Ambient air monitoring data summary report

Nederland, CO

Air Toxics and Ozone Precursor Program [ATOPs]

10.10.2025

COLORADO
Air Pollution Control Division
Department of Public Health & Environment

1. Executive Summary

1.1. Report Purpose

To investigate potential air toxics in the community after a fire began in a shopping center around 3:00 a.m. on Thursday, October 9, 2025 in Nederland, CO.

1.2. Background Information

Boulder County Department of Health submitted an air toxics monitoring request due to health concerns related to the fire in the community shopping center.

1.3. Key Findings

The volatile organic compounds monitored near the site of the fire included acetaldehyde, benzene, hydrogen cyanide, hydrogen sulfide, toluene, trimethylbenzene, xylene, acrolein*, furan*, and styrene*. Concentrations reported for the compounds with an asterisk are not directly calibrated and are thus only estimates.

The 1-hour average data reported in Table 1 represent data collected while parked 80 m downwind of the damaged site from 10:51 a.m. to 11:51 a.m. MDT. Although concentrations of the air toxics listed in Table 1 were elevated compared to background concentrations in Nederland, the average concentrations did not exceed acute Colorado Health Guideline Values (HGVs)[1] or EPA Acute Exposure Guideline Levels (AEGLs)[2].

Acute HGVs are defined as “the exposure level that is likely to be without appreciable risk of adverse non-cancer health effects in an exposed population…[for] intermittent exposures that could occur repeatedly for a few hours to a few days”.[1] When Colorado HGVs are not available for a given chemical species, EPA AEGL values are used. The AEGL values listed here, unless otherwise noted, correspond to Level 1 severity for 1 hour of exposure. If exposure exceeds the AEGL Level 1 values, one would have symptoms of irritation or discomfort from exposure to the chemical species, but the effects are reversible and not disabling after one is no longer exposed.

Table 1. *Air toxics monitored during deployment with corresponding a) acute Colorado HGVs or b) EPA AEGL Level 1 values. The 1-hour average concentration represents the average concentration measured when parked 80 m east of the damaged site from 10:51 – 11:51 a.m. MDT. The maximum 2-second detected concentration represents the maximum concentration measured within that time period. The average background concentration represents the 1-hour average concentration measured driving east, out of Nederland along Boulder Canyon Drive.*

Chemical species	1-hour average concentration [ppbv]	Maximum 2-second detected concentration [ppbv]	Average Background Concentration - Boulder Canyon Drive, east of Nederland [ppbv]	CO HGV[a] or AEGL Level 1 1-hour exposure[b] [ppbv]
Acetaldehyde	4.3	17.1	1.0	45,000[b]
Benzene	3.0	19.0	0.4	9[a]
Hydrogen cyanide	1.0	4.5	0.3	2000[b]
Hydrogen sulfide	1.6	5.2	1.6	510[b]
Toluene	1.6	92.4	0.4	2,000[a]
Trimethyl-benzene	0.2	38.4	0.2	3,000[a]
Xylene	0.6	80.0	0.2	2,000[a]
Acrolein*	1.6	5.2	0.8	30[b]
Furan*	0.9	3.7	0.1	6,800[b,‡]
Styrene*	4.7	21.3	0.5	5,000[a]

*Not directly calibrated.
‡AEGL Level 2 value (AEGL Level 1 not defined).

2. Introduction

The EMU mobile laboratory was deployed to Nederland on Friday, October 10, 2025. Prior to the deployment, a request was submitted from the Boulder County Department of Health to measure air toxics both near the site of the fire and surrounding neighborhoods. The EMU was operated by two scientists from the CDPHE APCD Air Toxics & Ozone Precursors (ATOPs) program.

3. Methods

3.1. The Emissions Monitoring Utility (EMU) Mobile Laboratory

The EMU 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 deployment. The parameters measured by these four instruments are summarized in Table 2.

Table 2. *EMU instrumentation summary*

Instrument	**Measured parameters**	**Time resolution**
Tofwerk Vocus Eiger Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS)	Benzene, toluene, xylene, methanethiol, acetone, acetonitrile, acetaldehyde, methyl ethyl ketone, hexene, tetrachloroethylene, trimethylbenzene	1 second
Tofwerk Vocus B AIM Chemical Ionization Time-Of-Flight Mass Spectrometer (CI-ToF-MS)	Hydrogen cyanide, toluene, ammonia	2 seconds
Picarro Cavity Ring-Down Spectroscopy (CRDS) instrument	Hydrogen sulfide, methane, water vapor	4 seconds
Gill Instruments Maximet GMX500	Pressure, temperature, relative humidity, wind speed & direction, GPS location, speed, heading	1 second
VectorNav GPS	GPS location	1 second

3.2. 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.

3.3. Quality Control & Assurance

During an internal audit on September 25, 2025, the EMU Vocus Eiger PTR-ToF-MS was determined to have a 2-second method detection limit (MDL)[3] for each benzene, hydrogen cyanide, and hydrogen sulfide. 2-second MDLs for toluene, trimethylbenzene, and xylene were most recently determined on May 20, 2024.. This value represents the minimum concentration of a compound that can be measured with 99% confidence. The MDL for each of these

compounds is shown in Table 3. If the measured concentration of a compound is less than the MDL, it is reported as 0.5 × MDL in Table 1.

Table 3. *Method detection limit for each benzene, hydrogen cyanide, hydrogen sulfide, toluene, trimethylbenzene, and xylene.*

Chemical compound	Date [YYYY.MM.DD]	Method Detection Limit (MDL) [ppbv]
Benzene	2025.09.25	0.79
Hydrogen cyanide	2025.09.25	0.67
Hydrogen sulfide	2025.09.25	3.19
Toluene	2024.05.20	0.21
Trimethylbenzene	2024.05.20	0.45
Xylene	2025.05.20	0.29

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

To quantify air toxics that are not calibrated using the method described above – acrolein, furan, and styrene – the sensitivity (instrument signal per unit concentration) was estimated assuming a proton-transfer reaction rate constant = 2.5 x 10^{-9} cm^3 $molecule^{-1}$ s^{-1}. Thus, the concentration values reported for these compounds in Table 1 are estimates. However, these estimates are likely within an order of magnitude of the true concentration. If the true concentration were an order of magnitude higher than the reported concentration for acrolein, furan, and styrene, the concentration of these compounds are still below the AEGL Level 1 8-hour exposure health guideline value.

4. Deployment Summary

The EMU arrived in Nederland, CO at approximately 10:30 a.m. MDT on Friday, October 10, 2025. The complete driving path is shown in Figure 1.

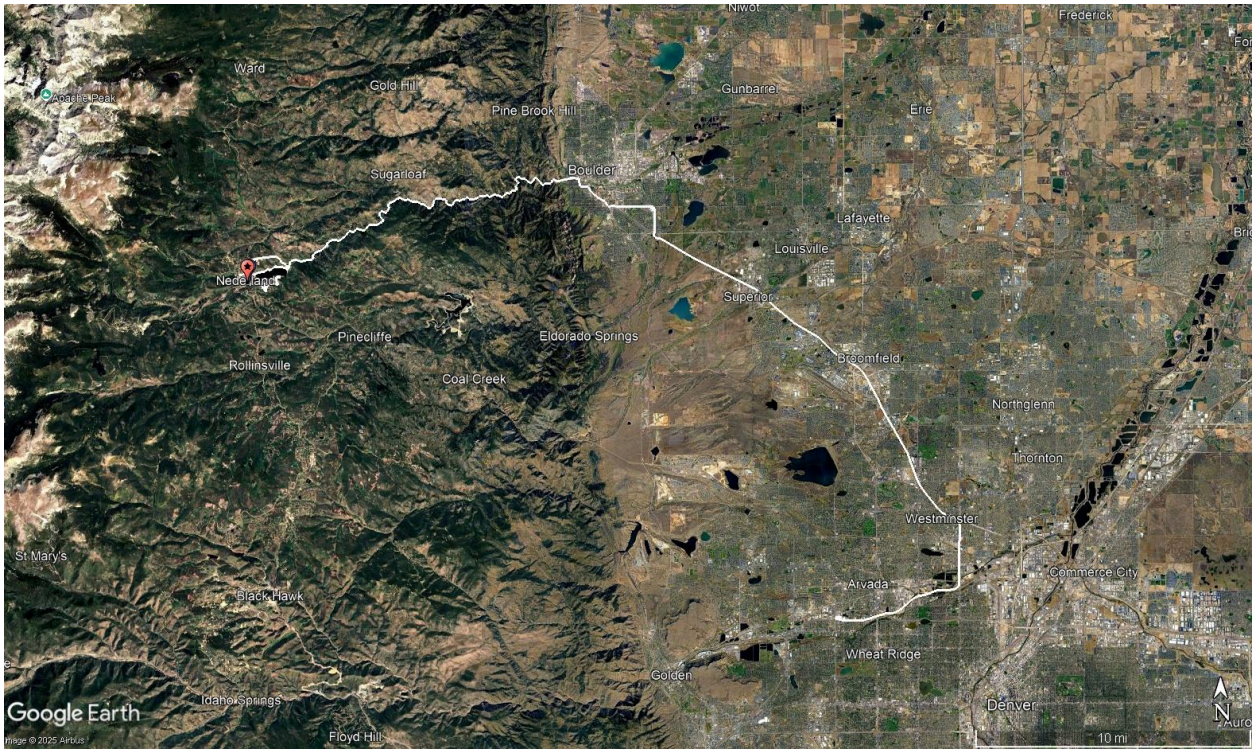

Figure 1. *Map of driving route.*

From 10:51 a.m. to 12:11 p.m. MDT, the EMU parked approximately 80 m east and downwind (noted by the blue marker in Figure 2) of the smoldering building at 20 Lakeview Dr, Nederland, CO (noted by the red marker in Figure 2).

From 12:11 p.m. to 12:25 p.m. MDT, the EMU was driven in a loop around residential areas both to the north and south of Barker Meadow Reservoir. The EMU was then parked near the media, in front of the damaged site, from 12:37 p.m. to 1:07 p.m. MDT before driving loops around each the north and south of Barker Meadow Reservoir a second time.

Figure 2. *Zoomed in map of driving route (in white).The red marker indicates the location of the damaged site. The blue marker indicates the location at which the EMU mobile monitoring laboratory was parked to measure 1-hour average concentrations of air toxics approximately ~80 m east and downwind of site.*

Figure 3 shows the concentration of the monitored air toxics over time. The compounds with an asterisk (*) are not directly calibrated but are estimated using the method described in Section 3.3, Quality Control & Assurance, above.

The regions highlighted in orange indicate the time at which the EMU mobile monitoring laboratory was parked approximately 80 m east and downwind of the damaged site. These data indicate that when close and downwind of the damaged site, there is an elevation of air toxics concentrations relative to the average concentration measured while driving east along Boulder Canyon Drive, away from the town of Nederland. However, the average concentration of each compound monitored during the period of time near the damaged site remained below their individual acute Colorado HGV or EPA AEGL Level 1, 1-hour exposure values. When the air toxics were measured near residential areas around the fire, benzene concentrations returned to typical benzene background concentrations (< 1 ppbv).

The regions highlighted in blue indicate the time at which the EMU mobile monitoring laboratory was driving east on Boulder Canyon Drive, away from the damaged site. The average concentration of air toxics during this time period are reported in Table 1 and used as a comparison to the elevated 1-hour average air toxics concentrations when measuring on-site.

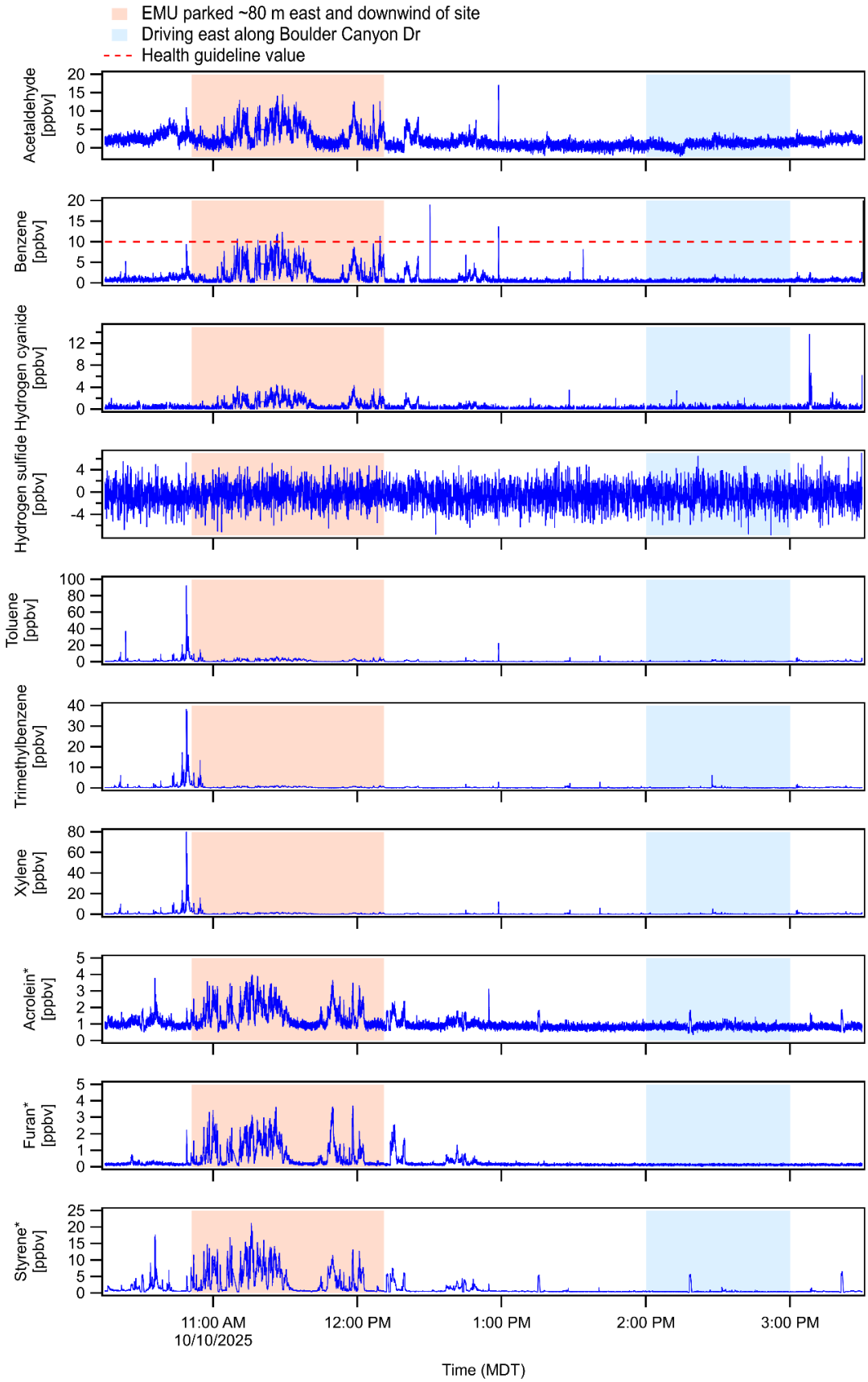
EMU parked ~80 m east and downwind of site
Driving east along Boulder Canyon Dr
Health guideline value
Acetaldehyde [ppbv]
Benzene [ppbv]
Hydrogen cyanide [ppbv]
Hydrogen sulfide [ppbv]
Toluene [ppbv]
Trimethylbenzene [ppbv]
Xylene [ppbv]
Acrolein* [ppbv]
Furan* [ppbv]
Styrene* [ppbv]
11:00 AM
10/10/2025
12:00 PM
1:00 PM
2:00 PM
3:00 PM
Time (MDT)

Figure 3. Time profiles of VOCs measured from 10:16 a.m. MDT to 3:30 p.m. MDT. The region highlighted in orange indicates the time when EMU was parked approximately 80 m east and downwind of the site. The region highlighted in blue indicates the time driving out of Nederland towards Boulder along Boulder Canyon Drive.

References

1. Colorado Department of Public Health & Environment. (2019, September 20). Updated acute and chronic health guideline values for use in preliminary risk assessments (referred to as “FA2019 HGVs”). https://www.google.com/url?q=https://drive.google.com/file/d/1b0zQofjlYUHS140gwOUVCf8emN4KSSDV/view&sa=D&source=docs&ust=1761149834561543&usg=AOvVaw17CpAjRd0MaMzfEozem6q6

2. Environmental Protection Agency. (2025, May 14). About Acute Exposure Guideline Levels (AEGLs). EPA. https://www.epa.gov/aegl/about-acute-exposure-guideline-levels-aegls

3. Environmental Protection Agency. (2025, September 16). Method Detection Limit – Frequent Questions. EPA. https://www.epa.gov/cwa-methods/method-detection-limit-frequent-questions