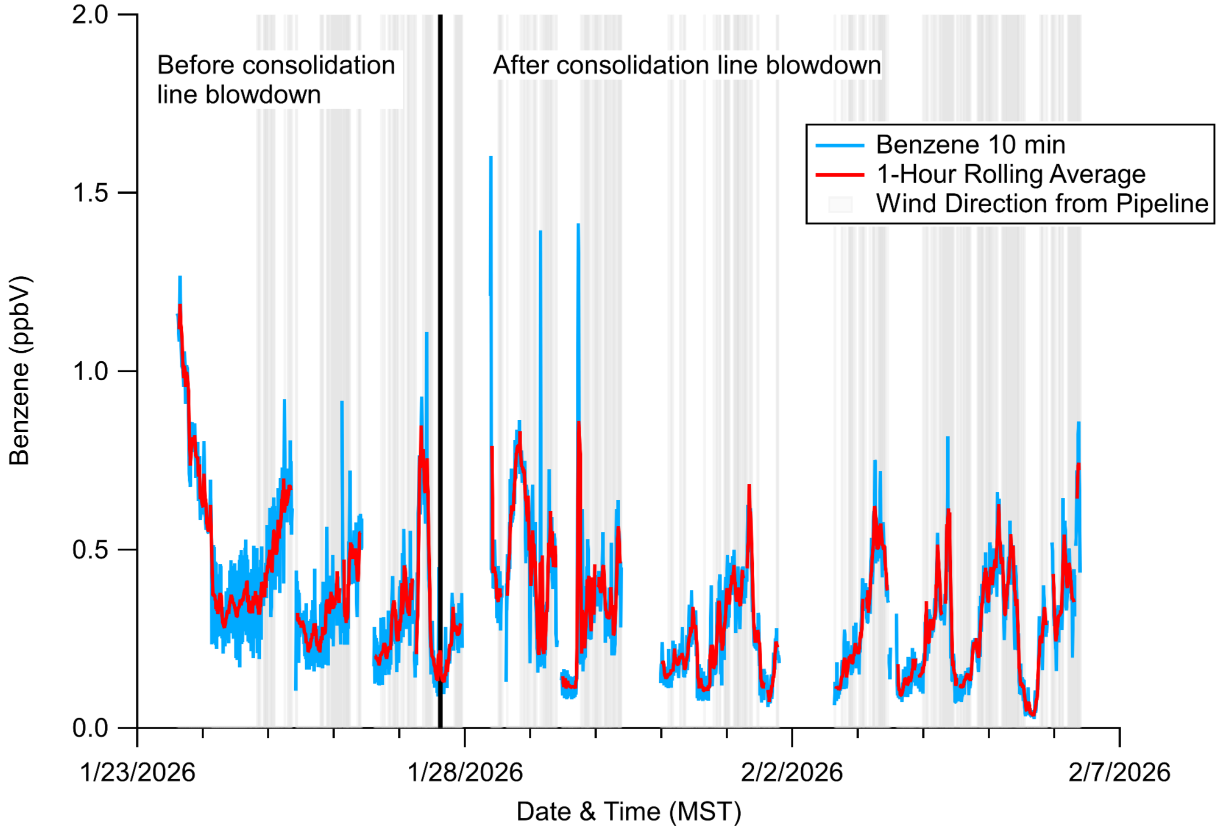

Figure 8: A time series showing the 10-minute benzene measurements (blue line) throughout the measurement period (January 23 to February 6, 2026) at the resident location. The red line indicates the 1-hour rolling average. Wind direction coming from the pipeline source is displayed as grey vertical lines. The black vertical line denotes the time of the consolidation line blowdown, with text on either side showing before and after the consolidation line blowdown.

The statistics for benzene before and after the consolidation line blowdown are shown in Table A7, and Table A8, respectively. The average benzene concentration prior to the consolidation line blowdown was 0.40 ppbV, and 0.31 ppbV after blowdown. However, benzene levels at the residence were not likely to be coming solely from the incident site, as shown by the polar plots in Figure 9. While benzene was clearly elevated from the direction of the pipeline as measured by the Pyxis microGC along the road (Section 4.2.1.), additional sources of benzene at the residence are coming from the north and east of the EAGLE (Fig. 9, panel A and B). The differing concentrations observed at the residence compared to concentrations at the incident site suggests that the benzene coming from the pipeline disperses to a large extent before it reaches the residence, and that it is one, but not the sole source, of benzene levels at the residence.

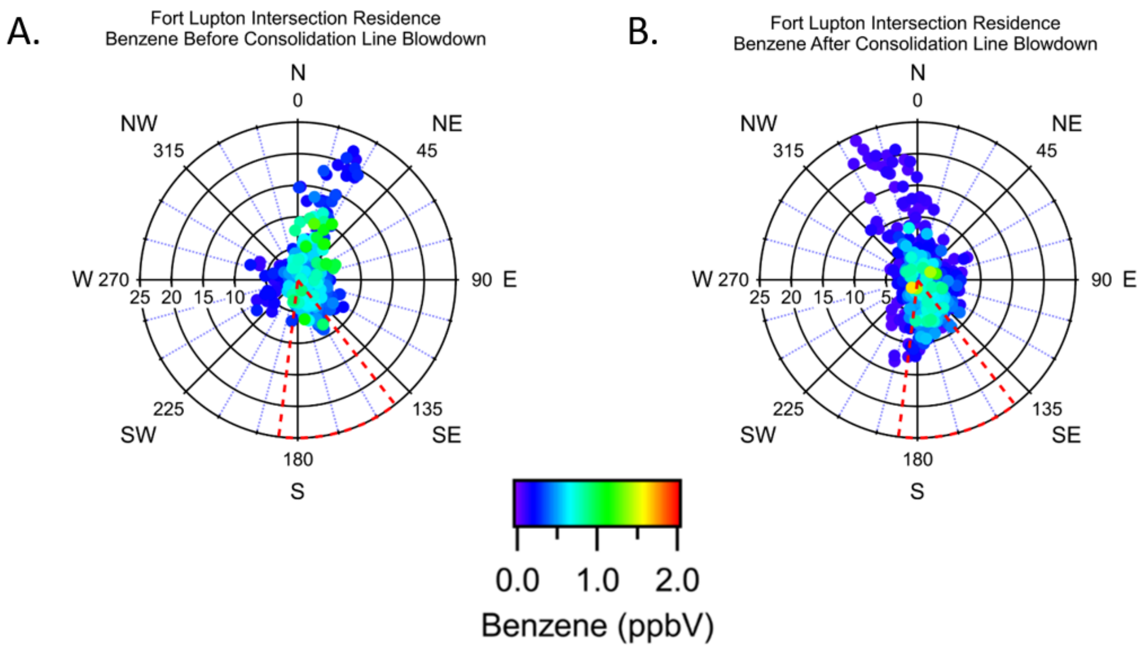

Figure 9: Two panel polar plots showing 10-minute averaged wind speed and wind direction data collected from the meteorological station on the EAGLE (A) at the residence, before the consolidation line blowdown from January 23, 2026 at 2:37 PM to January 27, 2026 at 3:00 PM, and (B) after the consolidation line blowdown from January 27, 2026 at 3:00 PM to February 6, 2026 at 9:50 AM. The wind direction is identified by the angle (degrees, where 0 degrees indicates North) and the wind speed is indicated by the radial value in mph. The wind direction from the Fort Lupton intersection source is within the red dashed line cone between 142 and 188 degrees. Each marker is colored by the benzene concentration observed from the AROMA-VOC at the time of a given wind speed and direction measurement to demonstrate the potential source winds of the pollution.

4.3.2. Aeris MIRA Ultra LDS - Methane

A time series of methane data measured by the Aeris MIRA Ultra is shown in Figure 10. The average methane concentration for the deployment was 2.29 ppmV, with a maximum 1-minute concentration of 10.03 ppmV that occurred on January 28, 2026 at 9:41 AM, with winds coming from the southwest (221 degrees) at 1.8 mph. This produced a maximum rolling 1-hour average of 3.69 ppmV and coincided with a maximum benzene concentration of 1.6 ppbV (Section 4.3.1.) This was not from the direction of the incident location, but rather from the direction of an oil and gas facility located to the southwest of the residence (Fig. 3). However, the direction of low wind speeds is more uncertain, and could indicate periods where pollution accumulates in a given region. Prior to the consolidation line blowdown, methane measurements regularly exceeded maximum background values of 4 ppmV. Following the consolidation line blowdown, very few measurements exceeded 4 ppmV. Rolling 1-hour averages reached similar elevated values before and after the consolidation line blowdown. The reason the average concentration remained similar following the consolidation line blowdown rather than decreasing is due to a larger number of measurements from the incident site direction following the consolidation line blowdown (37%) than prior (23%). The greater number of measurements from the direction of the pipeline allow for more instances of elevated methane, which in turn drives the average value calculated, post consolidation line blowdown, to be higher.

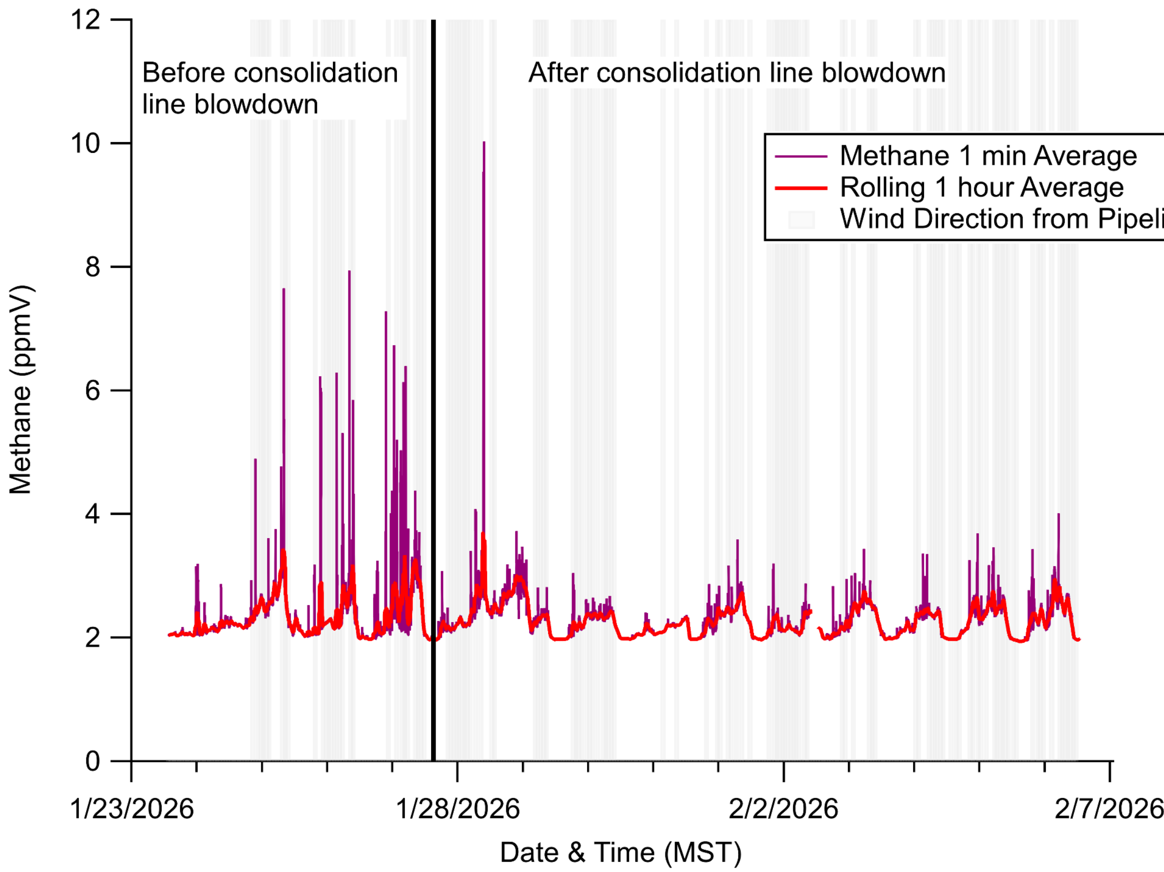

Figure 10: A time series showing the 1-minute averaged methane measurements (purple line) throughout the measurement period (January 23 to February 6, 2026) at the resident location. The red line indicates the 1-hour rolling average. Wind direction coming from the pipeline source is displayed as grey vertical lines. The black vertical line denotes the time of the consolidation line blowdown, with text on either side showing before and after the consolidation line blowdown.

The statistics for methane before and after consolidation line blowdown are shown in Table A7, and Table A8, respectively. The average methane concentration prior to consolidation line blowdown was 2.32 ppmV, and 2.27 ppmV after blowdown. Elevated methane levels were likely coming from the pipeline as indicated by the large number of elevated methane measurements coming from the south to southeast direction (Figure 11). After the blowdown, there were minimal elevated methane measurements from the direction of the pipeline.

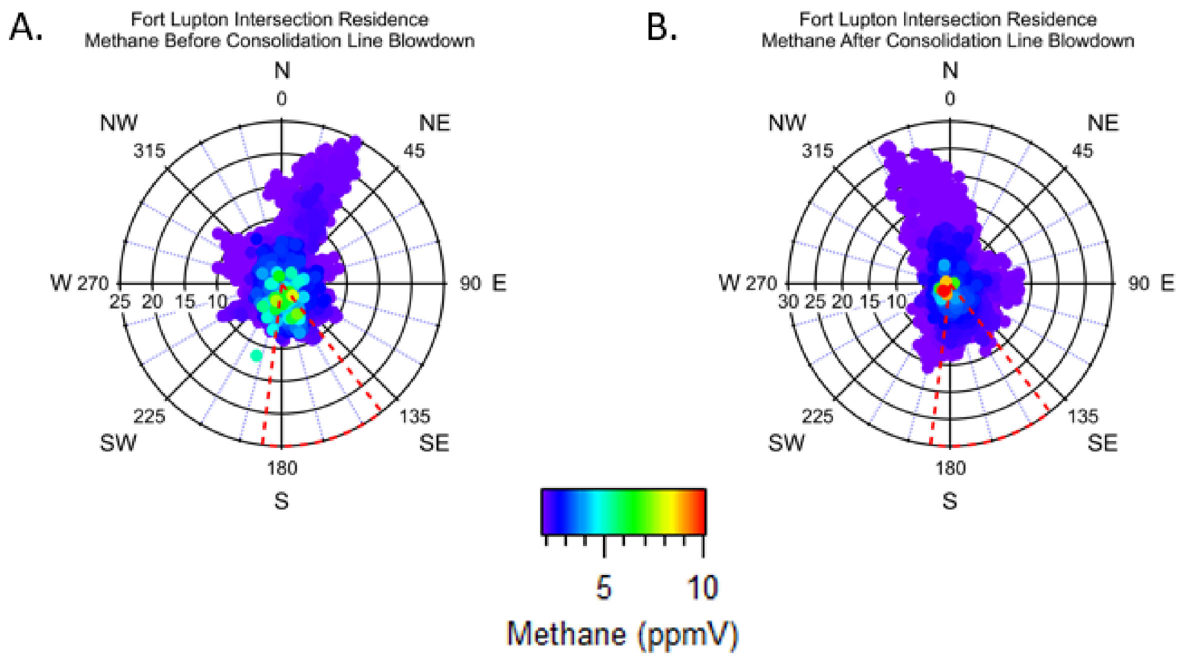

Figure 11: Two panel polar plots showing 1-minute averaged wind speed and wind direction data collected from the meteorological station on the EAGLE (A) before the consolidation line blowdown from January 23, 2026 at 1:59 PM to January 27, 2026 at 3:00 PM, and (B) after the consolidation line blowdown from January 27, 2026 at 3:00 PM to February 6, 2026 at 12:29 PM,. The wind direction is identified by the angle (degrees, where 0 degrees indicates North) and the wind speed is indicated by the radial value in mph. The wind direction from the Fort Lupton intersection source is within the red dashed line cone between 142 and 188 degrees. Each marker is colored by the methane concentration observed from the Aeris MIRA Ultra at the time of a given wind speed and direction measurement to demonstrate the potential source winds of the pollution.

5. Screening-Level Health Risk Assessment

We performed a screening-level health risk assessment to determine whether the measured levels of compounds in the air may pose a potential health risk. It is important to note that there are many compounds that were not measured and assessed in this report. Health risk assessments are a screening tool and cannot predict actual health outcomes. This approach was adapted from EPA and ATSDR screening methods. Please contact ToxCall at cdphe_toxcall@state.co.us or 303-692-2606 if you have any questions.

5.1. Benzene

We evaluated short-term health risk by calculating a hazard quotient (HQ) using the measurements collected before and after the consolidation line blowdown (Tables 1 and 2). To calculate an HQ for benzene, we divided the maximum one-hour average level by the short-term health guideline value. When an HQ is less than 1, short-term health impacts are not expected. When an HQ is greater than 1, further assessment is needed to understand the potential for health impacts. This helps us identify areas and compounds that require further investigation.

Before the consolidation line blowdown, benzene levels at the pipeline were consistently high, and frequently above the short-term health guideline value (Fig. 5). The maximum HQ was 6.53 (Table 1). This does not mean that exposure will cause health impacts, as health guideline values are set far below levels known to impact health. Rather, this helps us identify areas that require further attention. In this instance, the nearby bus stop was relocated to reduce potential exposure and we continued coordinating with regulatory agencies to address the source of emissions.

Benzene levels at the residence were much lower, with a maximum HQ of 0.13. This means that short-term health impacts would not be expected at this level.

Table 1. Short-term hazard quotients (HQ) for benzene before the consolidation line blowdown measured by the RATTLER at the pipeline and the EAGLE at the residence.

Compound	**Monitoring location**	**Maximum one-hour average level (ppb)**	**Short-term health guideline value (ppb)**	**Maximum hazard quotient (HQ)**
Benzene	Pipeline	58.8	9.0	6.53
Benzene	Residence	1.2	9.0	0.13

After the consolidation line blowdown, benzene levels immediately decreased, but were still above background levels. This was due to the presence of liquids from the consolidation line on top of the soil around the pipeline. As the liquid evaporated, benzene levels continued to decrease (Fig. 5).

HQs at both the pipeline and residence decreased in the first week following the blowdown, and decreased further in the second week following the blowdown (Table 2). The only HQ above 1 after the blowdown was in the first week at the pipeline location, with a maximum HQ of 1.62. The HQ in the first week at the residence, as well as HQs in the second week at both locations, indicate that short-term health impacts are not expected.

Table 2. Short-term hazard quotients (HQ) for benzene after the consolidation line blowdown measured by the RATTLER at the pipeline and the EAGLE at the residence the first week and a second RATTLER the second week.

Week Following Blowdown	**Monitoring location**	**Compound**	**Maximum one-hour average level (ppb)**	**Short-term health guideline value (ppb)**	**Maximum hazard quotient (HQ)**
1	Pipeline	Benzene	14.6	9.0	1.62
1	Residence	Benzene	0.86	9.0	0.10
2	Pipeline	Benzene	4.1	9.0	0.46
2	Residence	Benzene	0.77	9.0	0.09

Overall, benzene levels were quite high and posed a potential short-term health concern close to the pipeline. After the operator performed a consolidation line blowdown, levels decreased significantly, gradually returning to expected levels. The MOOSE periodically conducts air monitoring at this location as part of the Leak Detection program, should levels increase in the future.

6. Comparative Analysis

Mobile measurements showed a decrease in the average total alkane and methane concentrations by 58% and 55%, respectively (Tables A2 - A5), following the consolidation line blowdown when measured at a distance of 10 feet from the incident site and only accounting for measurements directly from the source. However, the average benzene concentrations showed variability in the concentration reduction between the two monitoring locations - at the incident site and at the residence. The distance between the two locations results in more dispersion creating lower concentrations at the residence compared to at the incident site. As a result, a smaller percentage decrease (24%) was observed at the residence which is likely caused by the lower initial concentrations combined with the additional sources to the north and east of the residence. Overall, measurements by the RATTLER located 50 feet to the northwest of the incident site showed a significant benzene concentration decrease of 87%.

Appendix A

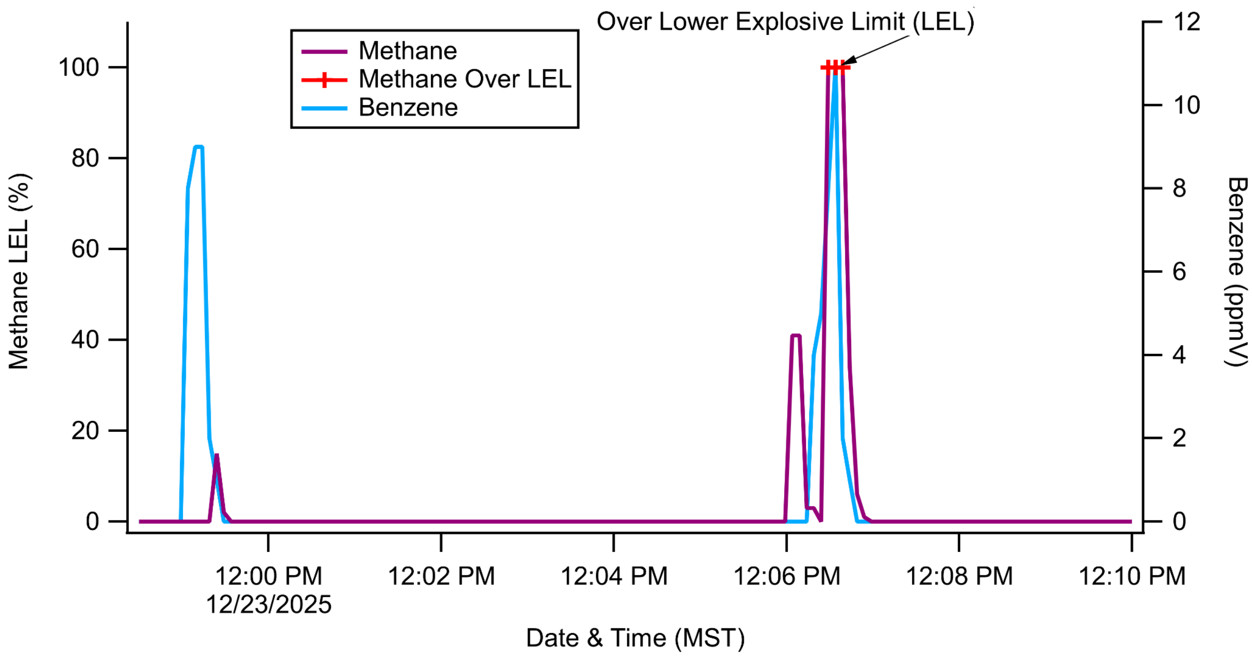

Figure A1: Time series showing 6-gas monitor measurements of methane (CH_4, purple line, in units of percent of lower explosive limit, left axis) and benzene (blue line, in units of ppmV, right axis) around the incident site along County Road 20. The increase in concentration occurred as the 6-gas monitor came into closer proximity to the incident site inlet. Red markers indicate readings exceeding the methane lower explosive limit (LEL) that occurred at the inlet of the incident site.

Table A1: Method detection limits for all species and instruments presented in this report.

Species (Formula)	Detection Limit	Units	Instrument	Asset
Total Alkanes	5	ppbV	MeFTIR	MOOSE
Methane (CH_4)	15	ppbV	MeFTIR	MOOSE
Benzene (C_6H_6)	1	ppbV	MeDOAS	MOOSE
Benzene (C_6H_6)	0.046	ppbV	AROMA-VOC	EAGLE
Methane (CH_4)	0.001	ppmV	Aeris MIRA Ultra	EAGLE
Benzene (C_6H_6)	0.05	ppbV	Pyxis micro GC	RATTLER

Table A2: Statistics of MOOSE transect measurements for total alkanes, methane, and benzene before consolidation line blowdown. Units: ppbV.

	Alkanes (ppmV)	Methane (ppmV)	Benzene (ppbV)
Maximum	5.0	11.4	<MDL**
Minimum	0.1	0.2	ND*
Average	1.2	2.9	<MDL**
Median	0.7	2.0	<MDL**
St.Dev.	1.3	2.9	0.3
Count	19	19	19

*ND = Non-detect

**<MDL = Less than the method detection limit (Table A1)

Table A3: Statistics of MOOSE transect measurements for total alkanes, methane, and benzene after consolidation line blowdown. Units: ppbV.

	Alkanes (ppmV)	Methane (ppmV)	Benzene (ppbV)
Maximum	1.4	3.4	<MDL**
Minimum	0.1	0.2	ND*
Average	0.5	1.3	<MDL**
Median	0.5	1.2	ND*
St.Dev.	0.4	1.0	–
Count	22	22	22

*ND = Non-detect

**<MDL = Less than the method detection limit (Table A1)

Table A4: Statistics of MOOSE dwell measurements for total alkanes, methane, and benzene before consolidation line blowdown ranging from 1-60 minutes in duration. Units: ppbV.

	Alkanes (ppmV)	Methane (ppmV)	Benzene (ppbV)

Maximum	1.4	4.1	1.1
Minimum	0.1	0.2	ND[*]
Average	0.6	1.4	<MDL[**]
Median	0.4	1.1	<MDL[**]
St.Dev.	0.5	1.3	0.3
Count	18	18	18

*ND = Non-detect

**<MDL = Less than the method detection limit (Table A1)

Table A5: Statistics of MOOSE dwell measurements for total alkanes, methane, and benzene after consolidation line blowdown ranging from 1-60 minutes in duration. Units: ppbV.

	Alkanes (ppbV)	Methane (ppbV)	Benzene (ppbV)
Maximum	1.3	3.1	<MDL[**]
Minimum	0.3	0.8	<MDL[**]
Average	0.7	1.7	<MDL[**]
Median	0.6	1.4	<MDL[**]
St.Dev.	0.4	1.0	–
Count	4	4	4

**<MDL = Less than the method detection limit (Table A1)

Table A6: Statistics of the Pyxis mGC 10-minute benzene measurements before and after the consolidation line blowdown at the pipeline and resident locations.

	Benzene (ppbV)	Benzene (ppbV)	Benzene (ppbV)
Location	Pipeline	Pipeline	Resident
Monitoring Period	Before consolidation line blowdown	After consolidation line blowdown	2/8/26 - 2/15/26
Maximum	222.4	26.4	2.46

Minimum	ND*	ND*	ND*
Average	10.7	1.37	0.18
Median	1.55	0.55	0.13
St.Dev.	21.2	2.54	0.16
Number of Observations	587	2709	1034

*ND = non-detect

Table A7: Statistics of the EAGLE benzene, and methane measurements at the residence before consolidation line blowdown. Benzene measurements are 10 minute samples, methane measurements are 1 minute-average samples.

	Benzene (ppbV)	Methane (ppmV)
Maximum	1.27	7.94
Minimum	0.09	1.96
Average	0.40	2.32
Median	0.36	2.18
St.Dev.	0.21	0.46
Number of Observations	465	5736

Table A8: Statistics of the EAGLE benzene, and methane measurements at the residence after consolidation line blowdown. Benzene measurements are 10 minute samples, methane measurements are 1 minute-average samples.

	Benzene (ppbV)	Methane (ppmV)
Maximum	1.60	10.03
Minimum	<MDL*	1.93
Average	0.31	2.27
Median	0.27	2.22

St.Dev.	0.19	0.30
Number of Observations	976	13854

*<MDL = Less than the method detection limit (Table A1)