

Ambient air monitoring data summary report

Platte River Biogas - Mobile Air Toxics Monitoring

Air Toxics and Ozone Precursor Program
[ATOPs]



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1. Executive Summary

1.1. Report Purpose

The purpose of this report is to describe measurements of hydrogen sulfide (H_2S), methane (CH_4), methanethiol (CH_3SH), and benzene (C_6H_6) by the CDPHE APCD Community Air Toxics (CAT) and Emissions Monitoring Utility (EMU) mobile laboratories at or near Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) during five (5) deployments between October 30, 2024 and September 17, 2025.

1.2. Background Information

Platte River Biogas is a facility which converts animal manure into renewable natural gas. Platte River Biogas is owned and operated by BerQ RNG. There have been a number of odor complaints from residents living nearby the facility.

At the request of the CDPHE APCD Compliance Monitoring Unit III Supervisor, the CAT mobile laboratory was deployed to Platte River Biogas on October 30, 2024. The EMU mobile laboratory was subsequently deployed to Platte River Biogas four (4) times: on December 16, 2024; on February 5, 2025; on June 25, 2025; and on September 17, 2025. The CAT & EMU mobile laboratories received permission to enter the Platte River Biogas facility property on October 30, 2024 and June 25, 2025. During the other three (3) deployments, the EMU mobile laboratory measured immediately downwind of the Platte River Biogas facility, but did not enter the facility itself. Both the CAT & EMU mobile laboratories are equipped with ambient air monitoring instrumentation for measuring hydrogen sulfide (H_2S), methane (CH_4), benzene (C_6H_6), methanethiol (CH_3SH), and other air toxics.

From December 18, 2024 until January 16, 2025, the CDPHE APCD Mobile Air Remote Monitoring Trailer (MARMOT) continuously measured hydrogen sulfide, methane, benzene, toluene, ethylbenzene, xylene, and meteorological parameters at a private residence approximately 2000 feet from Platte River Biogas. Data from that deployment are described in greater detail in a separate report.

During these deployments, the measured concentrations of compounds were evaluated according to the Environmental Protection Agency's (EPA) Acute Exposure Level Guidelines (AEGs), which are used by emergency planners and responders worldwide as guidance in dealing with rare, usually accidental, releases of chemicals into the air. AEGs are expressed as specific concentrations of airborne chemicals at which health effects may occur. AEGs are designed to protect the elderly and children, and other individuals who may be susceptible. AEGs are calculated for five relatively short exposure periods – 10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours – as differentiated from air standards based on longer or repeated exposures. AEG "levels" are dictated by the severity of the toxic effects caused by the exposure, with Level 1 being the least and Level 3 being the most severe.

Measurements during these past CAT, EMU, and MARMOT deployments have shown that although 1-hour average hydrogen sulfide concentrations at Platte River Biogas exceed the odor awareness threshold (10 ppbv), they do not exceed the EPA AEG Level 1 value (510 ppbv for a 1-hour average).

1.3. Key Findings

From October 30, 2024 to September 17, 2025, the CAT & EMU mobile laboratories were deployed to Platte River Biogas a total of five times. Generally, the observed ambient hydrogen sulfide (H_2S) concentration increased with temperature and proximity to Platte River Biogas. Conversely, the observed ambient hydrogen sulfide (H_2S) concentration was generally lower at lower temperatures and at greater distances from Platte River Biogas.

The highest observed 1-hour average hydrogen sulfide (H_2S) concentration at Platte River Biogas was 0.287 ppmv on October 30, 2024, while parked immediately next to two open-air pits containing liquid manure. The second-highest observed 1-hour average hydrogen sulfide (H_2S) concentration at Platte River Biogas was 0.266 ppmv on June 25, 2025, also while parked immediately next to two open-air pits containing liquid manure. Both of these values are below the EPA AEGL Level 1 value of 0.510 ppmv for a 1-hour average.

The highest observed two-second hydrogen sulfide (H_2S) concentration at Platte River Biogas was 6.078 ppmv on June 25, 2025. The second-highest observed two-second hydrogen sulfide (H_2S) concentration was 3.170 ppmv on October 30, 2024. Both of these concentrations were measured while parked immediately next to two open-air pits containing liquid manure. Typical ambient background hydrogen sulfide (H_2S) concentrations are below the method detection limit of ~ 0.005 ppmv. The typical odor threshold for hydrogen sulfide (H_2S) is 0.010 ppmv.

Methane (CH_4) concentrations were elevated compared to background concentrations near Platte River Biogas. The highest observed 1-hour average methane (CH_4) concentration at Platte River Biogas was 46.421 ppmv on October 30, 2024. Typical ambient background methane (CH_4) concentrations are ~ 2 ppmv. The EPA does not define AEGL values for methane (CH_4).

Methanethiol (CH_3SH) concentrations were elevated compared to background concentrations near Platte River Biogas. The highest observed 1-hour average methanethiol (CH_3SH) concentration was 14.1 ppbv on June 25, 2025. The EPA does not define AEGL Level 1 values for methanethiol; only AEGL Level 2 values. The EPA AEGL Level 2 value for a 1-hour average is 23,000 ppbv (23 ppmv). Typical ambient background methanethiol concentrations are below the method detection limit of ~ 0.4 ppbv.

Benzene (C_6H_6) does not appear to be directly emitted from Platte River Biogas, except for incidental emissions from the constant traffic of large diesel vehicles while the facility is operational.

2. Introduction

The CAT & EMU mobile laboratories have been deployed at or near Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) five (5) times: on October 30, 2024; on December 16, 2024; on February 5, 2025; on June 25, 2025; and on September 17, 2025. Prior to the CAT & EMU mobile laboratory deployments on October 30, 2024 and June 25, 2025, the APCD received permission from management at BerQ RNG to drive onto Platte River Biogas facility property. The mobile laboratories were operated by two scientists from the CDPHE APCD Air Toxics & Ozone Precursor (ATOPs) program.

3. Methods

3.1. The Community Air Toxics (CAT) Mobile Laboratory

The CAT mobile laboratory is a Mercedes Sprinter van equipped with four instruments for measuring air toxics: a ToFwerk Vocus Eiger Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS), a ToFwerk Vocus B AIM Chemical Ionization Time-of-Flight Mass Spectrometer (CI-ToF-MS), a Picarro Cavity Ringdown Spectroscopy (CRDS) instrument, and a Gill Instruments MaxiMet meteorological station. All four of these instruments were fully operational for the duration of the deployments at Platte River Biogas. The parameters measured by these four instruments are summarized in Table 1.

Table 1. CAT mobile laboratory instrumentation summary.

Instrument	Measured parameters	Time resolution
ToFwerk Vocus Eiger Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS)	Benzene (C ₆ H ₆) Toluene (C ₇ H ₈) Xylene (C ₈ H ₁₀) Methanethiol / Methyl mercaptan (CH ₃ SH) Acetone (C ₃ H ₆ O) Acetonitrile (CH ₃ CN) Acetaldehyde (CH ₃ CHO) Methyl ethyl ketone / Butanone (C ₄ H ₈ O) Hexene (C ₆ H ₁₂) Tetrachloroethylene (C ₂ Cl ₄) Trimethylbenzene (C ₉ H ₁₂)	1 second
ToFwerk Vocus B AIM Chemical Ionization Time-Of-Flight Mass Spectrometer (CI-ToF-MS)	Hydrogen cyanide (HCN) Toluene (C ₇ H ₈)	2 seconds
Picarro Cavity Ring-Down Spectroscopy (CRDS) instrument	Hydrogen sulfide (H ₂ S) Methane (CH ₄) Water vapor (H ₂ O)	4 seconds
Gill Instruments Maximet GMX500	Pressure Temperature Relative humidity Wind speed & direction GPS location, speed, heading	1 second

3.2. The Emissions Monitoring Utility (EMU) Mobile Laboratory

The EMU mobile laboratory is a Mercedes Sprinter van equipped with four instruments for measuring air toxics: a ToFwerk Vocus Eiger Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS), a ToFwerk Vocus B AIM Chemical Ionization Time-of-Flight Mass Spectrometer (CI-ToF-MS), a Picarro Cavity Ringdown Spectroscopy (CRDS) instrument, and a

Gill Instruments MaxiMet meteorological station. All four of these instruments were fully operational for the duration of the deployments at Platte River Biogas. The parameters measured by these four instruments are summarized in Table 2.

Table 2. EMU mobile laboratory instrumentation summary.

Instrument	Measured parameters	Time resolution
Tofwerk Vocus Eiger Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS)	Benzene (C ₆ H ₆) Toluene (C ₇ H ₈) Xylene (C ₈ H ₁₀) Methanethiol / Methyl mercaptan (CH ₃ SH) Acetone (C ₃ H ₆ O) Acetonitrile (CH ₃ CN) Acetaldehyde (CH ₃ CHO) Methyl ethyl ketone / Butanone (C ₄ H ₈ O) Hexene (C ₆ H ₁₂) Tetrachloroethylene (C ₂ Cl ₄) Trimethylbenzene (C ₉ H ₁₂)	1 second
Tofwerk Vocus B AIM Chemical Ionization Time-Of-Flight Mass Spectrometer (CI-ToF-MS)	Hydrogen cyanide (HCN) Toluene (C ₇ H ₈)	2 seconds
Picarro Cavity Ring-Down Spectroscopy (CRDS) instrument	Hydrogen sulfide (H ₂ S) Methane (CH ₄) Water vapor (H ₂ O)	4 seconds
Gill Instruments Maximet GMX500	Pressure Temperature Relative humidity Wind speed & direction GPS location, speed, heading	1 second

3.3. Data Processing

All data analysis was performed using IGOR Pro 9.05 and Google Earth. Instrument background data and calibration data were excluded from the analysis. Statistics were calculated by substituting zero for non-detects and substituting 1/2 the method detection limit (MDL) for measurements below the MDL. For methane, all measurements were assumed to be above the MDL, since the regional background signal is ~2 ppmv. For methanethiol, the benzene MDL was used.

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.

Immediately prior to and hourly throughout each deployment, the CAT & EMU Vocus Eiger PTR-ToF-MS instruments were directly calibrated for benzene, toluene, xylene, methanethiol, acetone, acetonitrile, acetaldehyde, methyl ethyl ketone, hexene, tetrachloroethylene, and trimethylbenzene using compressed gas cylinders containing known concentrations of these compounds. During each calibration, the CAT & EMU Vocus Eiger PTR-ToF-MS instrument background signals were characterized by overflowing the sample inlet with zero air from a zero air generator.

The CAT & EMU Vocus Eiger PTR-ToF-MS, Vocus B CI-ToF-MS, and Picarro CRDS instruments undergo quarterly audits to ensure that they are working as intended, and to quantify the instrument limit of detection for each measured compound using standard EPA methodology. These audits include the introduction of a test gas containing a known concentration of a given air toxic into the instrument sampling line. The audit criteria for percent recovery of the test gas is within +/- 30%. Audit results for the CAT & EMU Vocus Eiger PTR-ToF-MS instruments are shown in Table 3 and Table 4. Audit results for the CAT & EMU Picarro CRDS instruments are shown in Table 5 and Table 6.

Table 3. CAT Vocus Eiger PTR-ToF-MS instrument audit results

Date [yyyy.mm.dd]	2-second method detection limit for benzene	Percent recovery
2024.02.12	0.529 ppbv	105.7% to 117.1%
2024.06.24	Not reported	84% to 98%
2024.09.23	1.04 ppbv	91.59% to 105.98%
2025.03.26	0.343 ppbv	84.44% to 96.89%
2025.06.26	0.3641 ppbv	100.11% to 113.17%
2025.09.22	0.36 ppbv	93.6% to 111.1%

Table 4. EMU Vocus Eiger PTR-ToF-MS instrument audit results

Date [yyyy.mm.dd]	2-second method detection limit for benzene	Percent recovery
2024.02.26	3.15 ppbv	74.6% to 95.5%
2024.05.20	1.23 ppbv	93.0% to 104.8%
2024.09.23	0.67 ppbv	61.4% to 71.2%
2024.12.30	1.46 ppbv	83.92% to 92.58%

Date [yyyy.mm.dd]	2-second method detection limit for benzene	Percent recovery
2025.03.28	0.45 ppbv	66.3% to 104.3%
2025.06.27	0.42 ppbv	97.9% to 113.3%
2025.09.25	0.79 ppbv	81.5% to 117.3%

Table 5. CAT Picarro CRDS instrument audit results

Date [yyyy.mm.dd]	2-second method detection limit for hydrogen sulfide	Percent recovery
2024.02.12	4.885 ppbv	87.3% to 131.9%
2024.06.24	Not reported	83.3% to 88.8%
2024.09.23	5.85 ppbv	78.99% to 90.05%
2025.03.26	5.959 ppbv	79.07% to 81.39%
2025.06.26	8.559 ppbv	83.45% to 85.86%
2025.09.22	8.3 ppbv	71.5% to 93.6%

Table 6. EMU Picarro CRDS instrument audit results

Date [yyyy.mm.dd]	2-second method detection limit for hydrogen sulfide	Percent recovery
2024.02.26	2.37 ppbv	185.4% to 195.0%
2024.05.20	4.07 ppbv	159.4% to 177.5%
2024.09.23	4.79 ppbv	92.1% to 94.1%
2024.12.30	4.08 ppbv	84.1% to 88.2%
2025.03.28	4.032 ppbv	89.18% to 90.61%
2025.06.27	5.9 ppbv	85.3% to 88.5%
2025.09.25	3.19 ppbv	73.5% to 86.2%

4. Deployment Summary

4.1. Overview

From October 30, 2024 to September 17, 2025, the CAT & EMU mobile laboratories were deployed to Platte River Biogas a total of five times. Generally, the observed ambient



hydrogen sulfide (H₂S) concentration increased with temperature and proximity to Platte River Biogas. Conversely, the observed ambient hydrogen sulfide (H₂S) concentration was generally lower at lower temperatures and at greater distances from Platte River Biogas. A summary of these five deployments is provided in Table 7. Each of these deployments is described in greater detail in the following sections.

Table 7. Overview of CAT & EMU mobile laboratory deployments to Platte River Biogas. Minimum concentration values below the method detection limit (MDL) are marked as < MDL.

Date [yyyy.mm.dd]	Asset	Distance from facility	Maximum 2-second H ₂ S	1-hr average H ₂ S	1-hr average air temperature
2024.10.30	CAT	0 ft	3.170 ppmv	0.287 ppmv	44.2°F (6.8°C)
2024.12.16	EMU	4000 ft	0.025 ppmv	<0.006 ppmv	41.9°F (5.5°C)
2025.02.05	EMU	1850 ft	0.071 ppmv	0.024 ppmv	62.6°F (17.0°C)
2025.06.25	EMU	0 ft	6.078 ppmv	0.266 ppmv	71.4°F (21.9°C)
2025.09.17	EMU	1150 ft	0.089 ppmv	<0.006 ppmv	62.1°F (16.7°C)

4.2. CAT mobile laboratory deployment on October 30, 2024

The CDPHE APCD Community Air Toxics (CAT) mobile laboratory was deployed to Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on October 30, 2024 at the request of the CDPHE APCD Compliance Monitoring Unit III Supervisor. Prior to the deployment, the CAT received permission from the Sr. Director of Asset Management at BerQ RNG to drive onto Platte River Biogas facility property. The CAT was operated by two scientists from the CDPHE APCD Air Toxics & Ozone Precursor (ATOPs) program.

The CAT mobile laboratory arrived at Platte River Biogas at approximately 11:19 a.m. MDT. The CAT mobile laboratory continuously measured at Platte River Biogas until approximately 2:52 p.m. MDT. The complete CAT mobile laboratory drive path is shown in Figure 1.

While at Platte River Biogas, the CAT mobile laboratory intermittently but consistently measured elevated concentrations of hydrogen sulfide (H₂S), methanethiol (CH₃SH), methane (CH₄), and benzene (C₆H₆). The observed elevations in H₂S, CH₃SH, and CH₄ were strongly correlated with each other, indicating that the three compounds were likely co-emitted. A time series of the concentrations of these three chemicals, along with air temperature, are provided in Figure 2. A map of the CAT mobile laboratory drive path, color-coded by H₂S concentration, is provided in Figure 3.

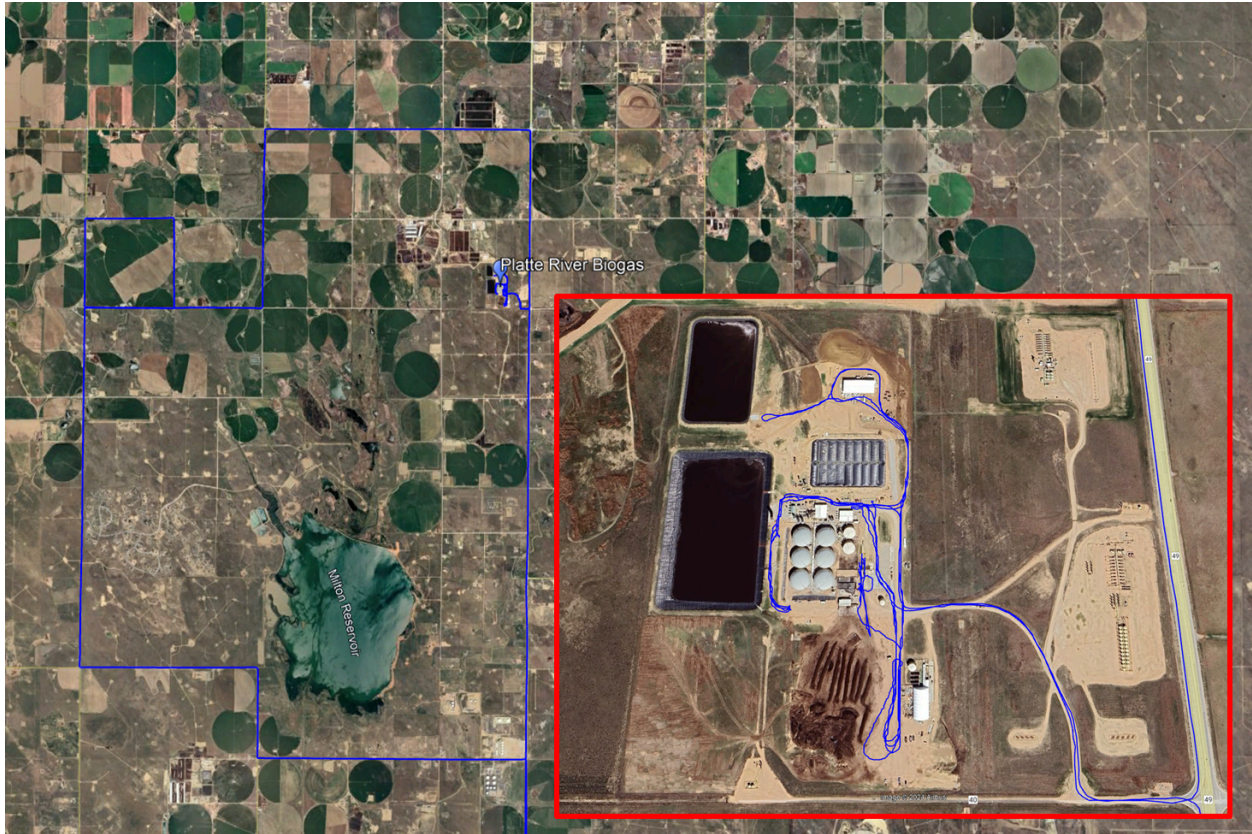


Figure 1. A map of the CAT mobile laboratory drive path for the deployment to Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on October 30, 2024. The CAT mobile laboratory drive path is shown as a blue line. The location of Platte River Biogas is denoted by a blue pin marker. The red inset shows the CAT mobile laboratory drive path inside the Platte River Biogas facility.

The highest concentrations of H_2S were observed while the CAT mobile laboratory was parked immediately next to two open-air pits. The CAT mobile laboratory was parked next to these pits from approximately 1:40 p.m. MDT to 2:30 p.m. MDT. During this time, the observed two-second H_2S concentration regularly reached above 1 ppmv, with the maximum observed concentration being 3 ppmv. Detailed statistics for these measurements are provided in Table 8.

It should be noted that the day of deployment was relatively cold, with air temperatures ranging from 4 to 9°C or 39.2 to 48.2 °F (see Figure 2). It should also be noted that the CAT mobile laboratory operators were informed by the plant manager that the facility was actively ramping down operations in preparation for the winter. For both of these reasons, the conditions during this CAT mobile laboratory deployment may not necessarily reflect standard operating conditions, especially during the summer months.

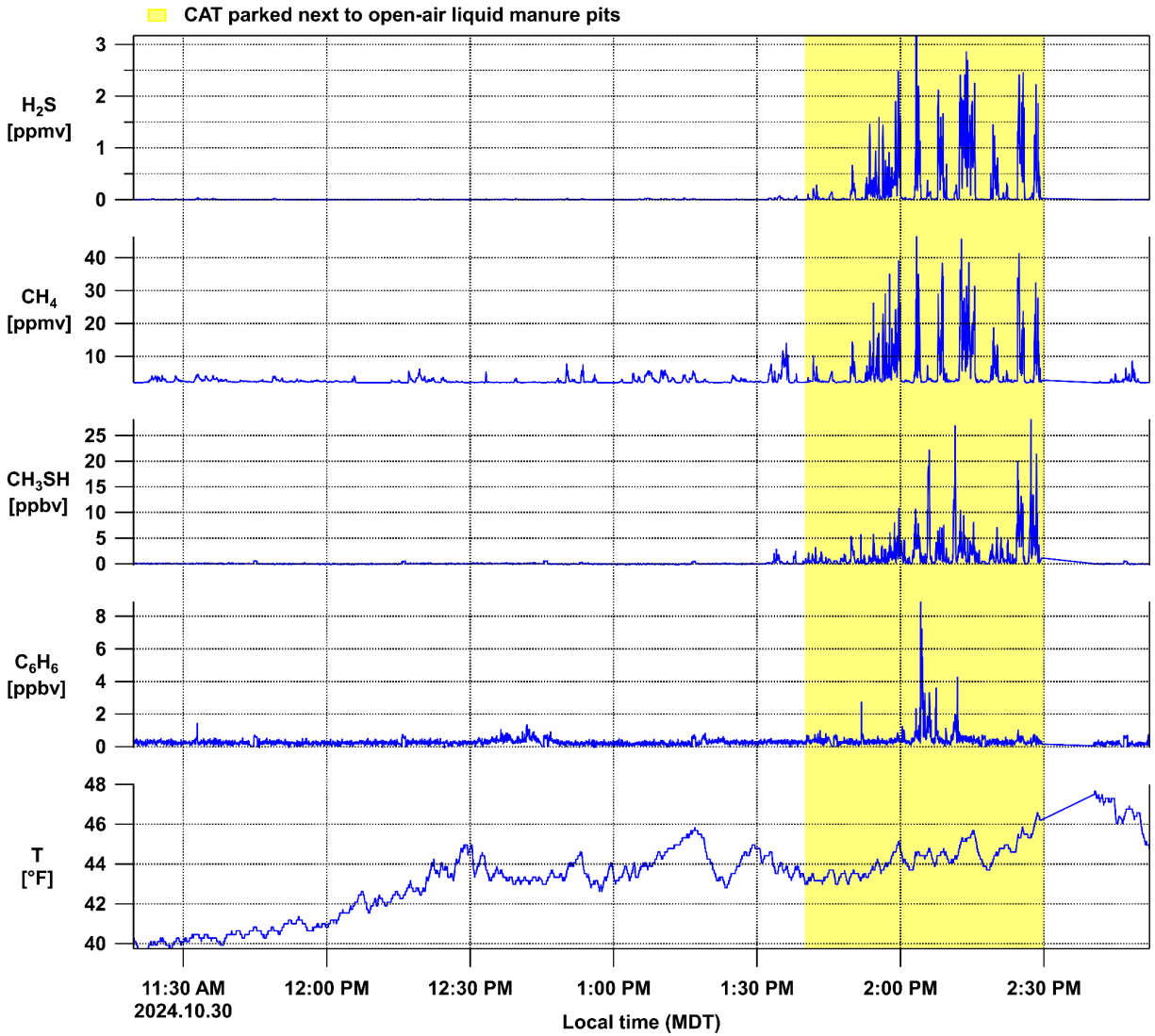


Figure 2. Time series of hydrogen sulfide (H₂S), methane (CH₄), methanethiol (CH₃SH), benzene (C₆H₆), and temperature as measured by the CAT mobile laboratory at Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on October 30, 2024.

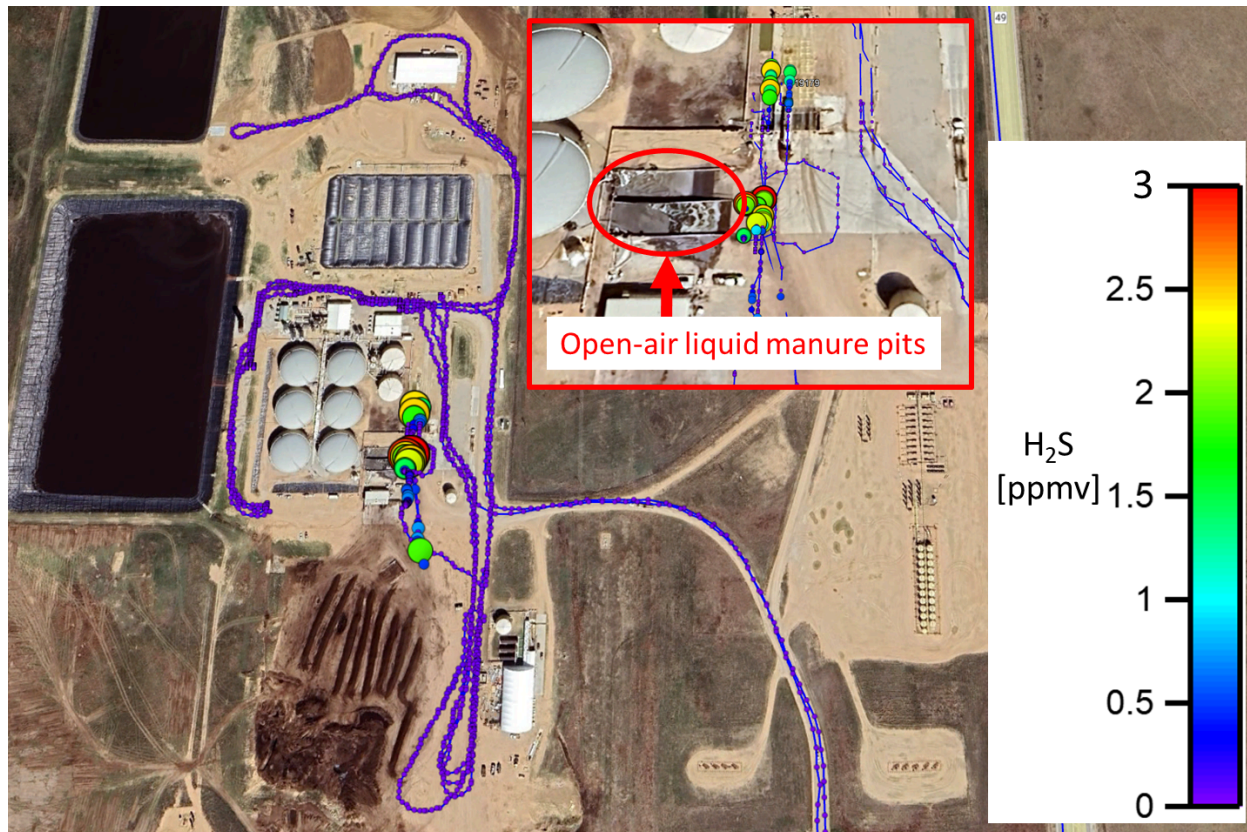


Figure 3. Map of ambient H₂S measurements at Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on October 30, 2024. The circular marker size and color indicates the ambient two-second H₂S concentration. The red inset shows the location of the open-air liquid manure pits where the highest ambient H₂S concentrations were observed.

Table 8. Measurement statistics at Platte River Biogas on October 30, 2024 from 1:40 p.m. MDT to 2:30 p.m. MDT, while the CAT mobile laboratory was parked next to the open-air liquid manure pits. Minimum concentration values below the method detection limit (MDL) are marked as < MDL.

Parameter	Average	Standard deviation	Minimum	Maximum
H ₂ S	0.287 ppmv	0.534 ppmv	< 0.006 ppmv	3.170 ppmv
CH ₄	6.162 ppmv	7.452 ppmv	2.041 ppmv	46.421 ppmv
CH ₃ SH	2.0 ppbv	3.3 ppbv	< 0.3 ppbv	28.2 ppbv
C ₆ H ₆	0.5 ppbv	0.6 ppbv	< 0.3 ppbv	8.9 ppbv
Air temperature	44.2°F (6.8°C)	32.7°F (0.4°C)	43.0°F (6.1°C)	46.6°F (8.1°C)

4.3. EMU mobile laboratory deployment on December 16, 2024

The CDPHE APCD Emissions Monitoring Utility (EMU) mobile laboratory was deployed to the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on December 16, 2024. Prior to this deployment, the EMU mobile laboratory did not receive permission to drive onto the Platte River Biogas facility property. The EMU mobile laboratory was operated by two scientists from the CDPHE APCD Air Toxics & Ozone Precursor (ATOPs) program.

The EMU mobile laboratory arrived in the area surrounding Platte River Biogas at approximately 11:10 a.m. MST. The EMU mobile laboratory drove in the area surrounding Platte River Biogas until approximately 11:43 p.m. MST. From 11:43 p.m. until 12:43 p.m. MST, the EMU mobile laboratory parked at a location approximately 4,000 feet downwind of Platte River Biogas. From 12:43 p.m. until 1:34 p.m. MST, the EMU mobile laboratory continued to drive in the area surrounding Platte River Biogas. The complete EMU mobile laboratory drive path around Platte River Biogas is shown in Figure 4.

While parked 4,000 feet downwind of Platte River Biogas, the EMU mobile laboratory intermittently but consistently measured elevated concentrations of hydrogen sulfide (H_2S) and methane (CH_4). While parked, the measured concentrations of methanethiol (CH_3SH) and benzene (C_6H_6) were almost entirely below the instrument detection limits of 0.2 ppbv and 0.3 ppbv for methanethiol and benzene, respectively. A time series of the concentrations of these four compounds, along with the air temperature, wind direction, and wind speed, is provided in Figure 5. A map of the EMU mobile laboratory drive path, color-coded by H_2S concentration, is provided in Figure 6. Detailed measurement statistics for the time period when the EMU was parked are provided in Table 9.

It should be noted that the day of the EMU mobile laboratory deployment was relatively cold, with air temperatures ranging from 3.3 to 7.7°C or 37.9 to 45.9°F (Figure 5). Also, the Platte River Biogas facility may have ramped down operations for winter. Therefore, the conditions during the EMU mobile laboratory deployment may not necessarily reflect standard operating conditions, especially during the summer months.

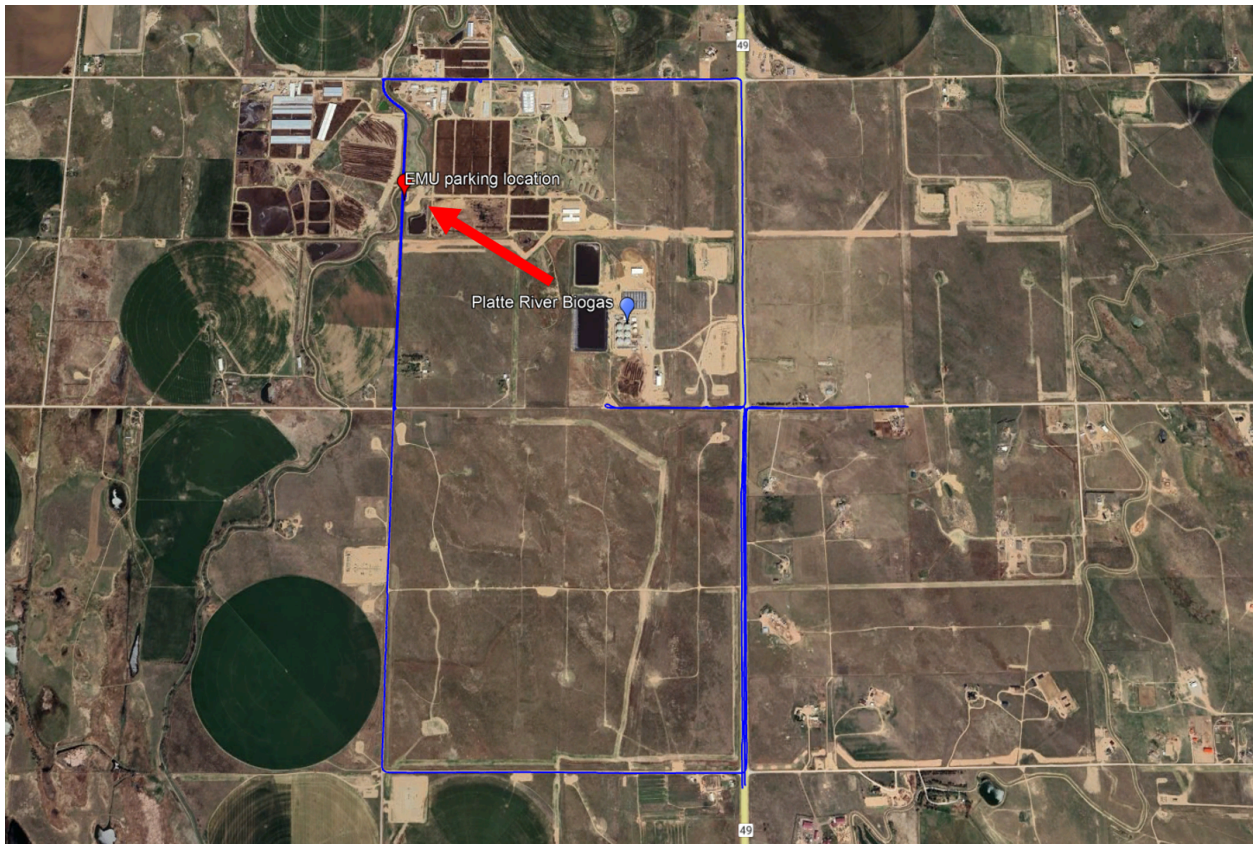


Figure 4. A map of the EMU mobile laboratory drive path for the deployment to the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on December 16, 2024. The EMU mobile laboratory drive path is shown as a blue line. The location of Platte River Biogas is shown as a blue marker (40.279°N, 104.608°W). The location where the EMU mobile laboratory was parked from 11:43 a.m. to 12:43 p.m. MST is shown as a red marker (40.285°N, 104.621°W). The red arrow indicates the average wind direction.

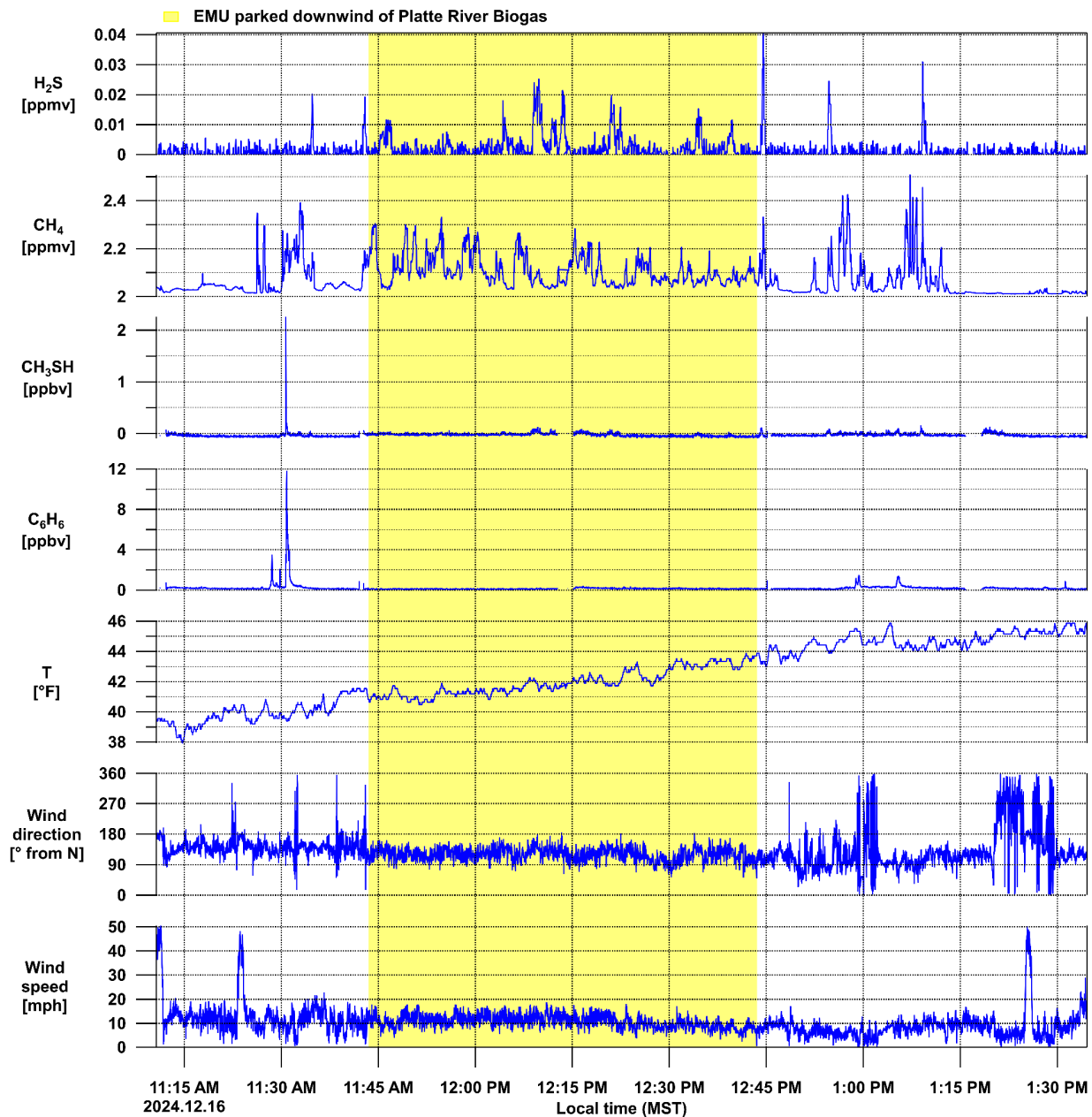


Figure 5. Time series of hydrogen sulfide (H₂S), methane (CH₄), methanethiol (CH₃SH), benzene (C₆H₆), temperature, wind direction, and wind speed as measured by the EMU mobile laboratory in the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on December 16, 2024. The wind direction is shown as degrees clockwise from north (0° = from north; 90° = from east; 180° = from south). The yellow shading indicates the time period when the EMU was parked 0.75 miles downwind of Platte River Biogas.

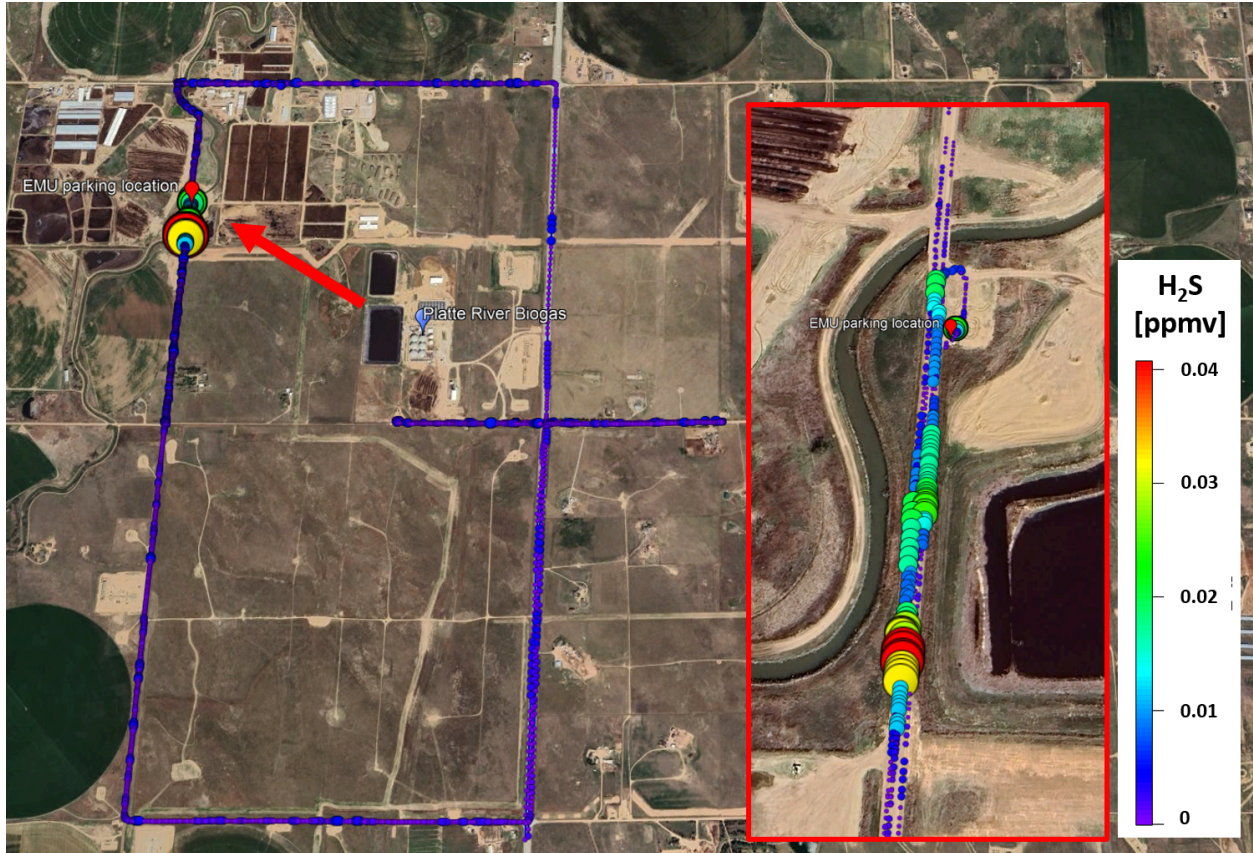


Figure 6. Map of ambient H₂S measurements in the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on December 16, 2024. The circular marker size and color indicates the ambient two-second H₂S concentration. The red arrow indicates the average wind direction. The red inset shows the area downwind of Platte River Biogas where the highest ambient H₂S concentrations were observed.

Table 9. Measurement statistics for the time period when the EMU mobile laboratory was parked downwind of Platte River Biogas (11:43 a.m. to 12:43 p.m. MST) on December 16, 2024. Minimum concentration values below the method detection limit (MDL) are marked as < MDL.

Parameter	Average	Standard deviation	Minimum	Maximum
H ₂ S	< 0.006 ppmv	< 0.006 ppmv	< 0.006 ppmv	0.025 ppmv
CH ₄	2.107 ppmv	0.063 ppmv	2.028 ppmv	2.331 ppmv
CH ₃ SH	< 0.4 ppbv	< 0.4 ppbv	< 0.4 ppbv	< 0.4 ppbv
C ₆ H ₆	< 0.4 ppbv	< 0.4 ppbv	< 0.4 ppbv	0.4 ppbv
Air temperature	41.9°F (5.5°C)	32.9°F (0.5°C)	40.5°F (4.7°C)	43.9°F (6.6°C)
Wind direction clockwise from N	120.6°	18.9°	52°	185°
Wind speed	11.0 mph	2.7 mph	2.2 mph	18.8 mph

4.4. EMU mobile laboratory deployment on February 5, 2025

The CDPHE APCD Emissions Monitoring Utility (EMU) mobile laboratory was deployed to the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on February 5, 2025. Prior to this deployment, the EMU mobile laboratory did not receive permission to drive onto the Platte River Biogas facility property. The EMU mobile laboratory was operated by two scientists from the CDPHE APCD Air Toxics & Ozone Precursor (ATOPs) program.

The EMU mobile laboratory arrived in the area surrounding Platte River Biogas at approximately 10:50 a.m. MST. The EMU mobile laboratory drove in the area surrounding Platte River Biogas until approximately 12:25 p.m. MST. From 12:25 p.m. until 1:30 p.m. MST, the EMU parked at a location approximately 1,850 feet downwind of Platte River Biogas. From 1:30 p.m. until 1:34 p.m. MST, the EMU mobile laboratory continued to drive in the area surrounding Platte River Biogas. The complete EMU mobile laboratory drive path around Platte River Biogas is shown in Figure 7.

While parked 1,850 feet downwind of Platte River Biogas, the EMU mobile laboratory consistently measured elevated concentrations of hydrogen sulfide (H₂S) and methane (CH₄). While parked, the methanethiol (CH₃SH) concentration was almost entirely below the instrument detection limit of 0.2 ppbv. A time series of these three compounds, along with the air temperature, wind direction, and wind speed, is provided in Figure 8. A map of the EMU drive path, color-coded by H₂S concentration, is provided in Figure 9. Detailed measurement statistics for the time period when the EMU was parked are provided in Table 10.

The Platte River Biogas facility may have ramped down operations for winter. Therefore, the conditions during the EMU deployment may not necessarily reflect standard operating conditions, especially during the summer months.

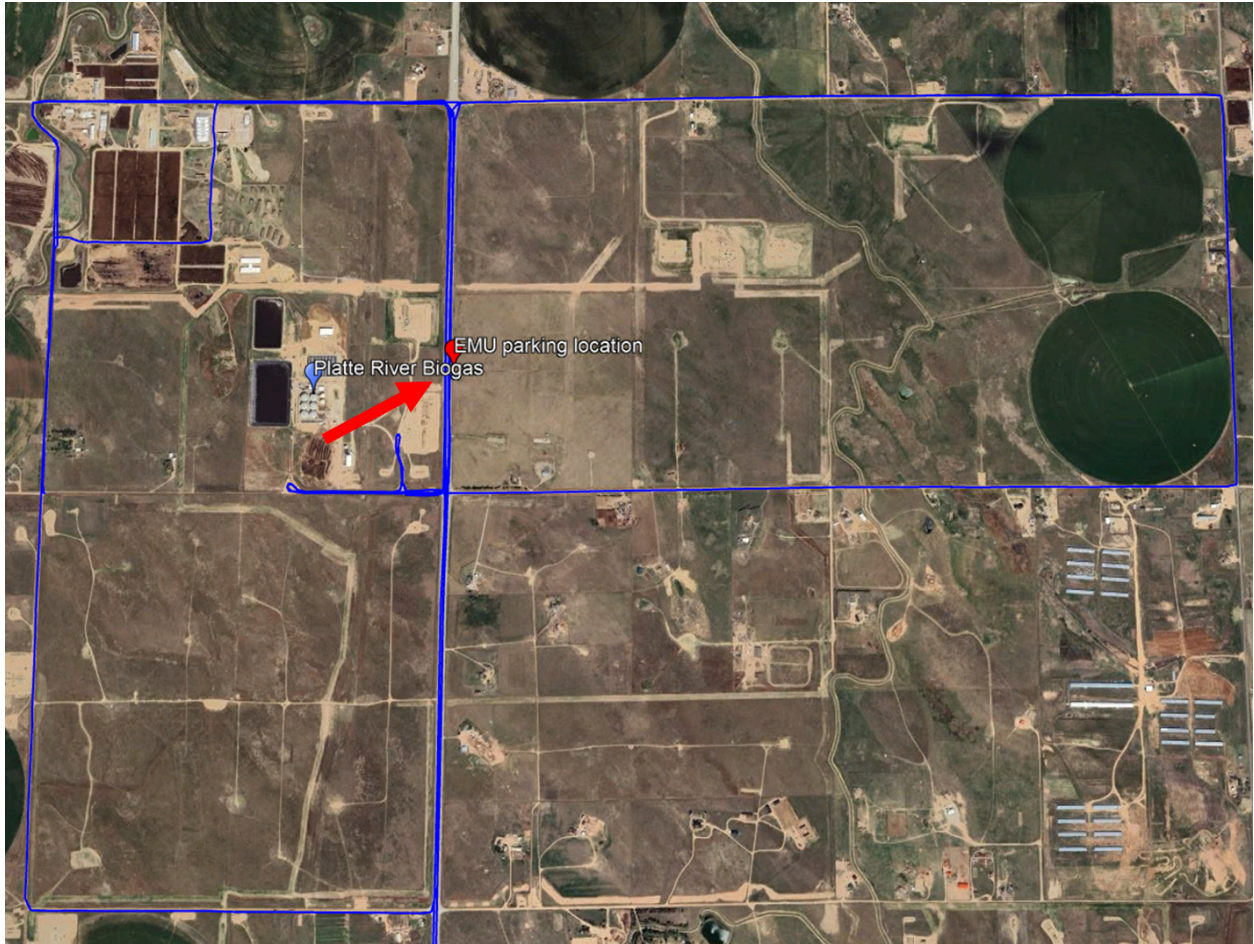


Figure 7. A map of the EMU mobile laboratory drive path for the deployment to the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on February 5, 2025. The EMU mobile laboratory drive path is shown as a blue line. The location of Platte River Biogas is shown as a blue marker (40.279°N, 104.608°W). The location where the EMU was parked from 12:25 p.m. to 1:30 p.m. MST is shown as a red marker (40.2804°N, 104.602°W). The red arrow indicates the average wind direction.

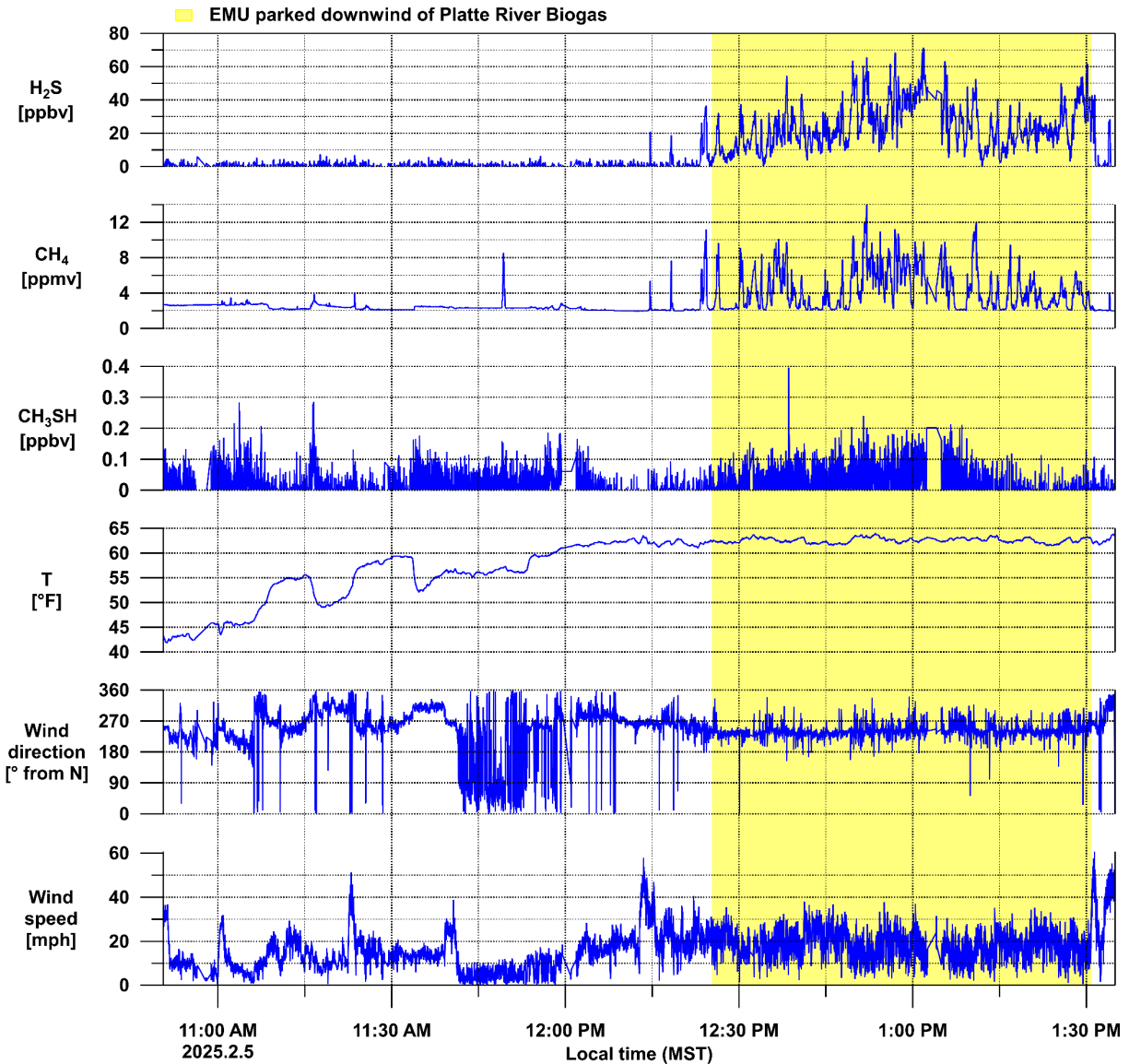


Figure 8. Time series of hydrogen sulfide (H₂S), methane (CH₄), methanethiol (CH₃SH), temperature, wind direction, and wind speed as measured by the EMU mobile laboratory in the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on February 5, 2025. The wind direction is shown as degrees clockwise from north (0° = from north; 90° = from east; 180° = from south). The yellow shading indicates the period when the EMU was parked 1850 feet downwind of Platte River Biogas.

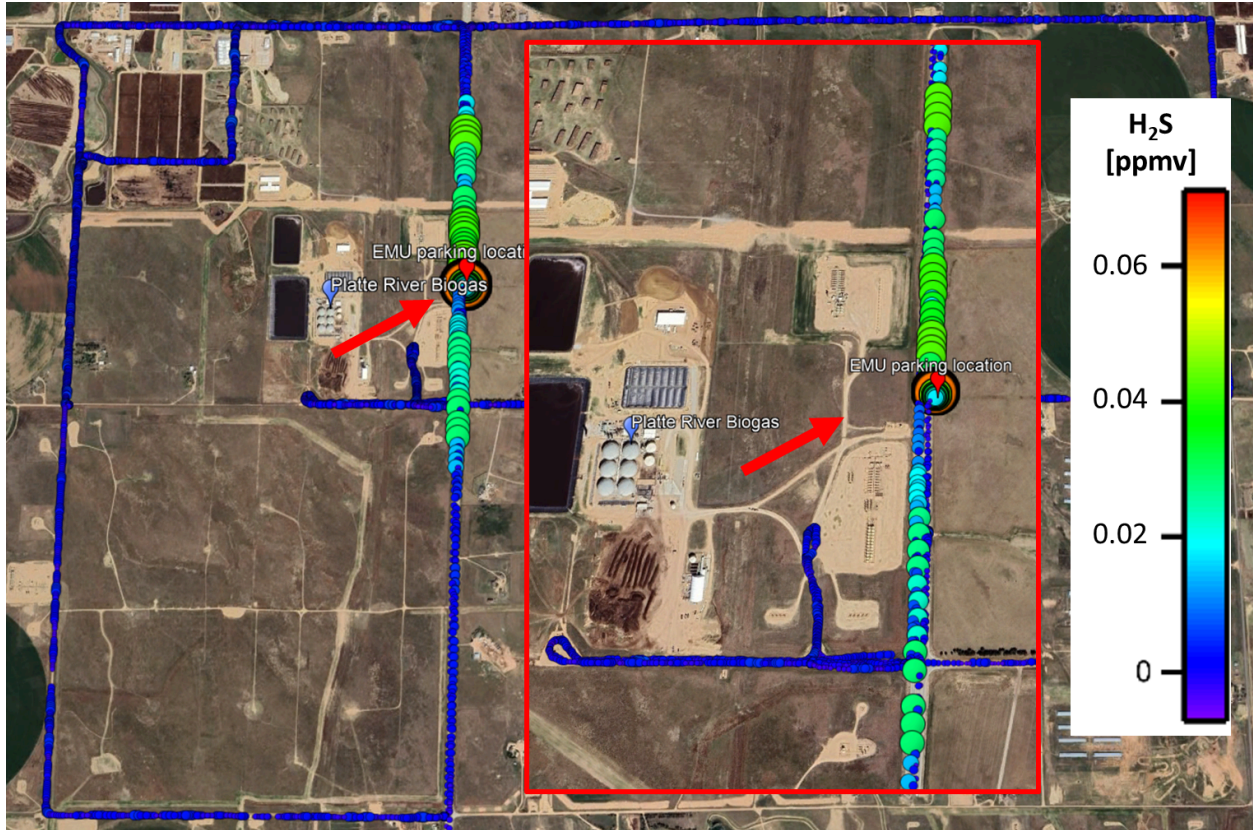


Figure 9. Map of ambient H₂S measurements in the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on February 5, 2025. The circular marker size and color indicates the ambient two-second H₂S concentration. The red arrow indicates the average wind direction. The red inset shows the area downwind of Platte River Biogas where the highest ambient H₂S concentrations were observed.

Table 10. Measurement statistics for the time period when the EMU mobile laboratory was parked downwind of Platte River Biogas (12:25 p.m. to 1:30 p.m. MST) on February 5, 2025. Minimum concentration values below the method detection limit (MDL) are marked as < MDL.

Parameter	Average	Standard deviation	Minimum	Maximum
H ₂ S	0.024 ppmv	0.013 ppmv	< 0.006 ppmv	0.071 ppmv
CH ₄	4.359 ppmv	2.336 ppmv	2.028 ppmv	13.964 ppmv
CH ₃ SH	< 0.4 ppbv	< 0.4 ppbv	< 0.4 ppbv	0.4 ppbv
Air temperature	62.6°F (17°C)	32.5°F (0.3°C)	61.5°F (16.4°C)	64.0°F (17.8°C)
Wind direction clockwise from N	239.9°	18.4°	3.0°	341.0°
Wind speed	18.6 mph	6.3 mph	0.7 mph	37.8 mph

4.5. EMU mobile laboratory deployment on June 25, 2025

The EMU mobile laboratory was deployed to Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on June 25, 2025. Prior to the deployment, the APCD received permission from management at BerQ RNG to drive onto Platte River Biogas facility property. The EMU was operated by two scientists from the CDPHE APCD Air Toxics & Ozone Precursor (ATOPs) program.

The EMU mobile laboratory arrived at Platte River Biogas at approximately 9:53 a.m. MDT on June 25, 2025. From 10:15 a.m. until 11:17 a.m. MDT, the EMU mobile laboratory parked next to two open-air pits containing liquid manure. The EMU mobile laboratory continued to measure at Platte River Biogas until approximately 11:56 a.m. MDT. The complete EMU mobile laboratory drive path is shown in Figure 10.

While at Platte River Biogas, the EMU mobile laboratory intermittently but consistently measured elevated concentrations of hydrogen sulfide (H₂S), methanethiol (CH₃SH), and methane (CH₄). The observed elevations in hydrogen sulfide and methanethiol were strongly correlated with each other, indicating that the two compounds were likely co-emitted. The EMU mobile laboratory did not observe elevated concentrations of benzene (C₆H₆) compared to typical ambient background concentrations. A time series of the concentrations of these three pollutants, along with air temperature, wind speed, and wind direction, is provided in Figure 11. A map of the EMU mobile laboratory drive path, color-coded by hydrogen sulfide concentration, is provided in Figure 12.

The highest concentrations of hydrogen sulfide were observed while the EMU mobile laboratory was parked next to two open-air pits. The EMU mobile laboratory was parked next to these pits from approximately 10:17 a.m. to 11:17 a.m. MDT. During this time, the observed hydrogen sulfide concentration reached as high as 6 ppmv, for a 2-second measurement. Detailed statistics for these measurements are provided in Table 11.

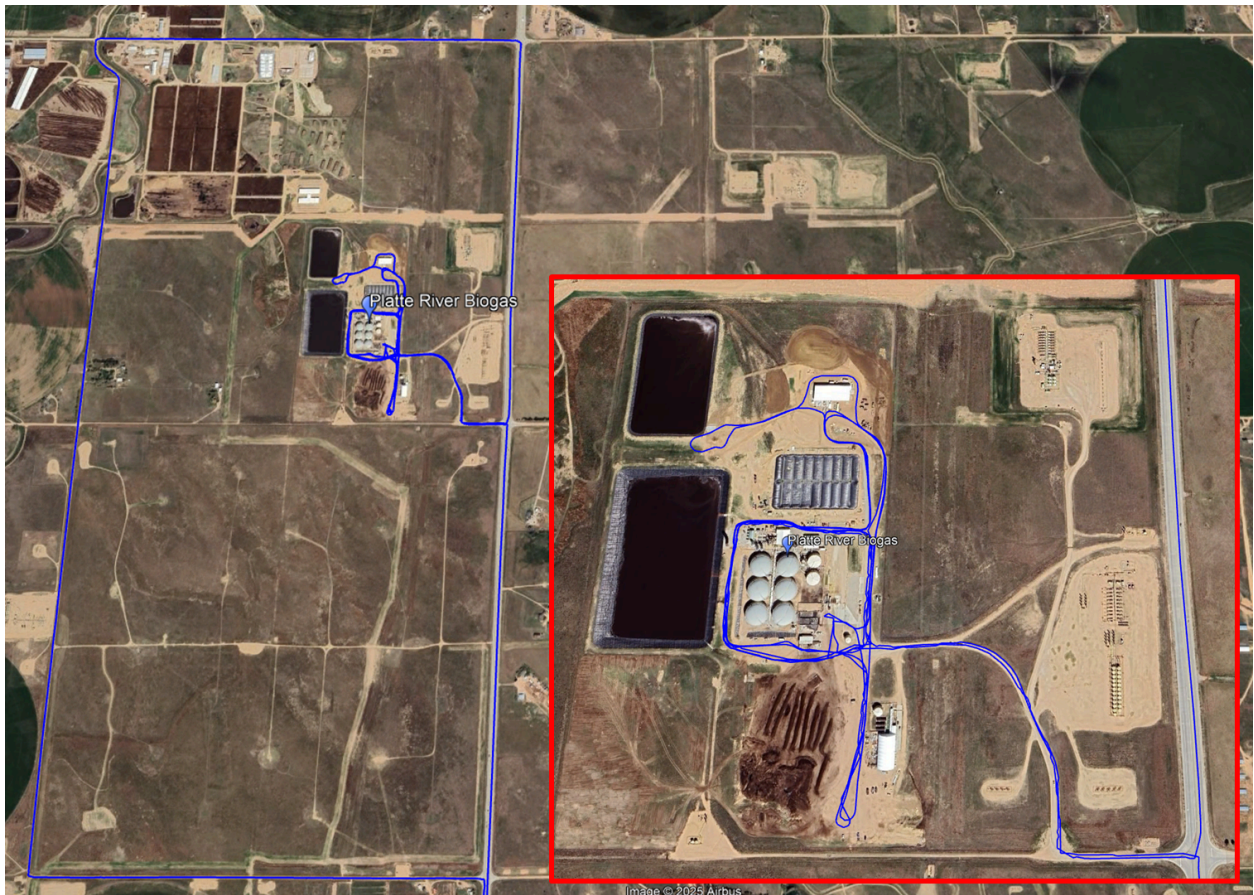


Figure 10. A map of the EMU mobile laboratory drive path for the deployment to Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on June 25, 2025. The EMU mobile laboratory drive path is shown as a blue line. The location of Platte River Biogas is denoted by a blue pin marker. The red inset shows the EMU mobile laboratory drive path inside Platte River Biogas.

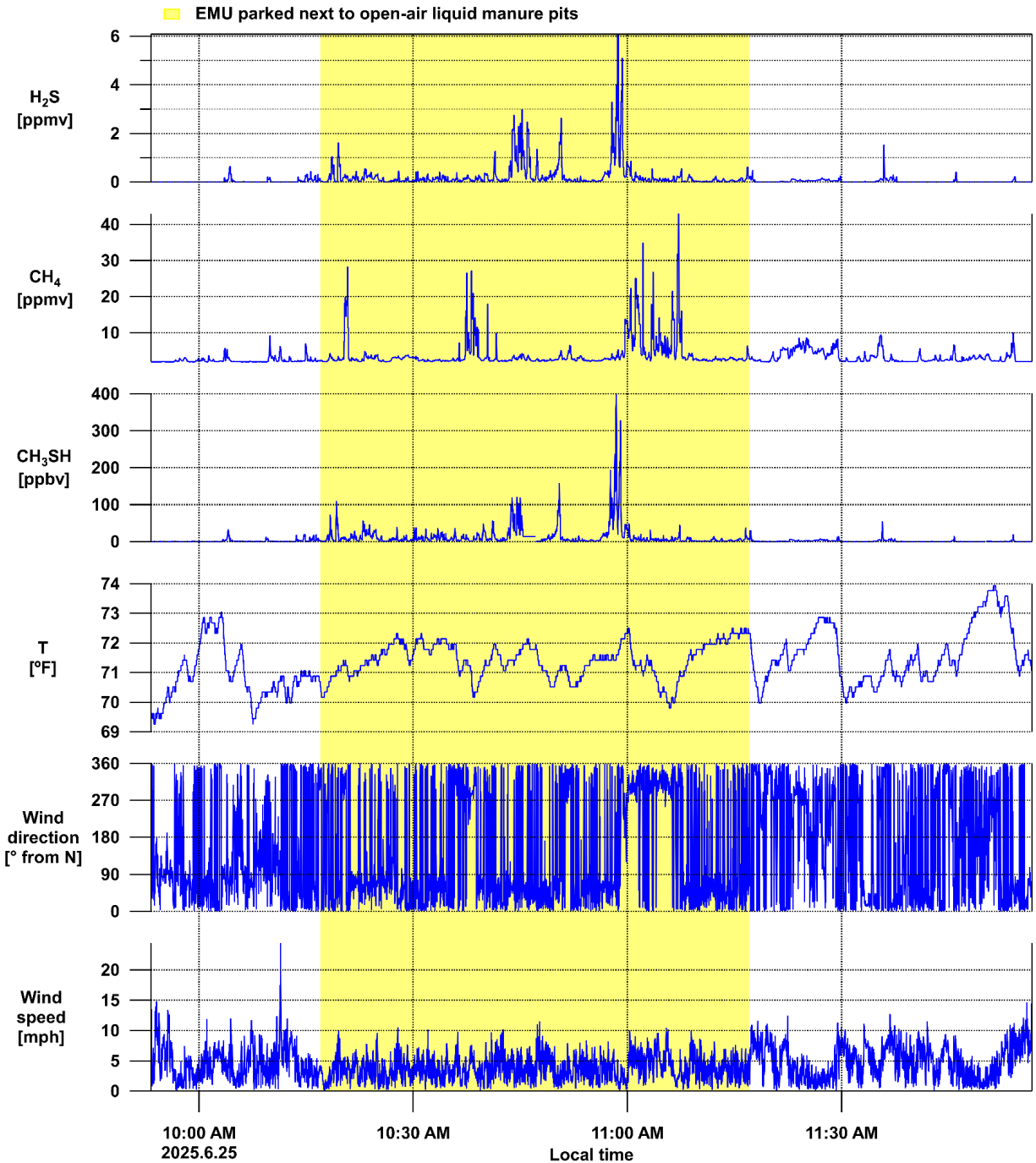


Figure 11. Time series of hydrogen sulfide (H₂S), methane (CH₄), methanethiol (CH₃SH), temperature, wind direction, and wind speed as measured by the EMU mobile laboratory at Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on June 25, 2025. The wind direction is shown as degrees clockwise from north (0° = from north; 90° = from east; 180° = from south). The yellow shading indicates the period when the EMU mobile laboratory was parked directly next to the open-air pits.

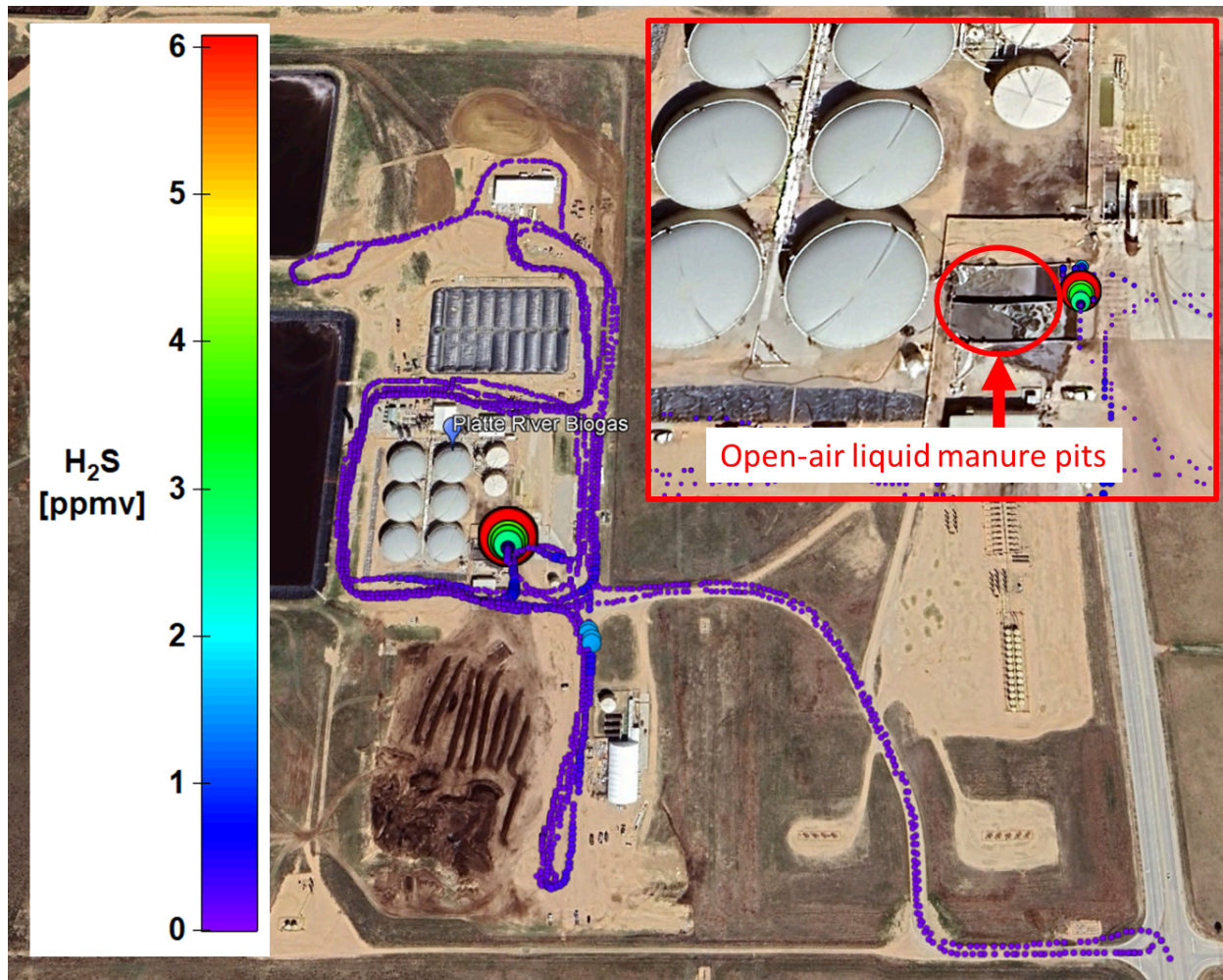


Figure 12. Map of ambient hydrogen sulfide (H₂S) measurements at Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on June 25, 2025. The circular marker size and color indicates the ambient two-second hydrogen sulfide concentration. The red inset shows the location of the open-air liquid manure pits where the highest ambient H₂S concentrations were observed.

Table 11. Measurement statistics for two-second measurements at Platte River Biogas on June 25, 2025 from 10:17 a.m. MDT to 11:17 a.m. MDT, while the EMU mobile laboratory was parked next to the open-air liquid manure pits. Minimum concentration values below the method detection limit (MDL) are marked as < MDL.

Parameter	Average	Standard deviation	Minimum	Maximum
Hydrogen sulfide (H ₂ S)	0.266 ppmv	0.578 ppbv	< 0.006 ppmv	6.078 ppmv
Methane (CH ₄)	4.077 ppmv	4.338 ppmv	1.954 ppmv	42.900 ppmv
Methanethiol (CH ₃ SH)	14.1 ppbv	30.6 ppbv	< 0.4 ppbv	400.9 ppbv
Benzene (C ₆ H ₆)	0.3 ppbv	0.2 ppbv	< 0.4 ppbv	1.0 ppbv
Air temperature	71.4°F (21.9°C)	32.5°F (0.3°C)	69.8°F (21.0°C)	72.5°F (22.5°C)

4.6. EMU mobile laboratory deployment on September 17, 2025

The CDPHE APCD Emissions Monitoring Utility (EMU) mobile laboratory was deployed to the area surrounding Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on September 17, 2025. Prior to this deployment, the EMU mobile laboratory did not receive permission to drive onto the Platte River Biogas facility property. The EMU mobile laboratory was operated by two scientists from the CDPHE APCD Air Toxics & Ozone Precursor (ATOPs) program.

The EMU mobile laboratory arrived in the area surrounding Platte River Biogas at approximately 8:46 a.m. MST. The EMU mobile laboratory drove in the area surrounding Platte River Biogas until approximately 9:51 a.m. MST. From 9:51 a.m. until 10:52 a.m. MST, the EMU parked at a location approximately 1150 feet downwind of Platte River Biogas. From 10:52 a.m. until 11:15 a.m. MST, the EMU mobile laboratory continued to drive in the area surrounding Platte River Biogas. The complete EMU mobile laboratory drive path around Platte River Biogas is shown in Figure 13.

While parked 1150 feet downwind of Platte River Biogas, the EMU mobile laboratory measured elevated concentrations of hydrogen sulfide (H₂S), methane (CH₄), and methanethiol (CH₃SH). A time series of these three compounds, along with the air temperature, wind direction, and wind speed, is provided in Figure 14. A map of the EMU drive path, color-coded by H₂S concentration, is provided in Figure 15. Detailed measurement statistics for the time period when the EMU was parked are provided in Table 12.

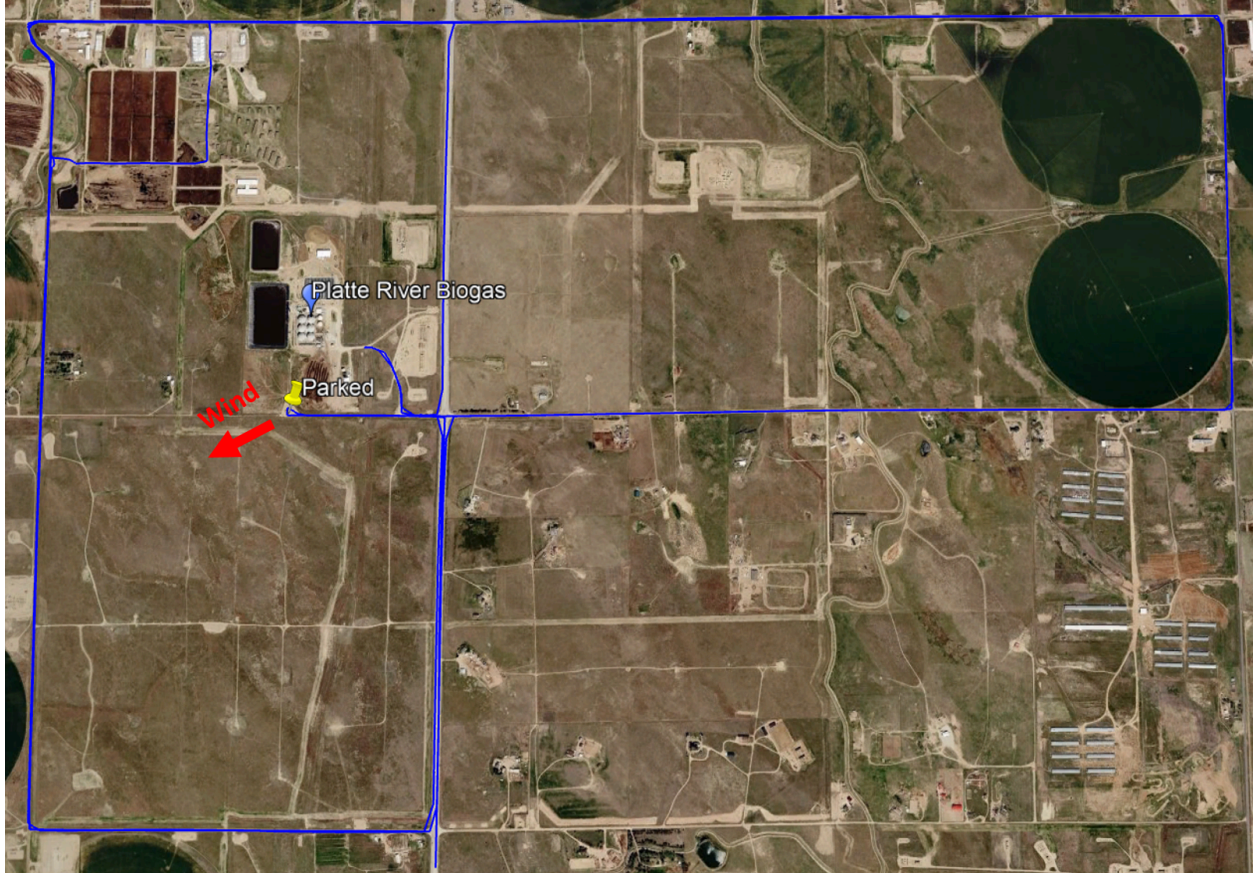


Figure 13. A map of the EMU mobile laboratory drive path for the deployment to Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on September 17, 2025. The EMU mobile laboratory drive path is shown as a blue line. The location of Platte River Biogas is denoted by a blue pin marker. The location where the EMU mobile laboratory was parked from 9:51 a.m. MST to 10:52 a.m. MST is denoted by a yellow pushpin marker. The red arrow indicates the wind direction while the EMU mobile laboratory was parked.

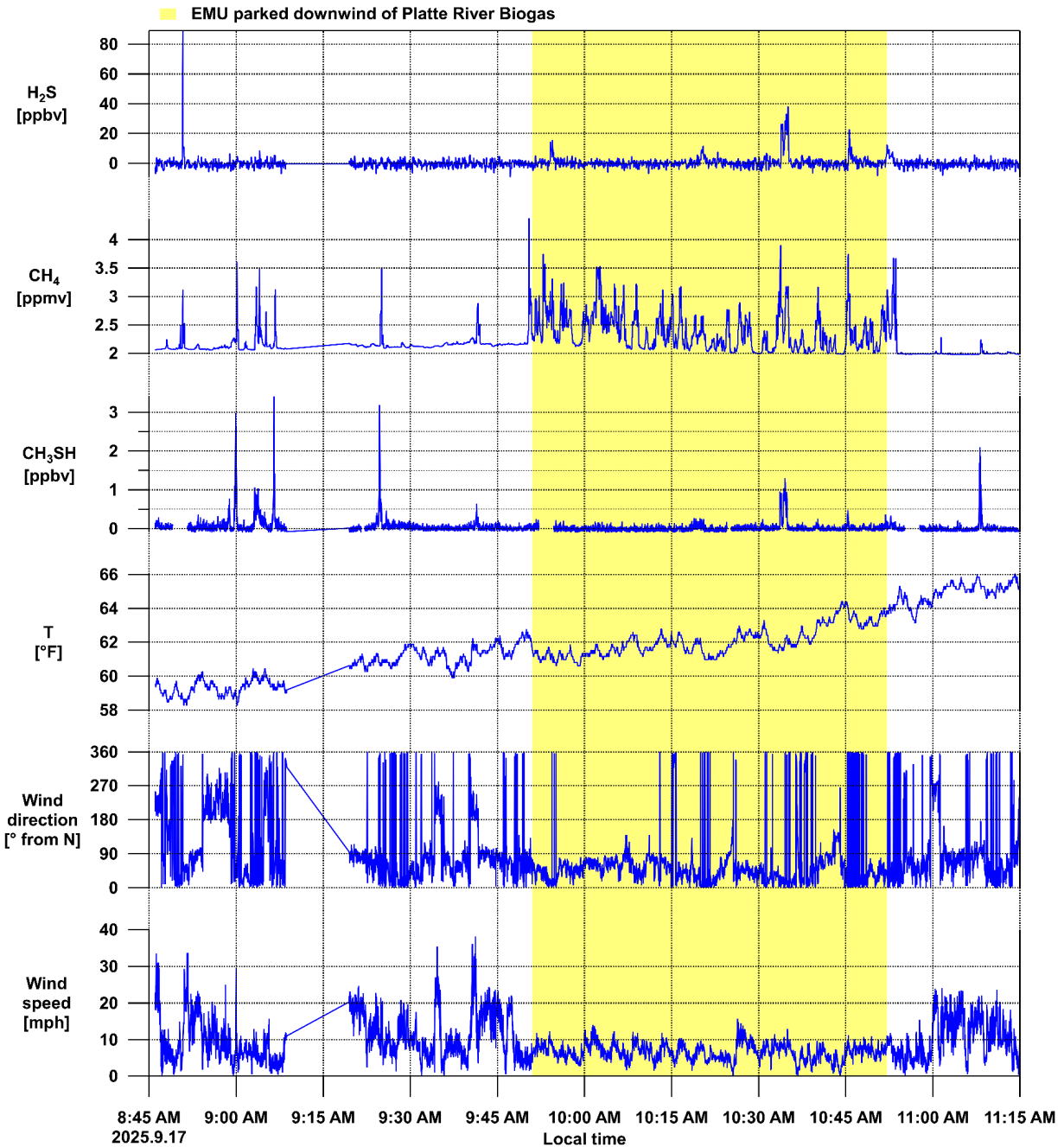


Figure 14. Time series of hydrogen sulfide (H₂S), methane (CH₄), methanethiol (CH₃SH), temperature, wind direction, and wind speed as measured by the EMU mobile laboratory at Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on September 17, 2025. The wind direction is shown as degrees clockwise from north (0° = from north; 90° = from east; 180° = from south). The yellow shading indicates the period when the EMU mobile laboratory was parked approximately 1150 feet downwind of Platte River Biogas.

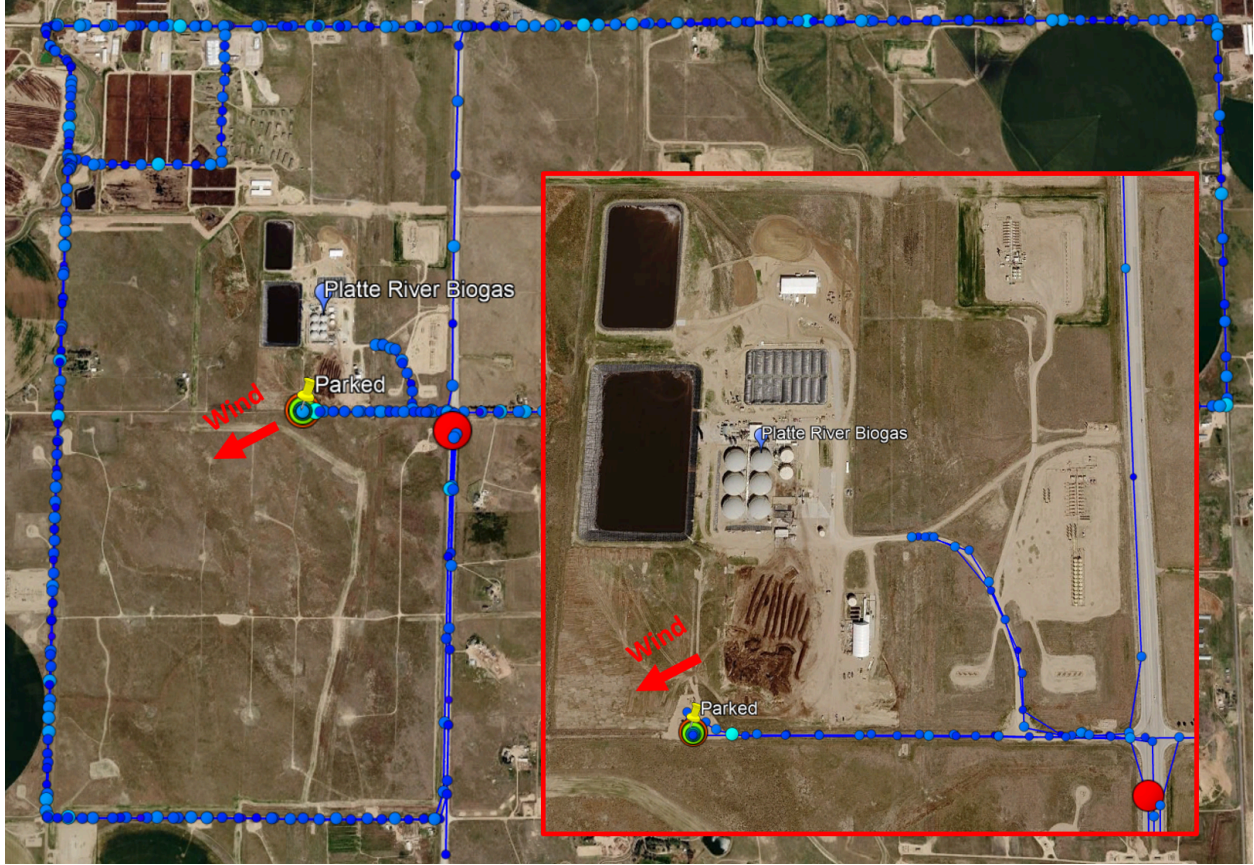


Figure 15. Map of ambient hydrogen sulfide (H₂S) measurements at Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on September 17, 2025. The circular marker size and color indicates the ambient two-second hydrogen sulfide concentration. The red inset shows the exact location of where the EMU mobile laboratory was parked approximately 1150 feet downwind of Platte River Biogas. The red arrows indicate the wind direction while the EMU mobile laboratory was parked.

Table 12. Measurement statistics for two-second measurements at Platte River Biogas on September 17, 2025 from 9:51 a.m. MST to 10:52 a.m. MST while the EMU mobile laboratory was parked approximately 1150 feet downwind of Platte River Biogas. Minimum concentration values below the method detection limit (MDL) are marked as < MDL.

Parameter	Average	Standard deviation	Minimum	Maximum
Hydrogen sulfide (H ₂ S)	<0.006 ppmv	<0.006 ppmv	<0.006 ppmv	0.037 ppmv
Methane (CH ₄)	2.363 ppmv	0.336 ppmv	1.984 ppmv	3.899 ppmv
Methanethiol (CH ₃ SH)	<0.4 ppbv	<0.4 ppbv	<0.4 ppbv	1.3 ppbv

Parameter	Average	Standard deviation	Minimum	Maximum
Benzene (C ₆ H ₆)	0.4 ppbv	<0.4 ppbv	<0.4 ppbv	1.4 ppbv
Air temperature	62.1°F (16.7°C)	32.9°F (0.5°C)	60.6°F (15.9°C)	64.4°F (18.0°C)

5. Comparative Analysis

The CAT mobile laboratory deployment to Platte River Biogas (19179 Co Rd 49, La Salle, CO 80645) on October 30, 2024 is the most relevant dataset for comparison to the EMU mobile laboratory deployment to Platte River Biogas on June 25, 2025. These are the only two sets of measurements actually on Platte River Biogas facility property, directly adjacent to the two open-air liquid manure pits where the highest hydrogen sulfide concentrations have been observed. As noted above, both the CAT and EMU mobile laboratories are outfitted with identical air toxics monitoring instrumentation, so the measurements are directly comparable.

There are significant differences between the October 30 and June 25 deployments. The October 30 deployment took place during late fall, when air temperatures were colder, and facility staff informed us that Platte River Biogas was ramping down operations for the winter. The June 25 deployment took place during summer, when air temperatures were much warmer, and facility staff informed us that Platte River Biogas was operating at 80-90% capacity. One concern is that the warmer summer temperatures could lead to higher air toxics emissions due to increased rates of anaerobic decomposition of manure, and therefore higher ambient air toxics concentrations. To investigate this, a side-by-side comparison of one-hour statistics for measurements taken next to the open-air liquid manure pits is provided in Table 13.

Table 13. Comparison between the one-hour sampling period statistics for two-second measurements of hydrogen sulfide (H₂S), methane (CH₄), methanethiol (CH₃SH), benzene (C₆H₆), air temperature, and wind speed at Platte River Biogas on October 30, 2024 (1:40 p.m. to 2:30 p.m. MDT) and June 25, 2025 (10:17 a.m. to 11:17 a.m. MDT), while the CAT / EMU mobile laboratory was parked next to the open-air liquid manure pits. Minimum concentration values below the method detection limit (MDL) are marked as < MDL.

Parameter	Average		Standard deviation		Minimum		Maximum	
	Oct 30	Jun 25	Oct 30	Jun 25	Oct 30	Jun 25	Oct 30	Jun 25
H ₂ S [ppmv]	0.287	0.266	0.543	0.578	<0.006	<0.006	3.170	6.078
CH ₄ [ppmv]	6.162	4.077	7.452	4.338	2.041	1.954	46.421	42.900
CH ₃ SH [ppbv]	2.0	14.1	3.3	30.6	<0.2	<0.3	28.2	400.9
C ₆ H ₆ [ppbv]	0.5	0.3	0.6	0.2	<0.3	<0.3	8.9	1.0

Parameter	Average		Standard deviation		Minimum		Maximum	
	Oct 30	Jun 25	Oct 30	Jun 25	Oct 30	Jun 25	Oct 30	Jun 25
Air temperature [°F]	44.2	71.4	32.7	32.5	43.0	69.8	46.6	72.5
Wind speed [mph]	4.7	3.8	2.7	2.0	<0.2	<0.2	14.1	11.6

The average hydrogen sulfide concentration is actually slightly higher on October 30 (0.287 ppbv) than on June 25 (0.266 ppmv). The standard deviation and minimum hydrogen sulfide concentrations are very similar between October 30 and June 25. However, the maximum hydrogen sulfide concentration on June 25 (6.078 ppmv) is nearly twice that observed on October 30 (3.170 ppmv). This suggests that depending on facility activity and wind conditions, peak hydrogen sulfide emissions may be higher during summer than during the late fall. It is important to note that this conclusion is based on one hour of data collected during October 30 and one hour of data collected during June 25; more monitoring data is needed to add additional certainty.

The methane concentrations observed on October 30 are higher compared to those observed on June 25. This is consistent with the observation that hydrogen sulfide does not appear to be directly co-emitted with methane.

The average, standard deviation, and maximum methanethiol concentrations are higher on June 25 than on October 30. The average methanethiol concentration observed on June 25 (14.1 ppbv) is seven times higher than that observed on October 30 (2.0 ppbv). The maximum methanethiol concentration observed on June 25 (400.9 ppbv) is more than fourteen times higher than that observed on October 30 (28.2 ppbv). Because hydrogen sulfide and methanethiol appear to be co-emitted, this is secondary evidence that hydrogen sulfide emissions may be higher during the summer than during the late fall.

The average, standard deviation, and maximum benzene concentrations are higher on October 30 than on June 25. Given that the month-long MARMOT deployment yielded a dataset where the ambient benzene concentration did not exceed 1 ppbv, it is likely that the Platte River Biogas facility is not a significant source of benzene, except for enhanced emissions due to facility vehicle traffic. The maximum of 8.9 ppbv benzene observed on October 30 may have been due to tailpipe emissions from the many trucks which are constantly hauling manure into the facility while it is operating, or from the numerous construction vehicles operating at the facility.