Project Quarter 8

Upper South and Appalachia Citizen Air Monitoring Project (USACAMP)

Appalachian Voices

Upper South and Appalachia Citizen Air Monitoring Project (USACAMP)

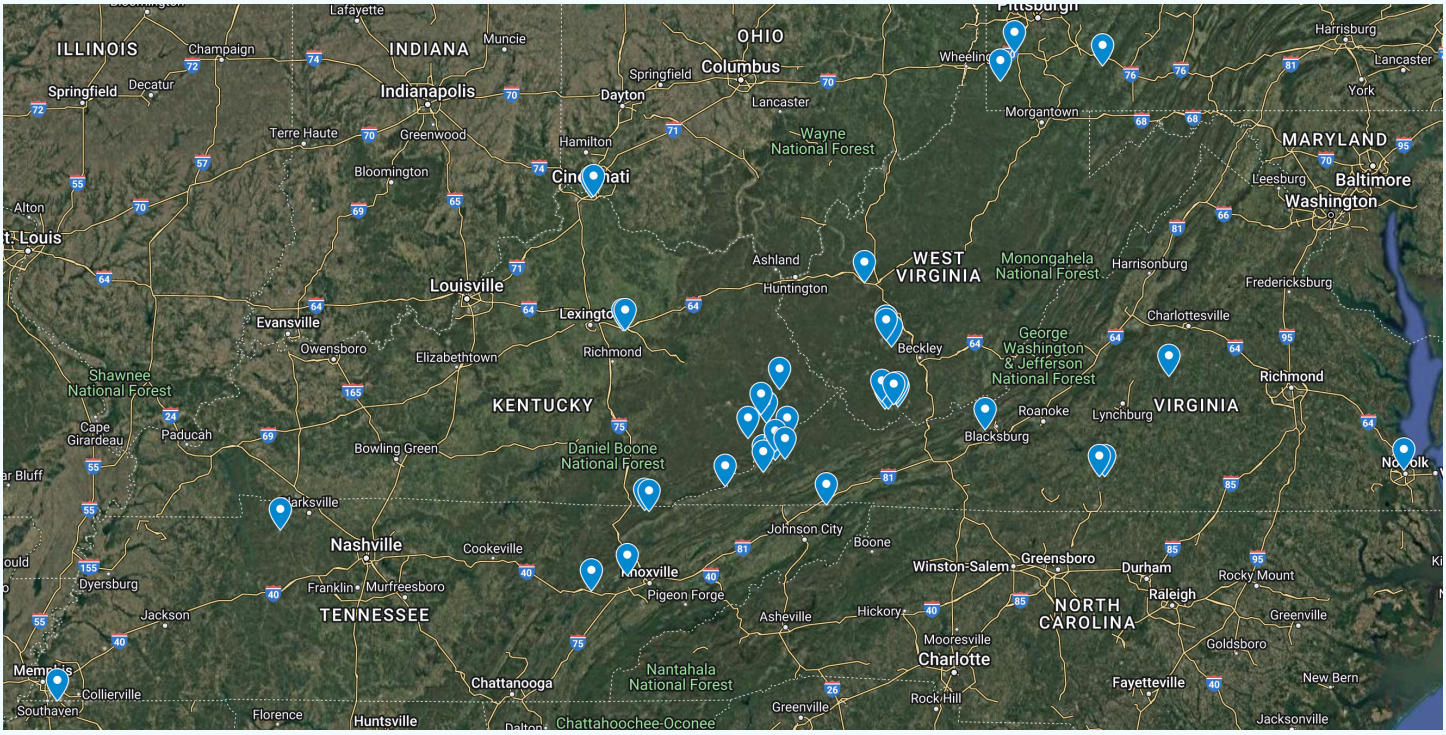
January 2026

In pursuit of a better understanding of air quality within our region, we are pleased to present the quarterly report for the Upper South and Appalachia Citizen Air Monitoring Project (USACAMP). Funded by an Environmental Protection Agency Enhanced Air Quality Monitoring for Communities grant, USACAMP focuses on the collection and analysis of air quality data through the use of PurpleAir monitors and other electronic monitoring devices.

This initiative engages communities across portions of Kentucky, Pennsylvania, Tennessee, Virginia, and West Virginia, deploying low-cost monitoring devices to facilitate the collection and dissemination of air quality data. The project aims to empower local residents, encourage dialogue around public health and policy, and promote clean air and healthy communities through data transparency and community science.

The primary focus of the project is particulate matter (PM), particularly PM2.5 (fine particles) and PM10 (coarse particles), due to their well-documented health impacts, especially for vulnerable populations such as children, the elderly, and individuals with pre-existing conditions. Data collected in 2024 was analyzed against existing and revised National Ambient Air Quality Standards (NAAQS), with additional attention paid to pollutant spikes, long-term averages, and potential exceedances.

Community Partner Locations



About PurpleAir and Data Adjustments

PurpleAir monitors use laser-based sensors to estimate the size and concentration of airborne particulate matter. These affordable, Internet-connected devices make air quality data more accessible, especially in underserved areas.

However, raw PurpleAir data are known to overstate PM2.5 concentrations. As a result, USACAMP has adopted a correction formula developed by Barkjohn et al. (2021), applying it uniformly to all PM2.5 data for improved alignment with Federal Reference Monitors (FRMs).

Corrected PM2.5 = 0.38 × PA + 2.94

In this equation, PA refers to the PM2.5 concentration reported directly by the PurpleAir® sensor.

Particulate Matter Regulatory Overview

This report references the following EPA National Ambient Air Quality Standards for particulate matter:

- **24-hour PM10: 150 $\mu g/m^3$**
- **24-hour PM2.5: 35 $\mu g/m^3$ (based on the 98th percentile average**
- **Annual PM2.5: 9 $\mu g/m^3$ (updated in 2024 from 12 $\mu g/m^3$)**

Due to the multi-year nature of NAAQS compliance calculations, direct exceedance determination is not always possible. Instead, this report provides metrics and visuals that mimic NAAQS methodologies to give insight into likely patterns of exposure.

EPA Administrator Lee Zeldin has said that the agency will reconsider the standards for PM2.5 as part of a broad deregulatory agenda. At this time, the applicable standards are as they appear above, but in the coming months, EPA is likely to commence rule-making procedures to change the annual and/or 24-hour standards for this pollutant, making these standards less stringent.

Low-cost air quality sensors, such as those produced by PurpleAir, have expanded access to fine particulate matter (PM2.5) monitoring, particularly in underserved or rural areas. However, the raw measurements produced by these sensors often require adjustment to ensure comparability with reference-grade monitors used by regulatory agencies, such as the EPA's Federal Reference Method (FRM) and Federal Equivalent Method (FEM) instruments.

The first model tested applies a linear transformation developed by Barkjohn et al. (2021), which adjusts for the typical overestimation of PM2.5 by PurpleAir sensors. This approach is expressed by the formula:

CPM2.5-transformed =
0.38 × Raw PM2.5 + 2.94

Our 2024 annual report noted that this model performs well in the region and is competitive with other popular PurpleAir transformation models.

Community Spotlight: Mountain Watershed Association

Protecting, Preserving, and Restoring the Youghiogheny River Watershed

"Some people want to discredit the knowledge, or like the brain power, of rural folk," said Stacey Magda, a community organizer with Mountain Watershed Association (MWA). "But you know, when people are driving down the road and they see coal dust piled up on the side of the road or grasses and fields covered in coal dust, they're thinking, 'If that's there, it's in my house, it's in my lungs.'"

For 30 years, MWA has worked to protect, preserve, and restore the Youghiogheny (pronounced 'ya-kuh-ge-nee') River watershed. Commonly known as the "Yough," (pronounced 'yock') this river runs from Backbone Mountain in West Virginia through Western Maryland and into Pennsylvania. After winding its way through Fayette, Westmoreland and Allegheny counties, the Yough flows into the Monongahela River at McKeesport, about 12 miles southeast of Pittsburgh.

Stacey Magda, community organizer with Mountain Watershed Association speaking at a community meeting. Photo: Mountain Watershed Association

Powered by local, grassroots organizing, MWA runs several conservation, advocacy, recreation and education programs. The organization's primary focus is on monitoring water quality and advocating for the waterways and their sustainable use in the Youghiogheny Valley, including key tributaries like Indian Creek. This work entails everything from activism addressing the expansion of coal mining and other polluting industries to collaboration with local governments and state regulators around recreation access and land conservation initiatives to stream remediation projects in partnership.

The group's commitment to environmental justice also extends to protecting the region's air. Since 2022, MWA has been one of two partners in Pennsylvania (the other is the Center for Coalfield Justice), working on the Upper South and Appalachia Citizen Air Monitoring Project. For Stacey Magda, the project is valuable not only for the data collected but also because it is responsive to the vision and leadership of local residents. Magda describes the air monitoring she does with her neighbors as a continuation of MWA's grassroots, people-power tradition.

"[MWA was] started around the kitchen table," said Magda. "And like many grassroots groups, we really have relied — from the beginning — on citizen science, and folks knowing what's going on in their backyards instinctually."

With the earliest mines in Western Pennsylvania dating back to the late 1700s, there are few areas in the United States where coal mining has been going on as long as it has in the Youghiogheny Valley. Most recently, proposed expansions to the Rustic Ridge Deep Mine have alarmed residents. Subsidence caused by such mines is a major

issue in the area, as it can cause damage to homes and other structures and cause streams to dry up entirely. Fugitive coal dust, which blows into the community from stockpiles, preparation facilities and coal trucks, is another key concern.

“We knew from the start that air quality was an issue,” said Magda. “All the coal dust.. all the mining that we have been dealing with in this area… We are dealing with a resurgence of active coal mining and quarry operations here in our hills, and it is setting us back decades.”

To support these communities, MWA has partnered with organizations deploying particulate matter and volatile organic compound (VOC) monitors in locations such as churches and residential yards near polluting facilities.

These affordable, real-time tools help residents validate what they see and feel, such as coal dust accumulating on porches and chemical smells hanging in the air, with data — and visual representations of that data — that they can bring to public meetings and regulators.

By incorporating air monitoring into their broader mission, MWA hopes to empower rural communities with the information they need to hold polluters like LCT Energy, which operates the Rustic Ridge Coal mine complex, accountable to advocate for public health, and to tell their own stories with credible data to back them up.

VOC and Gas Pollutant Monitoring

In addition to measuring particulate matter, USACAMP's two SENSIT RAMP monitors — located in Bristol, Virginia, (unit 1145) and Bristol, Tennessee, (unit 1144) — captured minute-by-minute concentrations of **sulfur dioxide (SO_2), volatile organic compounds (VOCs), ammonia (NH_3), hydrogen sulfide (H_2S), and carbon monoxide (CO).**

These sensors use electrochemical cells and a photo-ionization detector to identify and quantify low-concentration gases. Data was evaluated using public health and occupational exposure standards from multiple agencies, including the EPA's National Ambient Air Quality Standards (NAAQS), Occupational Safety and Health Administration (OSHA) standards, and Mine Safety and Health Administration (MSHA) standards.

Measurements from both sites show that most pollutants remained within generally acceptable levels throughout the quarter. We continue to have some problems with our VOC sensors; both units have been replaced, but unit 1144 needs to be replaced for a second time. The new sensor has been replaced, but it is not reflected in the timeframe of this data. The Sulphur Dioxide had one reading above limits which has been true intermittentely throughout the project.

All other pollutants — NH_3, H_2S, and CO — remained well below their respective regulatory thresholds at both monitoring locations. VOC readings were assessed against OSHA's benzene exposure limit, which serves as a conservative benchmark for potential health concerns.

A description of the measured gases and table of relevant standards is included below.

- **Volatile organic compounds (VOCs)** are a category of organic chemicals characterized by high vapor pressures at room temperature; these compounds easily transition into gaseous states under normal atmospheric conditions. Exposure to high levels of some VOCs can irritate the eyes and throat, cause nausea and trouble breathing, and is associated with damage to the central nervous system and other organs, according to the American Lung Association. Being a category of gases, they can not be directly compared to any one standard. For the purpose of this project, the performance of the SENSIT RAMP VOC sensor is specifically compared to OSHA's exposure limits for benzene.
- **Carbon Monoxide (CO)** is a colorless, odorless gas produced by burning fossil fuels. It is harmful because it can prevent the blood from carrying oxygen to cells, tissues, and organs.
- **Ammonia (NH3)** is a colorless gas with a pungent odor, commonly used in industrial and cleaning products. It is a common toxicant that originates from wastes, fertilizers, and natural processes.
- **Sulfur Dioxide (SO2)** is a gas produced by industrial processes, especially the burning of fossil fuels containing sulfur. It can cause respiratory problems and contribute to the formation of acid rain.
- **Hydrogen Sulfide (H2S)** is a colorless gas known for its characteristic foul odor of rotten eggs. It is toxic and can cause respiratory distress and other health issues at high concentrations.

Chemical Concentration Limits

Ammonia	NH_3	OSHA sets a permissible exposure limit (PEL) of 50 parts per million (ppm) as an 8-hour time-weighted average (TWA).
Volatile organic compounds	VOCs (benzene)	OSHA sets a PEL for benzene of 1 ppm as an 8-hour TWA.
Sulfur dioxide	SO_2	The EPA NAAQS for SO2 specifies that the highest observed 1-hour SO2 concentration should not exceed 75 parts per billion (ppb) more than once per year.*
Carbon monoxide	CO	The EPA NAAQS limits CO to 9 ppm over an 8-hour period and 35 ppm over a 1-hour period.
Hydrogen sulfide	H_2S	MSHA imposes a ceiling of 20 ppm to prevent chronic effects, and a short-term exposure limit (STEL) of 50 ppm for up to 10 minutes to allow for brief peak exposures without severe health risks.

VOC and Other Pollutant Data

All SENSIT RAMP data was compared against the relevant standards. No exceedances were indicated for any of the parameters measured. The table and graphs below show the highest concentrations detected by each of the SENSIT RAMP devices, utilizing calculations as described in the regulations. Sulfur dioxide is shown with the second-highest max value for the quarter, as the regulations require the highest values to be excluded from calculations.

SENSIT RAMP Data

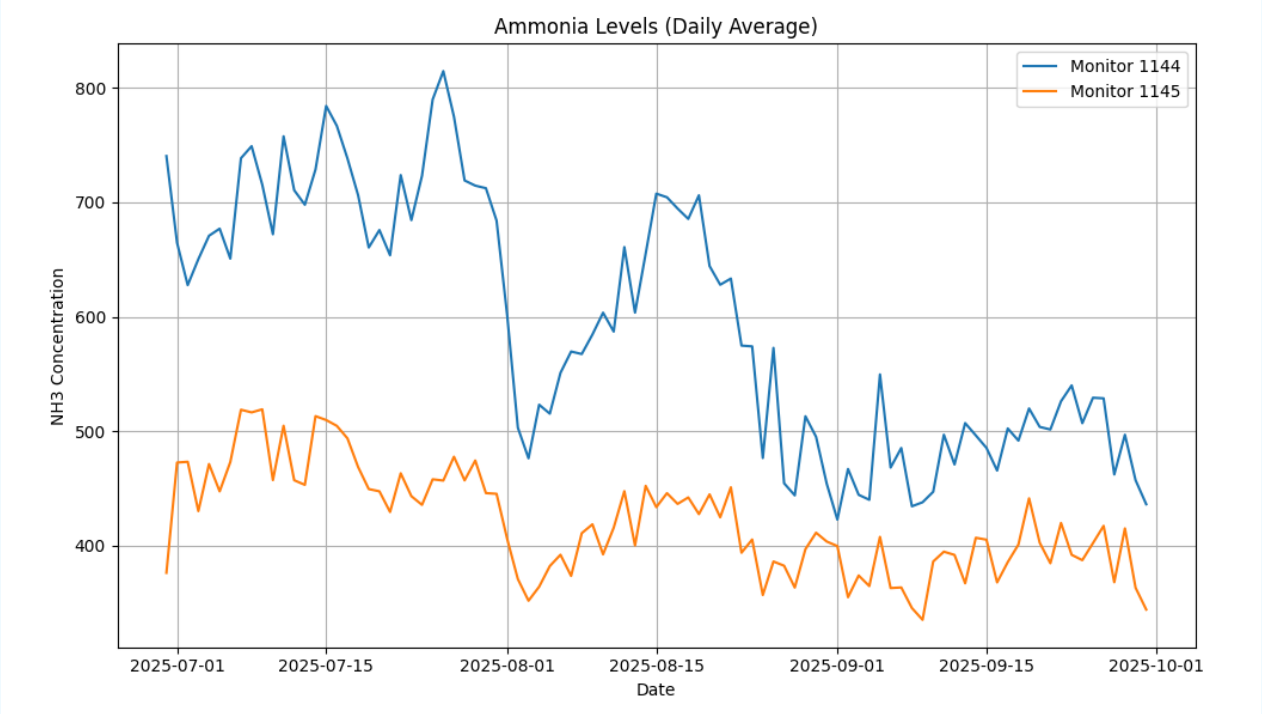
Parameter	Metric Type	Standard	1144	1145
Ammonia (NH3)	Max 8-Hour Weighted Avg	50 ppm (8-hr TWA OSHA)	0.96	0.73
Carbon Monoxide (CO)	Max 1-Hour Avg	35 ppm (1-hr NAAQS)	0.74	0.51
Carbon Monoxide (CO)	Max 8-Hour Avg	9 ppm (8-hr NAAQS)	1.51	0.60
Hydrogen Sulfide (H2S)	Max Concentration	50 ppm (10-min MSHA)	0.17	0.22
Sulfur Dioxide (SO2)	Max Hourly Avg	0.075 ppm (1-hr NAAQS)	0.07	0.22
Volatile Organic Compounds (VOC)	Max 15-Min Avg	5 ppm (15-min STEL OSHA)	N/A	N/A
Volatile Organic Compounds (VOC)	Max 8-Hour Avg	1 ppm (8-hr TWA OSHA)	0.00	0.04

All results reported in parts per million (ppm)

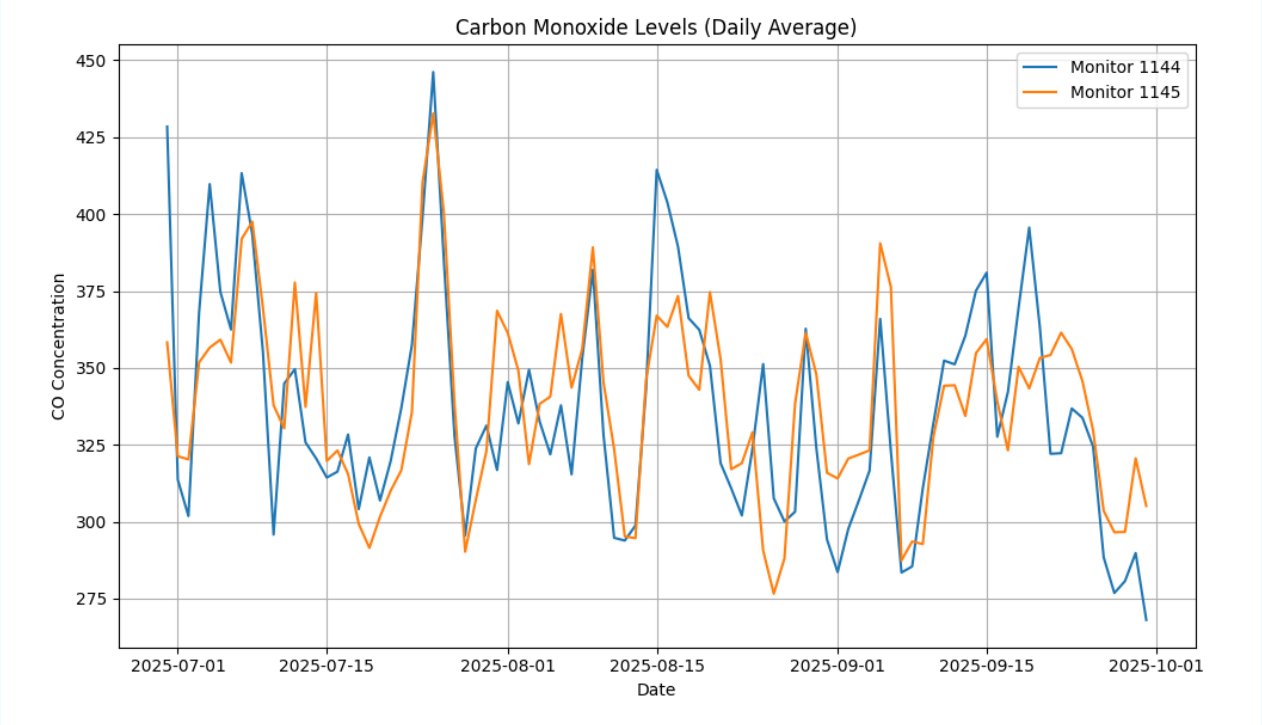
*National primary ambient air quality standards require three years' worth of data for calculations used to determine an exceedance. That said, we do expect exceedances of SO2 will be likely, given the data we have thus far. But this data will also be averaged with data for other years, so it is possible that the average value could remain in compliance.

Graphs of data from the SENSIT RAMPs are shown on the following pages.

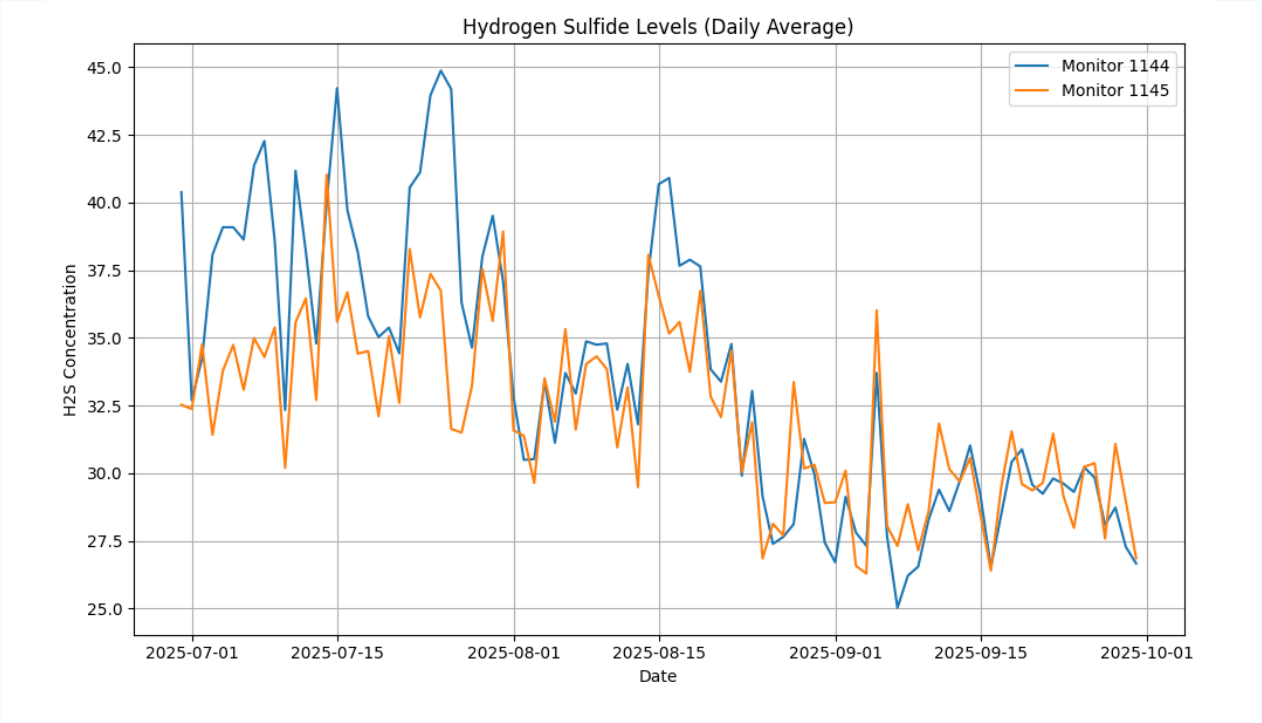
Ammonia: Bristol Virginia and Tennessee



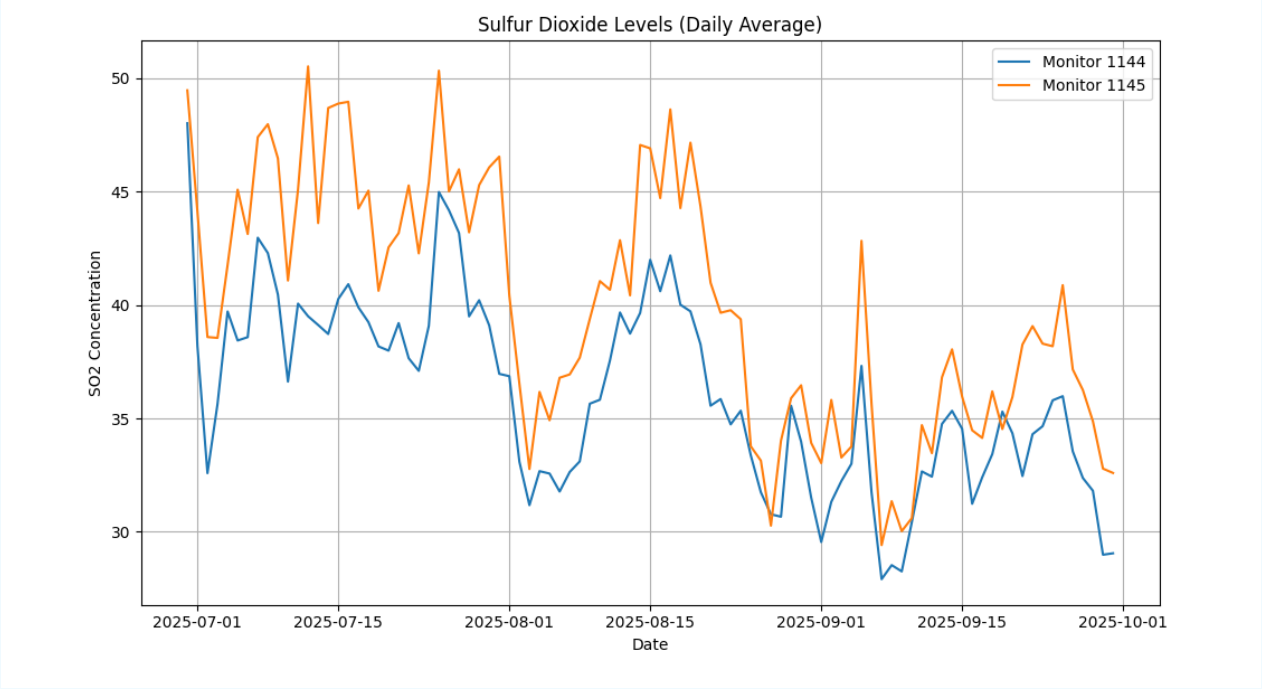
Carbon Monoxide: Bristol Virginia and Tennessee



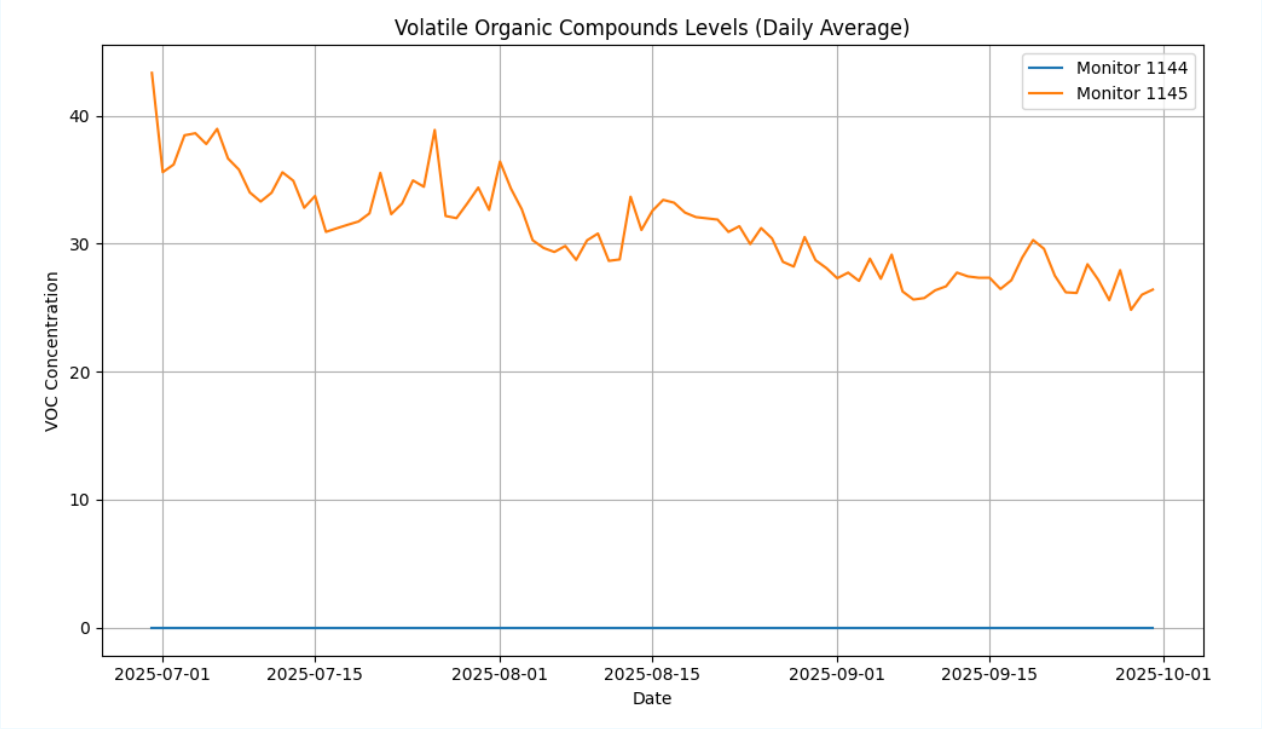
Hydrogen Sulfide: Bristol Virginia and Tennessee



Sulfur Dioxide: Bristol Virginia and Tennessee



Volatile Organic Compounds: Bristol Virginia and Tennessee



Note: Monitor 1144 and 1145 sensors are failing to report VOC data. The sensors are being replaced.

SENSIT RAMP monitors.

Conclusion and Future Directions

The Project Quarter 8 USACAMP dataset provides another quarter of valuable air quality data from rural and underserved communities across Central Appalachia and the Upper South. With growing sensor coverage, expanded analysis methods, and strong community partnerships, we look forward to improving our technical evaluations and continuing this work throughout the year to serve the community.

Questions and data requests can be directed to Willie Dodson at willie@appvoices.org or Matt Hepler at matt.hepler@appvoices.org.

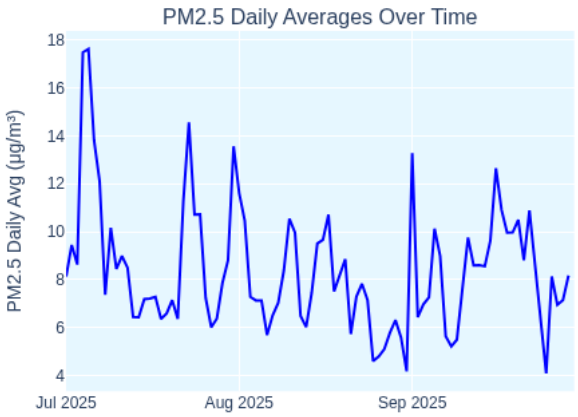
Photo: Michael Swensen for EarthJustice

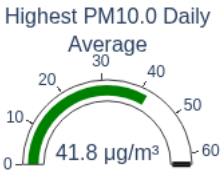
Appendix A

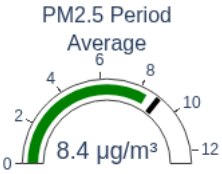
Quarterly PM2.5 and PM10 Trends

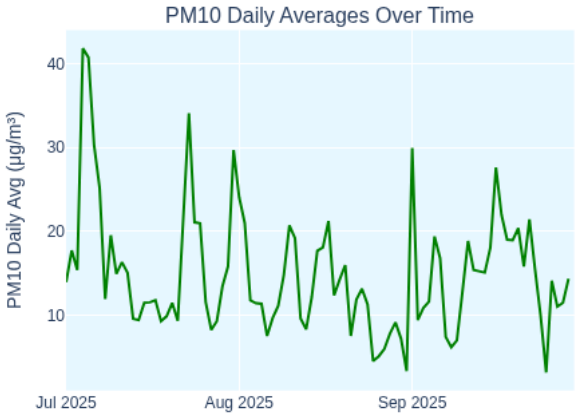
KENTUCKY

2025-01-01 to 2025-03-31 Report for Sensor 184505: AV-40, Clark_County, KY









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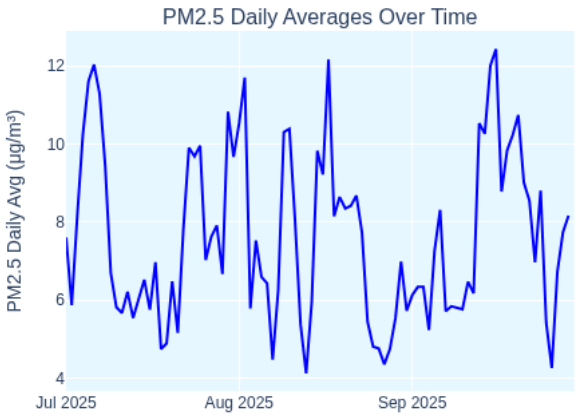

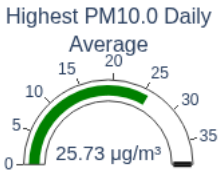

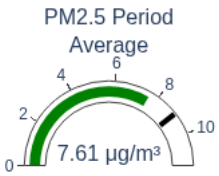

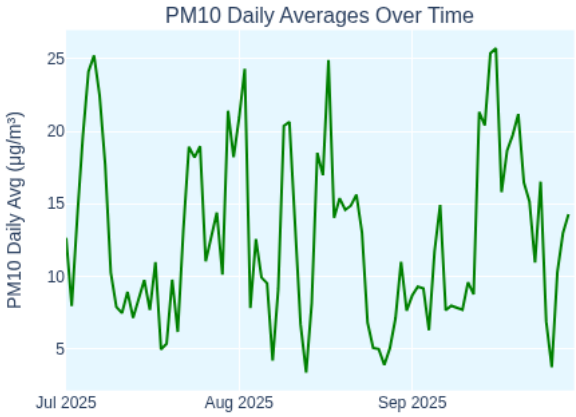

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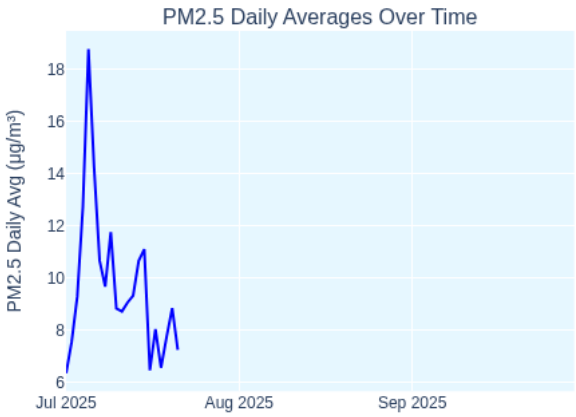

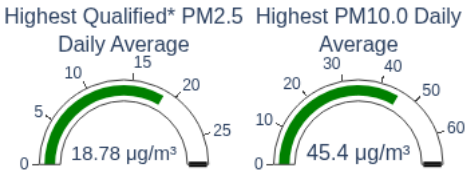

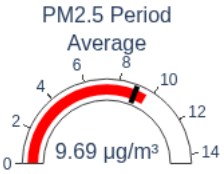

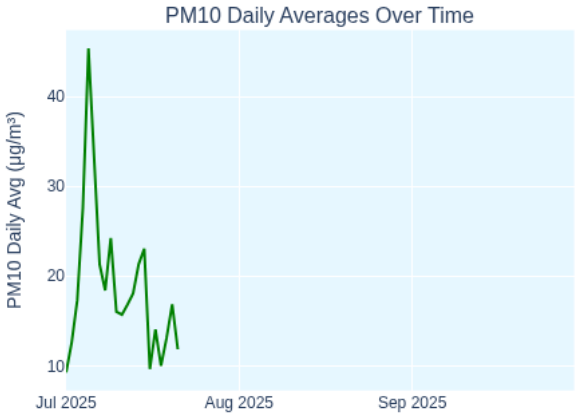

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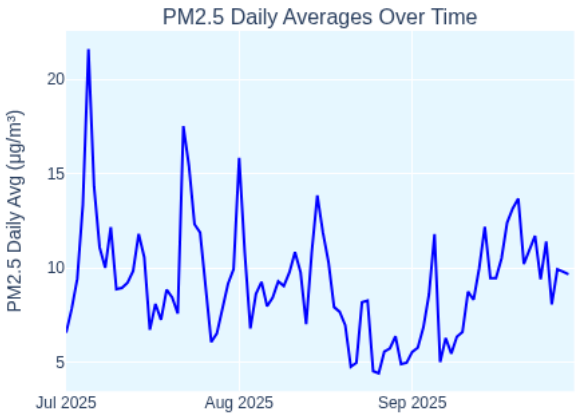

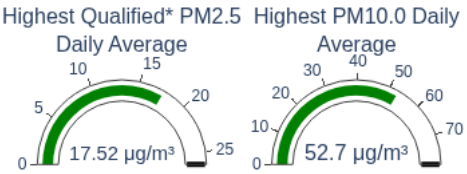

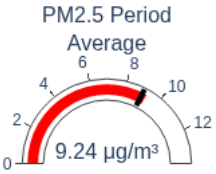

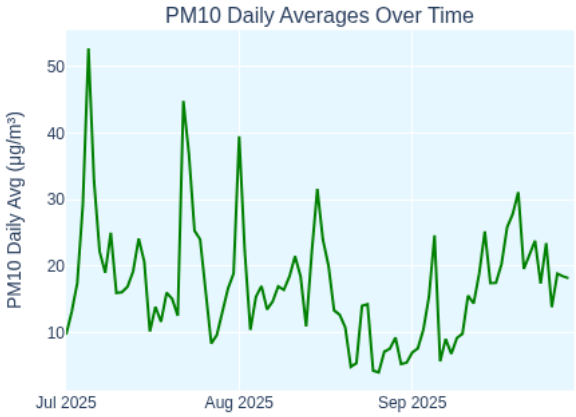

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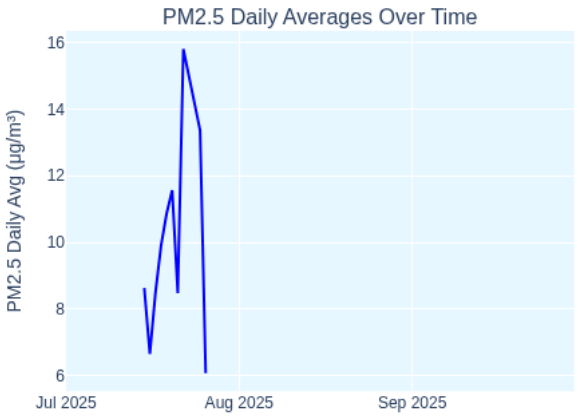

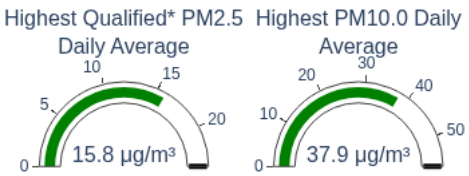

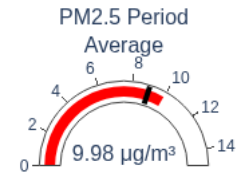

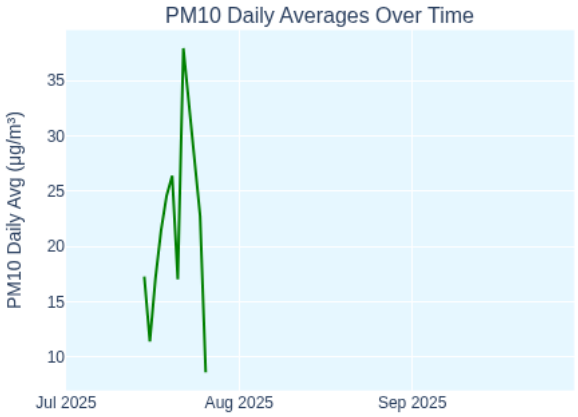

PENNSYLVANIA

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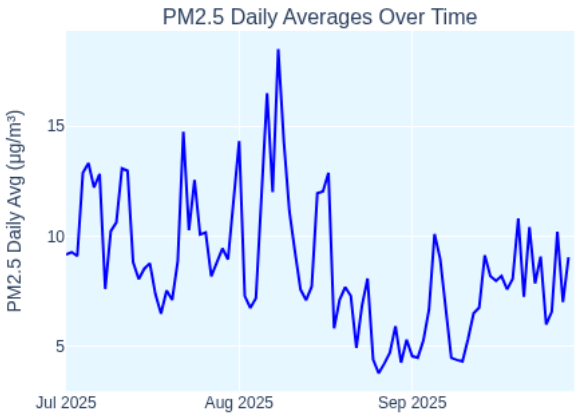

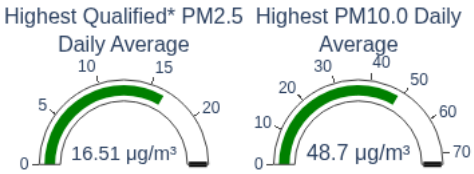

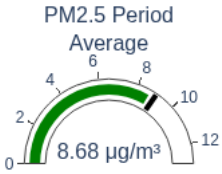

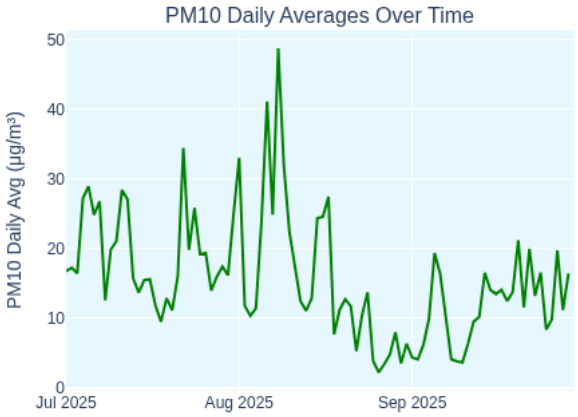

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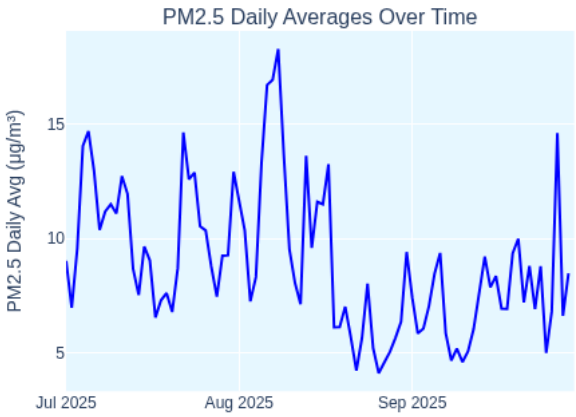
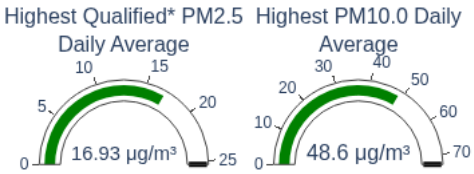
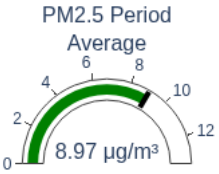
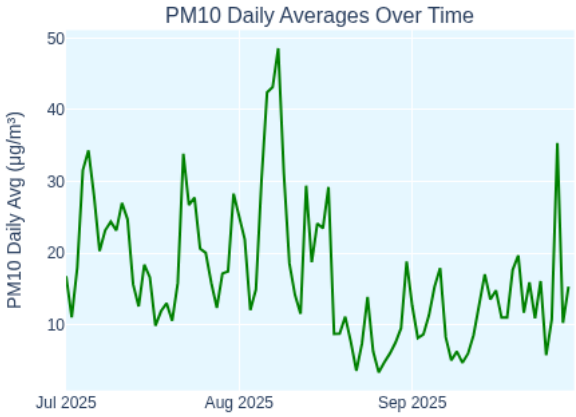
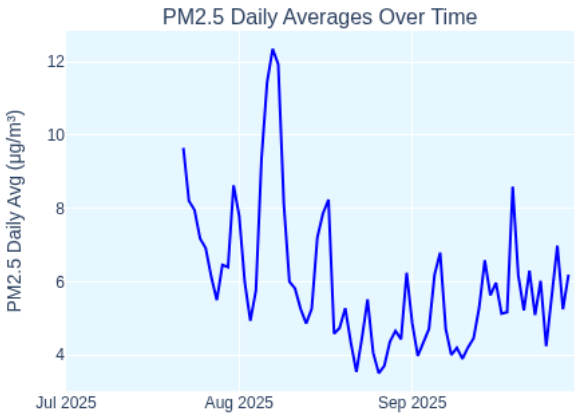


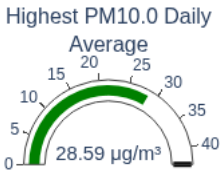


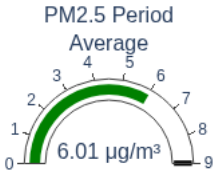


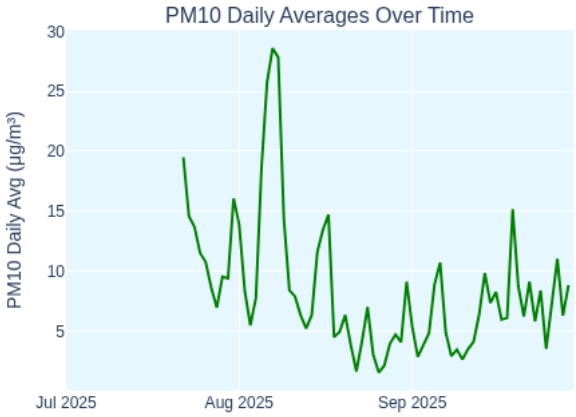


2025-01-01 to 2025-03-31 Report for Sensor 183811: AV-10, Westmoreland_County, F



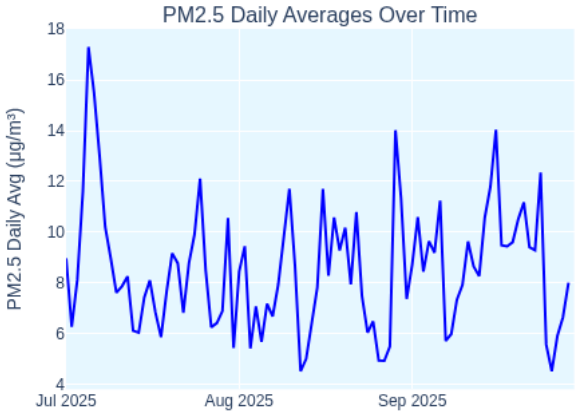


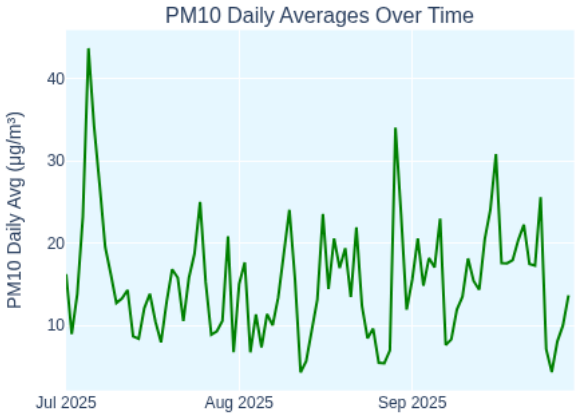


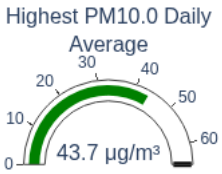


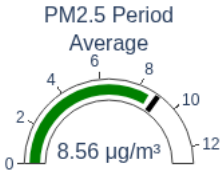
TENNESSEE

2025-01-01 to 2025-03-31 Report for Sensor 196109: AV-49, Anderson_County, TN

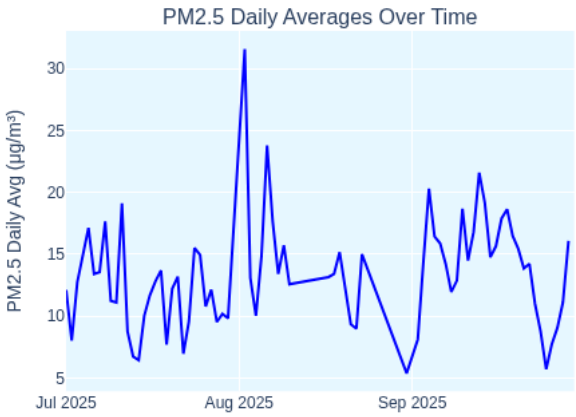


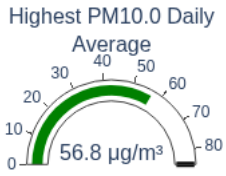


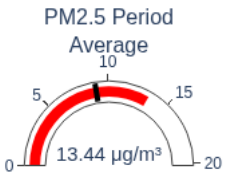


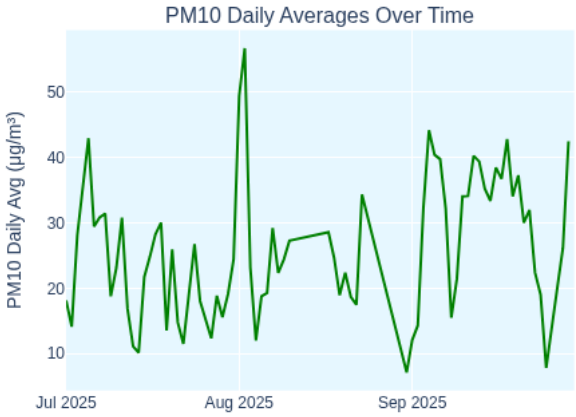


2025-01-01 to 2025-03-31 Report for Sensor 184531: AV-29, Montgomery_County, TN

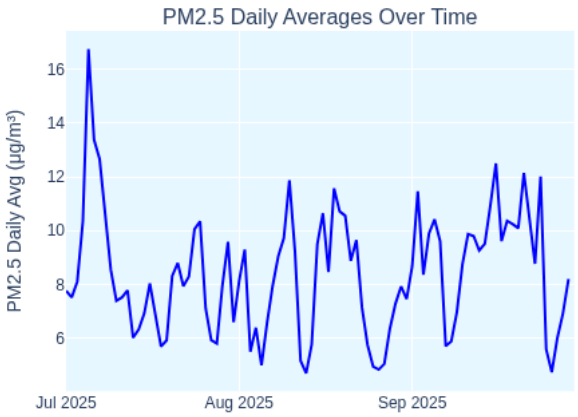


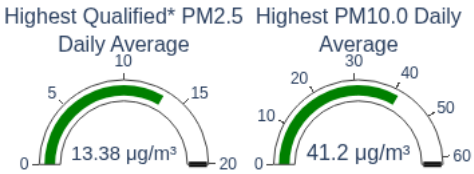


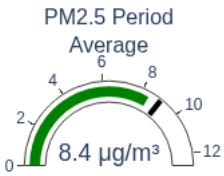


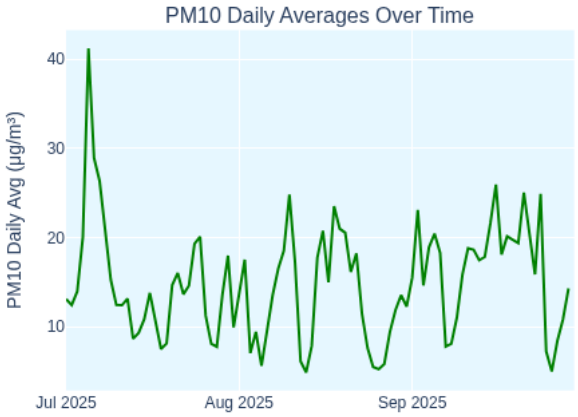


2025-01-01 to 2025-03-31 Report for Sensor 184349: AV-30, Roane_County, TN



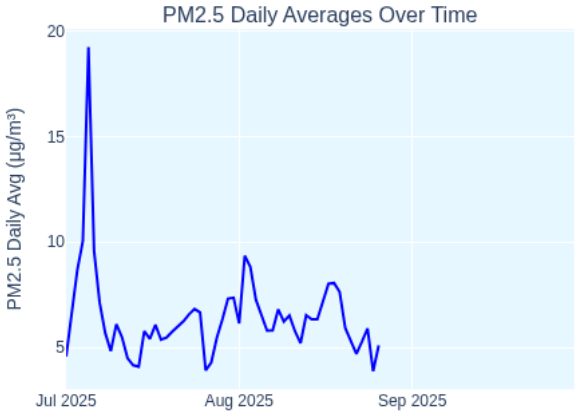


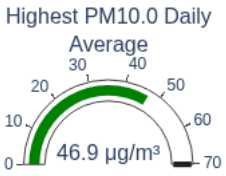


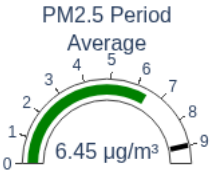


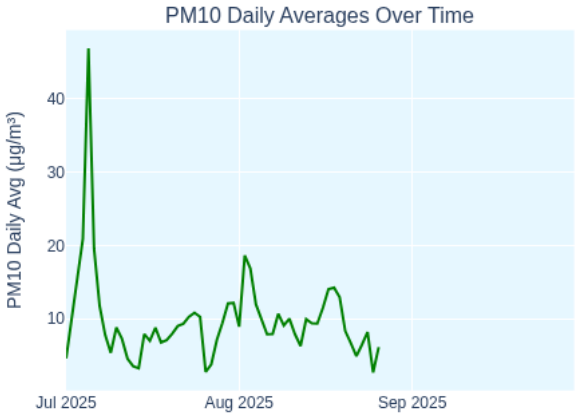
2025-01-01 to 2025-03-31 Report for Sensor 212013: AV-63, Shelby_County, TN

Note: This report has been flagged as possibly returning insufficient data.

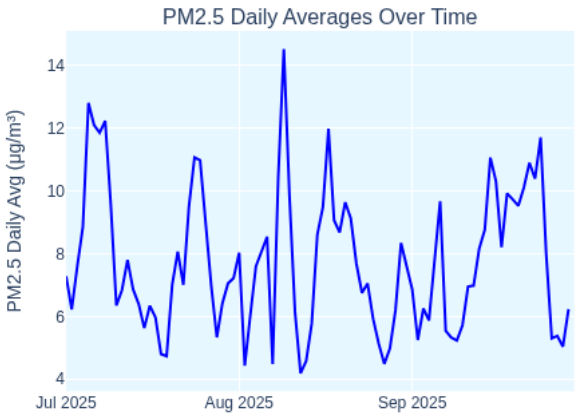


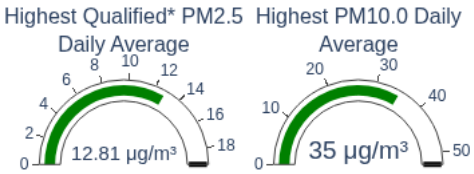


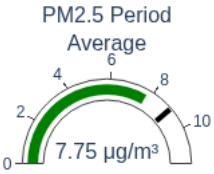


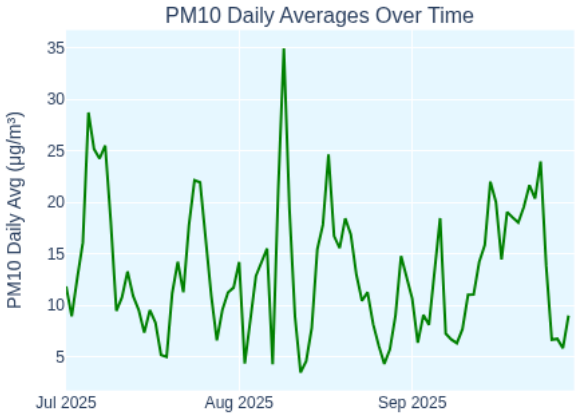


2025-01-01 to 2025-03-31 Report for Sensor 199001: AV-59, Sullivan_County, TN

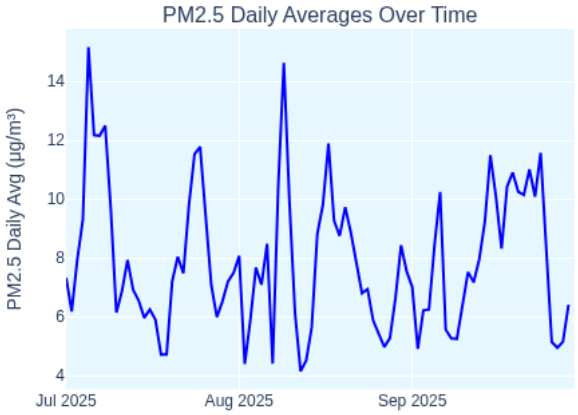


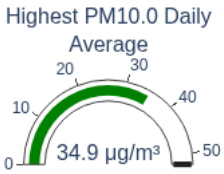


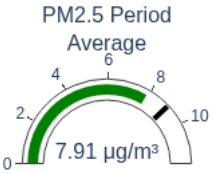


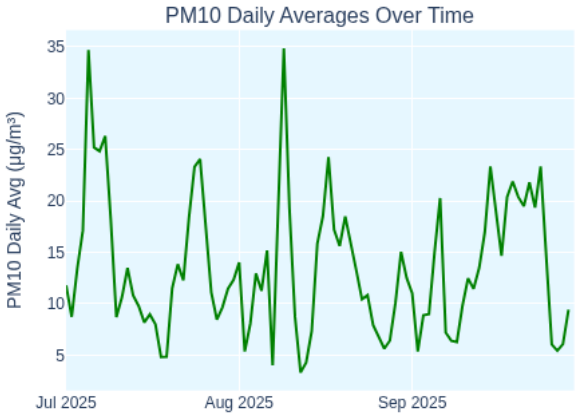


2025-01-01 to 2025-03-31 Report for Sensor 198979: AV-60, Sullivan_County, TN





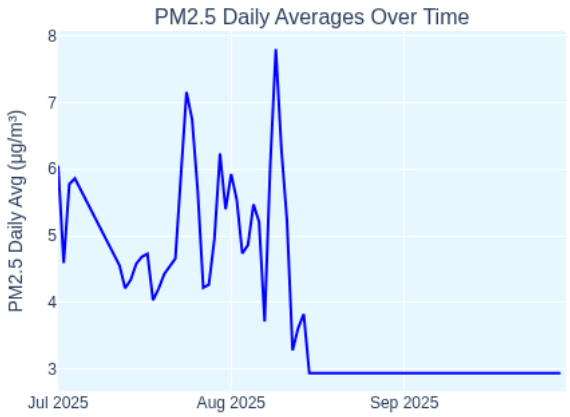


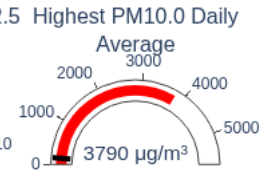


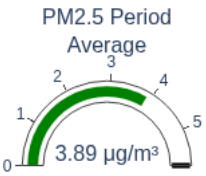
VIRGINIA

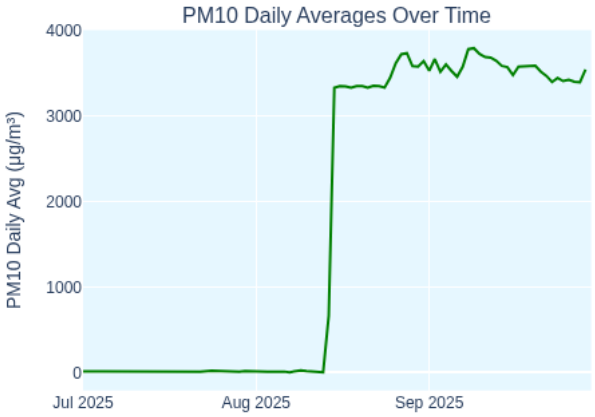
2025-01-01 to 2025-03-31 Report for Sensor 198969: AV-55, Buchanan_County, VA

Note: This report has been flagged as possibly returning insufficient data.



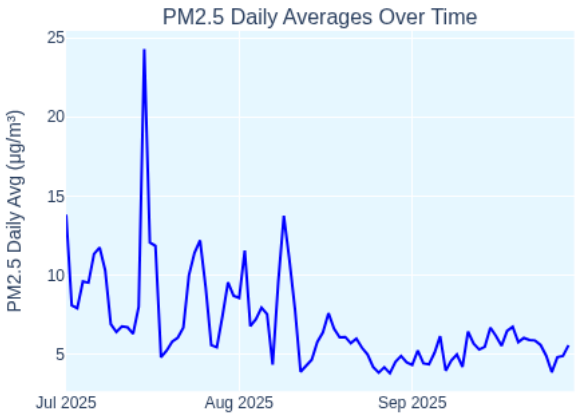


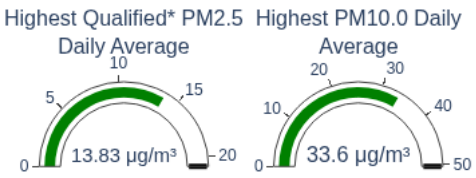


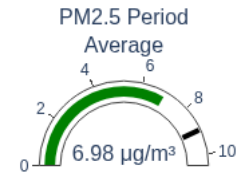


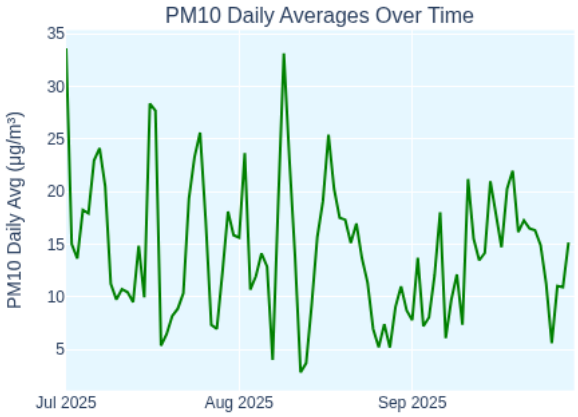
Days PM2.5 Exceeded	Days PM10.0 Exceeded
	2025-08-14
	2025-08-15
	2025-08-16
	2025-08-17
	2025-08-18
	2025-08-19
	2025-08-20
	2025-08-21
	2025-08-22
	2025-08-23
	2025-08-24
	2025-08-25

2025-01-01 to 2025-03-31 Report for Sensor 198281: AV-57, Buchanan_County, VA

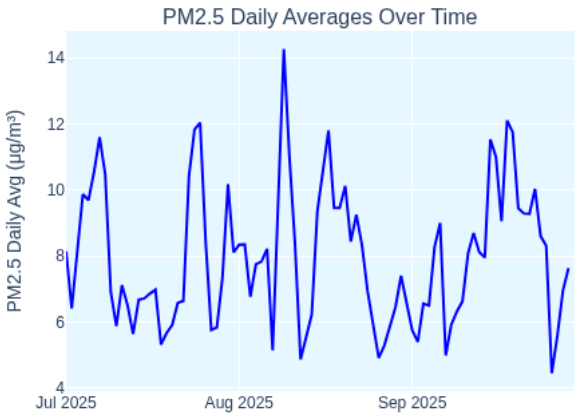


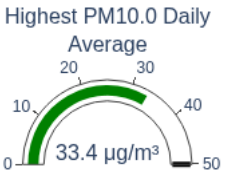


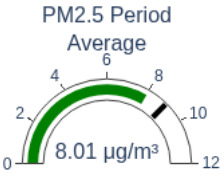


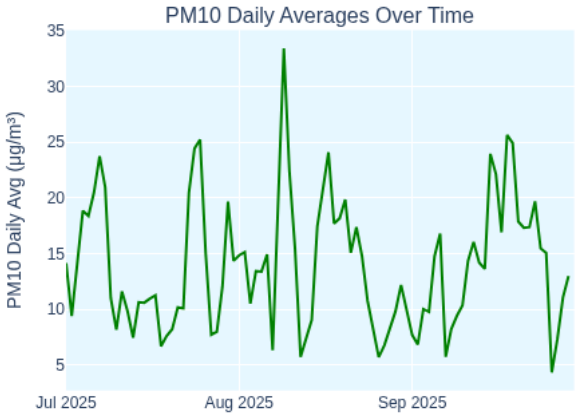


2025-01-01 to 2025-03-31 Report for Sensor 211973: AV-64, Buchanan_County, VA

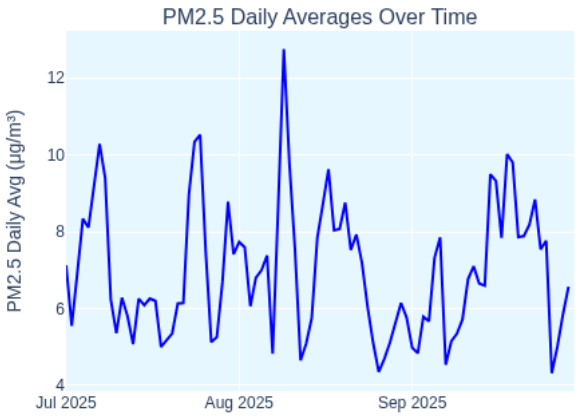


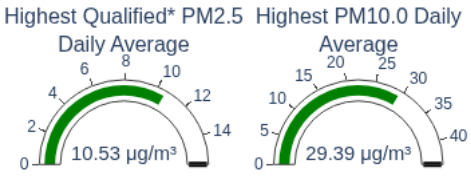


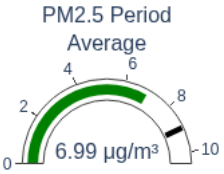


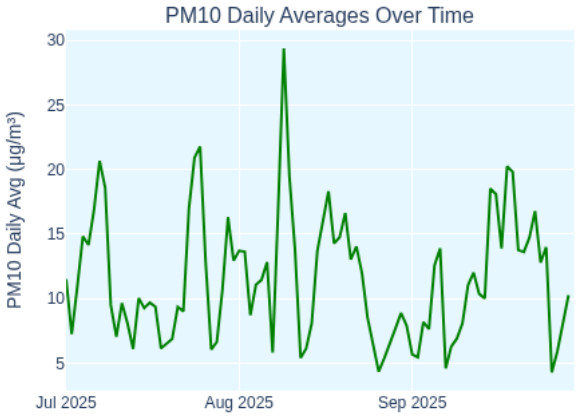


2025-01-01 to 2025-03-31 Report for Sensor 211937: AV-65, Buchanan_County, VA



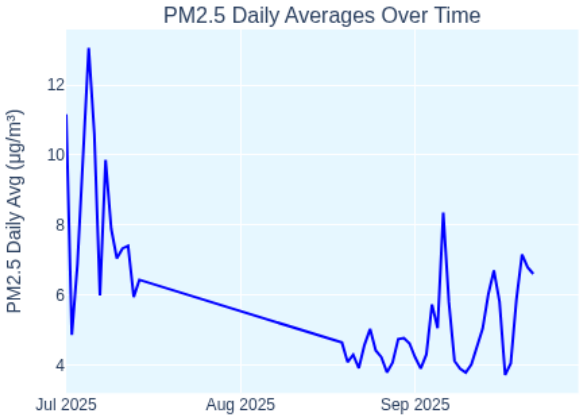


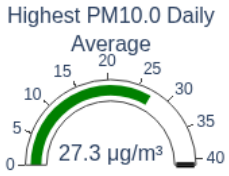


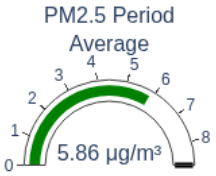


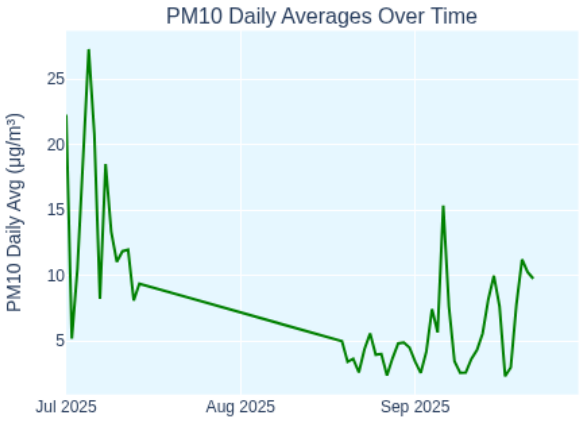
2025-01-01 to 2025-03-31 Report for Sensor 183737: AV-34, Buckingham_County, VA

Note: This report has been flagged as possibly returning insufficient data.



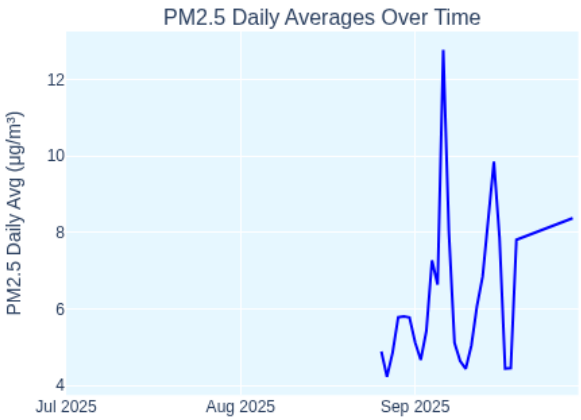


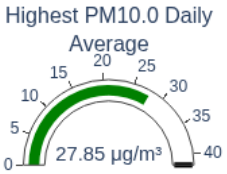


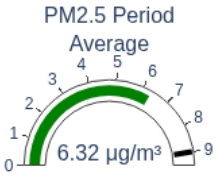


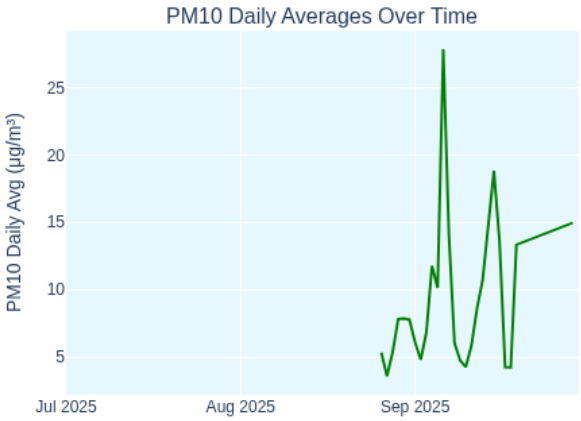
2025-01-01 to 2025-03-31 Report for Sensor 184523: AV-39, Buckingham_County, VA

Note: This report has been flagged as possibly returning insufficient data.



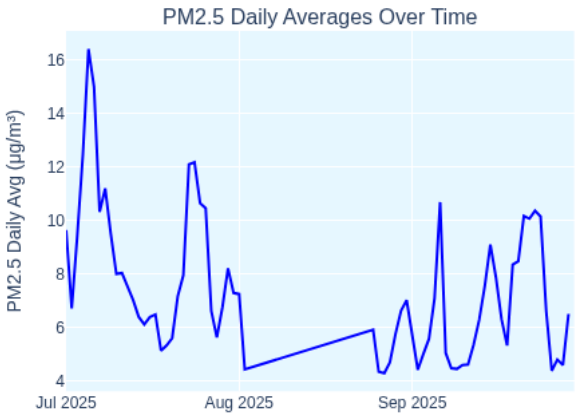


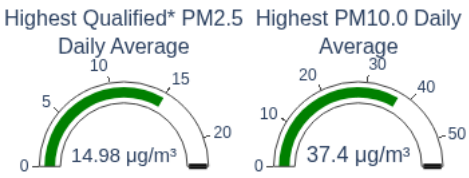


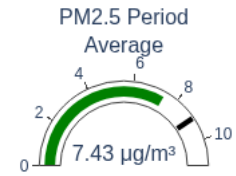


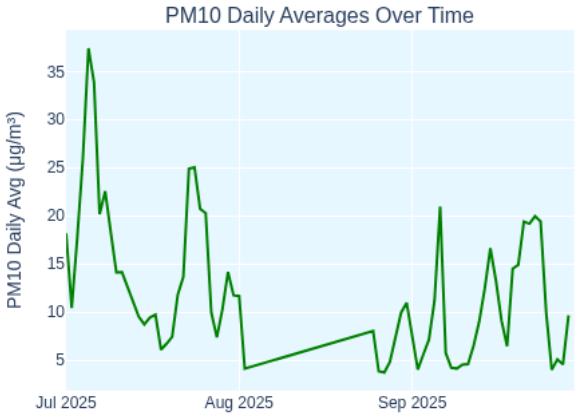
2025-01-01 to 2025-03-31 Report for Sensor 183743: AV-04, Montgomery_County, VA

Note: This report has been flagged as possibly returning insufficient data.

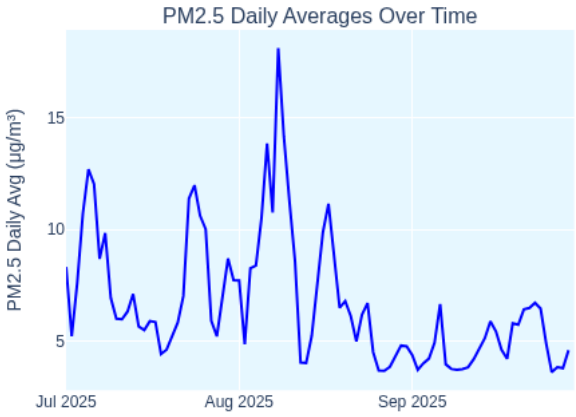


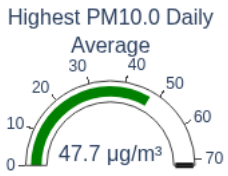


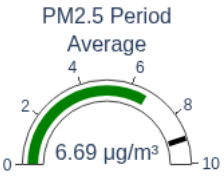


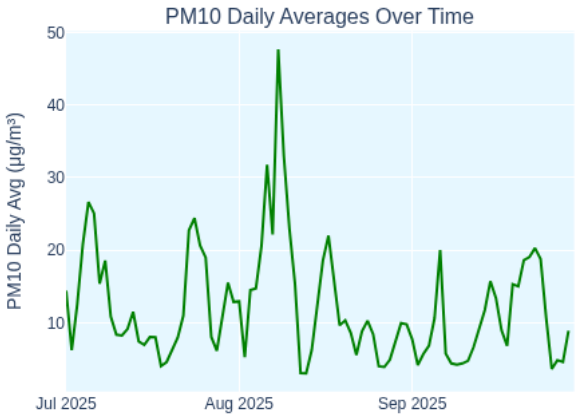


2025-01-01 to 2025-03-31 Report for Sensor 183813: AV-05, Montgomery_County, VA



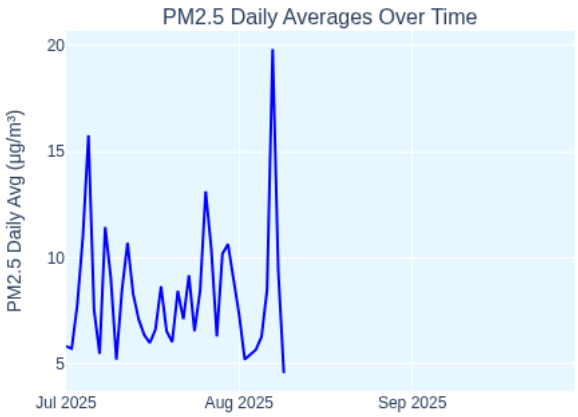


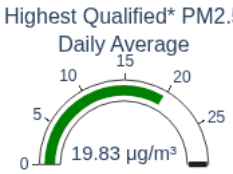


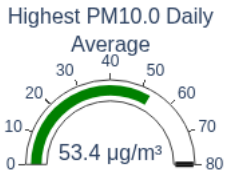


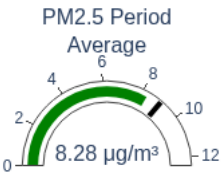
2025-01-01 to 2025-03-31 Report for Sensor 196167: AV-47, Norfolk, VA

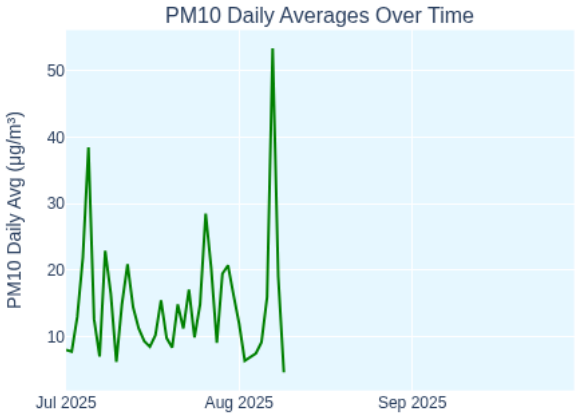
Note: This report has been flagged as possibly returning insufficient data.



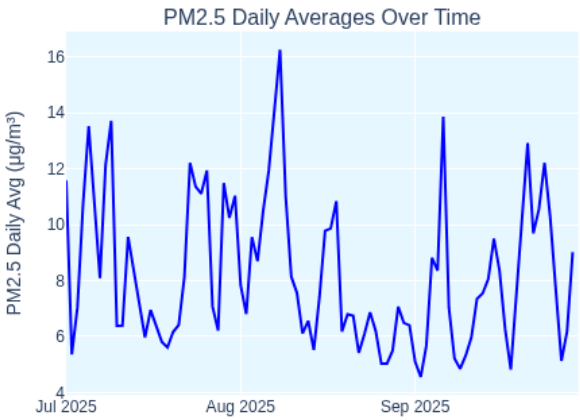


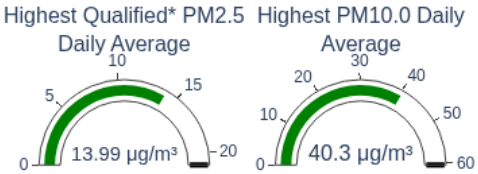


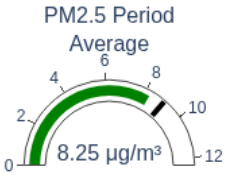


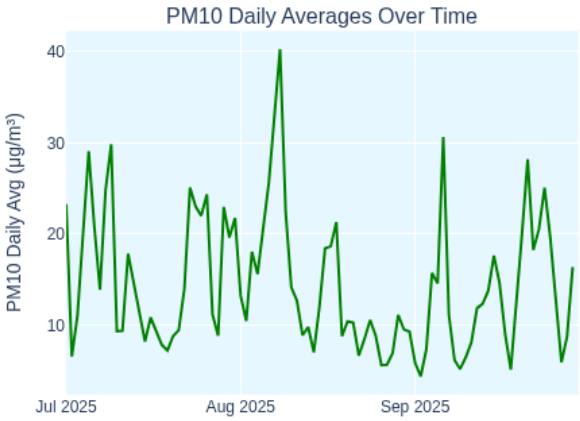


2025-01-01 to 2025-03-31 Report for Sensor 184519: AV-35, Pittsylvania_County, VA



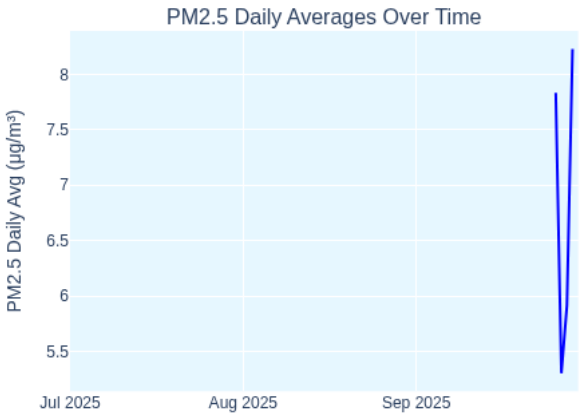


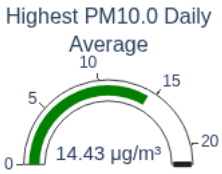


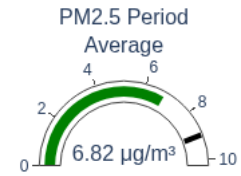


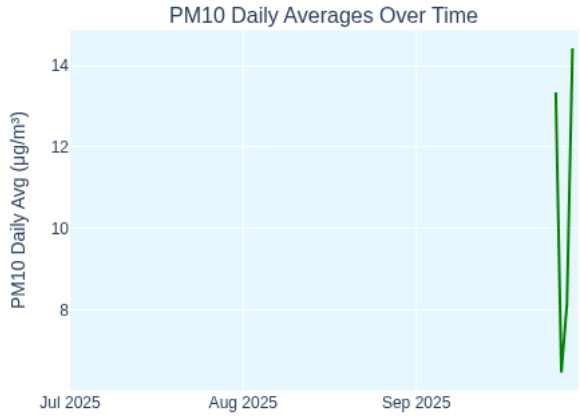
2025-01-01 to 2025-03-31 Report for Sensor 211949: AV-62, Pittsylvania_County, VA

Note: This report has been flagged as possibly returning insufficient data.

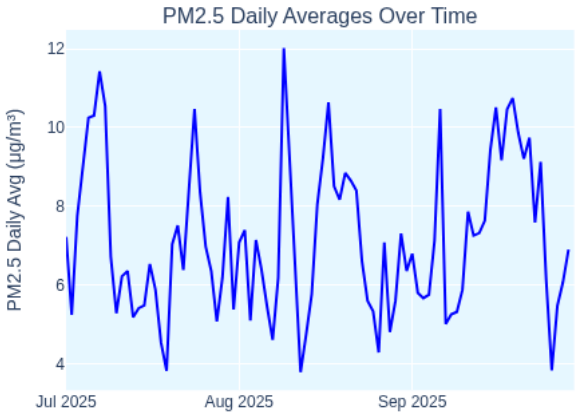


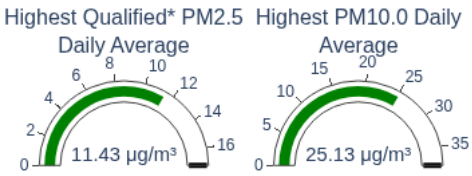


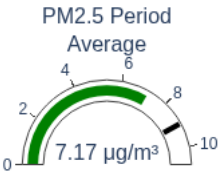


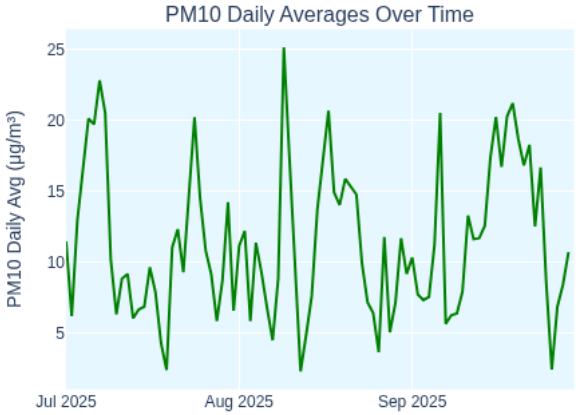


2025-01-01 to 2025-03-31 Report for Sensor 183749: AV-16, Wise_County, VA

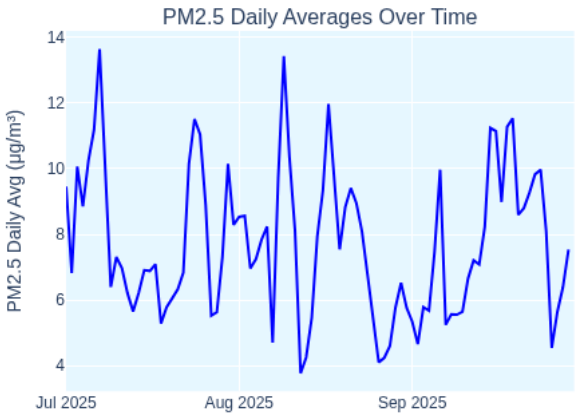


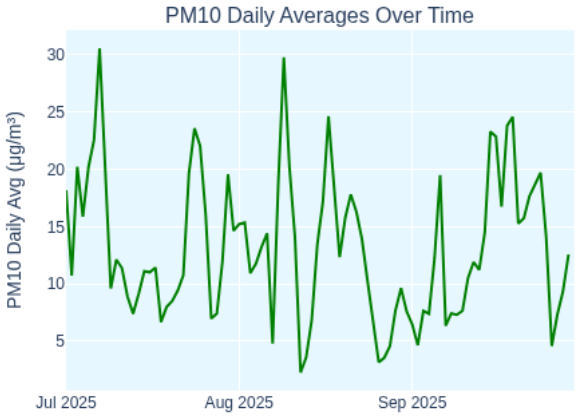


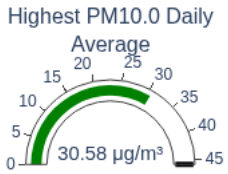


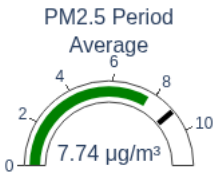


2025-01-01 to 2025-03-31 Report for Sensor 184559: AV-25, Wise_County, VA

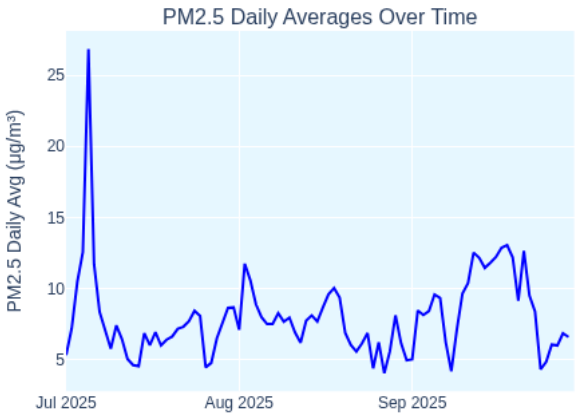


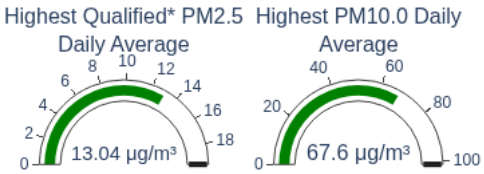


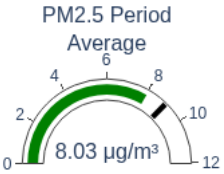


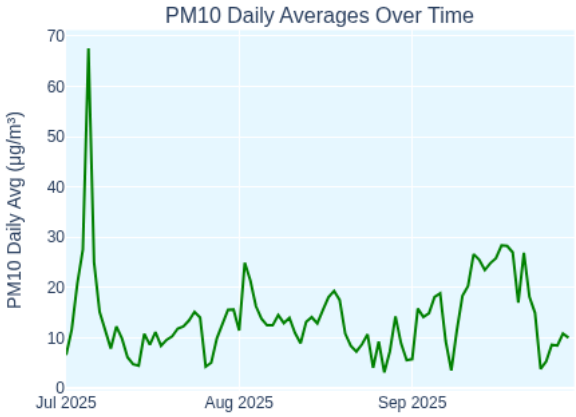


2025-01-01 to 2025-03-31 Report for Sensor 198253: AV-53, Wise_County, VA



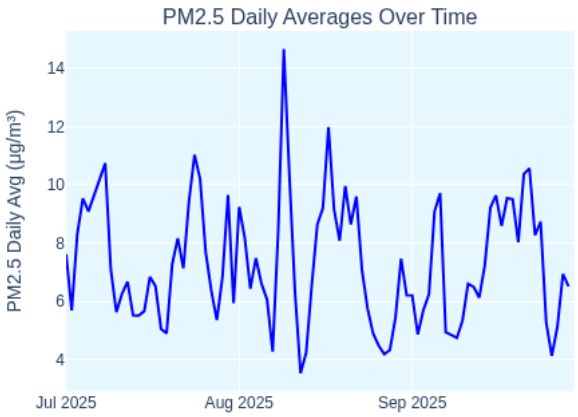


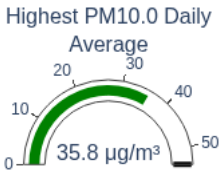


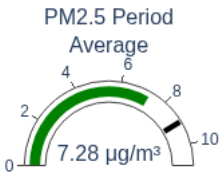


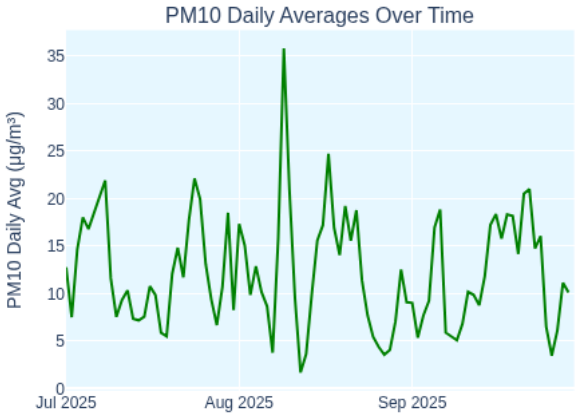
WEST VIRGINIA

2025-01-01 to 2025-03-31 Report for Sensor 199007: AV-52, Boone_County, WV

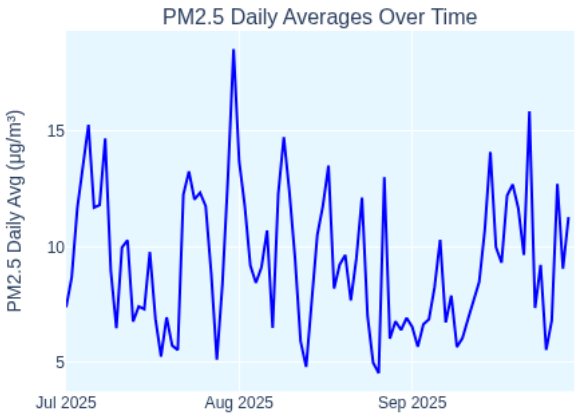


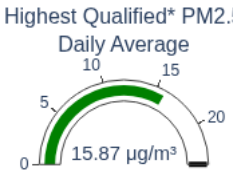


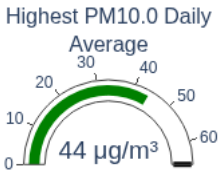


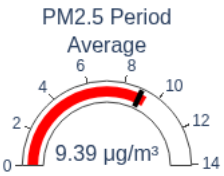


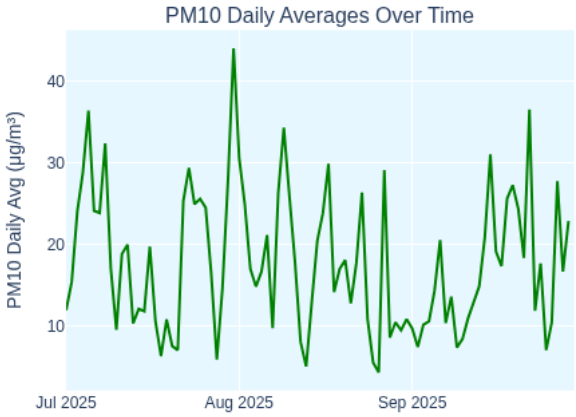
2025-01-01 to 2025-03-31 Report for Sensor 184513: AV-24, Kanawha_County, WV





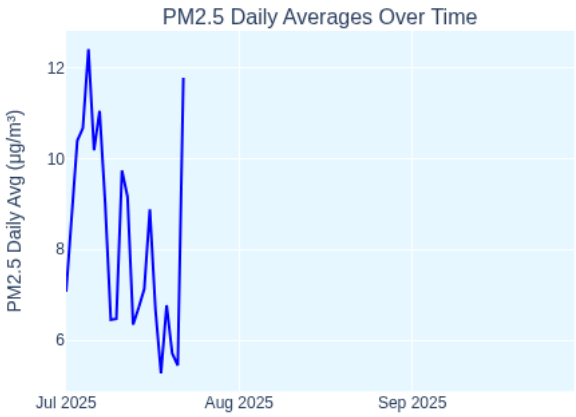


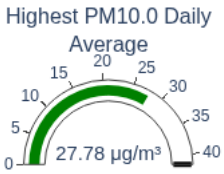


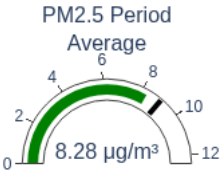


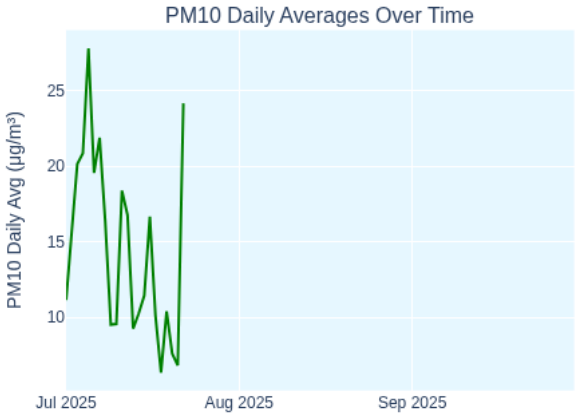
2025-01-01 to 2025-03-31 Report for Sensor 184561: AV-32, Kanawha_County, WV

Note: This report has been flagged as possibly returning insufficient data.

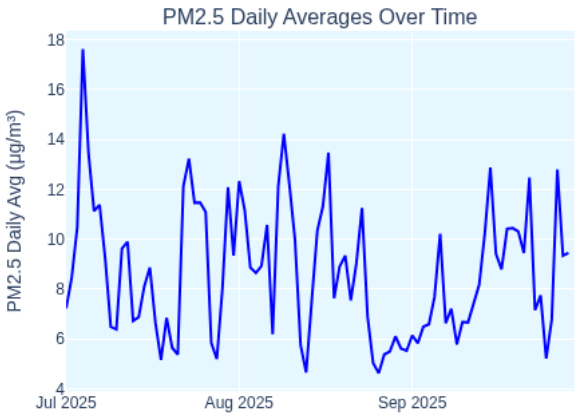


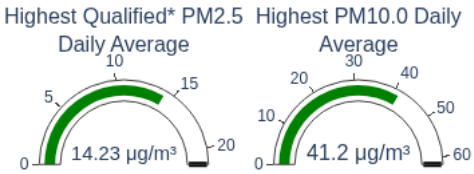


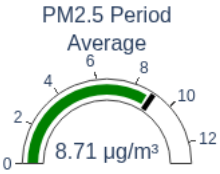


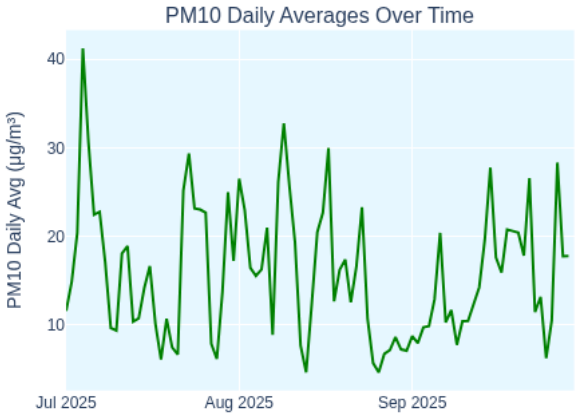


2025-01-01 to 2025-03-31 Report for Sensor 184515: AV-36, Kanawha_County, WV

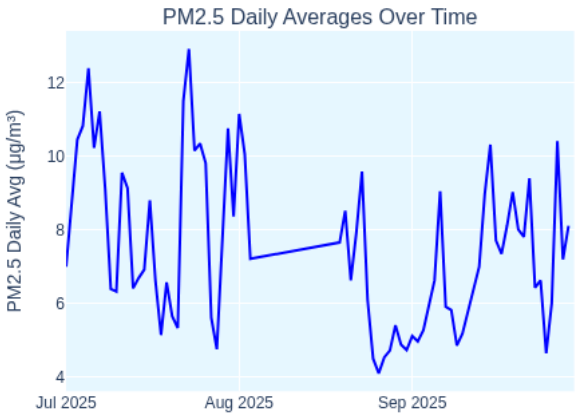


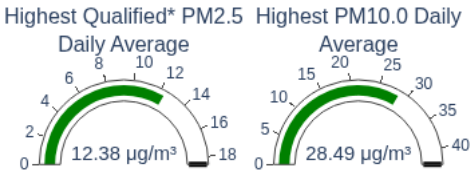


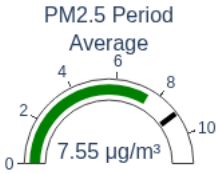


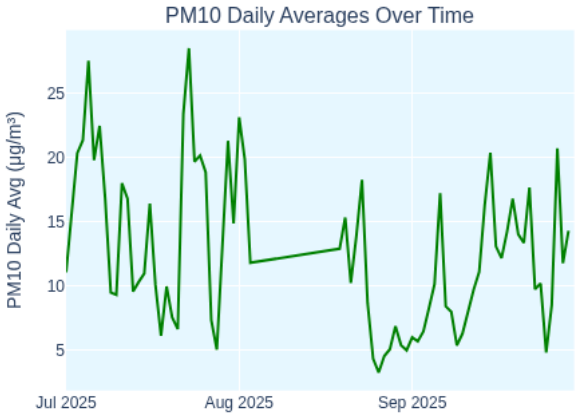


2025-01-01 to 2025-03-31 Report for Sensor 183793: AV-38, Kanawha_County, WV



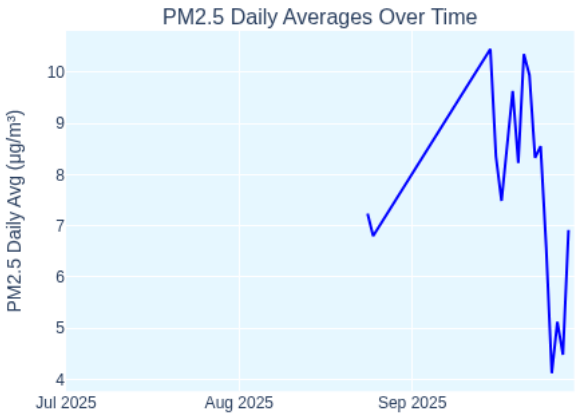


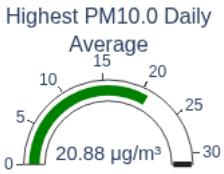


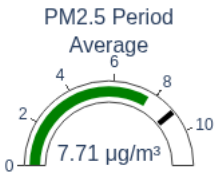


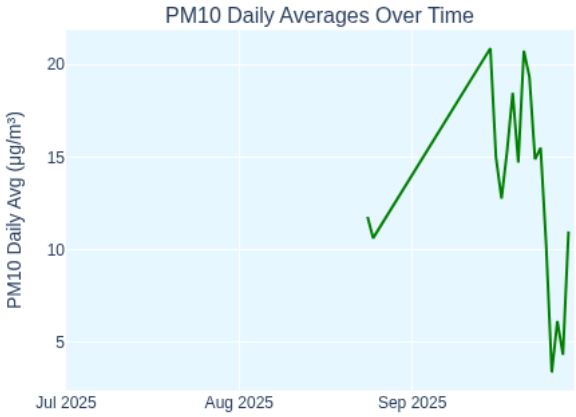
2025-01-01 to 2025-03-31 Report for Sensor 183807: AV-03, McDowell_County, WV

Note: This report has been flagged as possibly returning insufficient data.

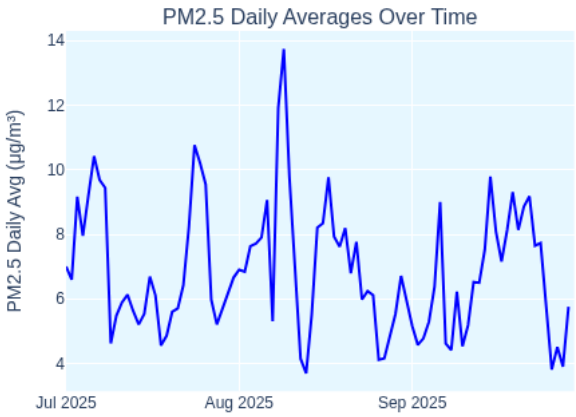


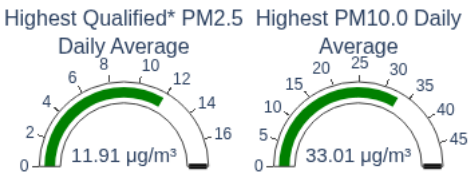


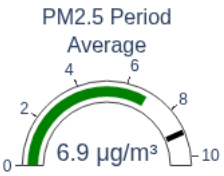


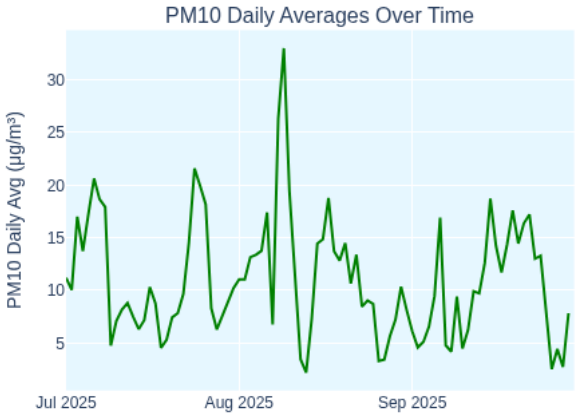


2025-01-01 to 2025-03-31 Report for Sensor 198997: AV-42, McDowell_County, WV

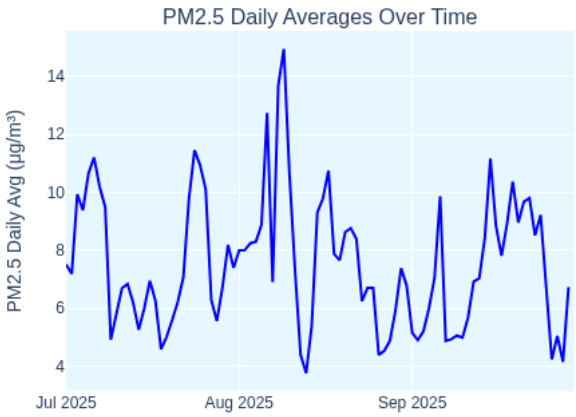


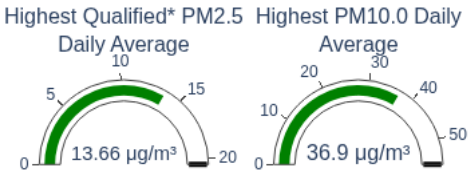


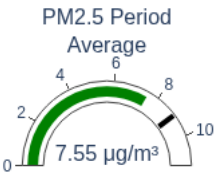


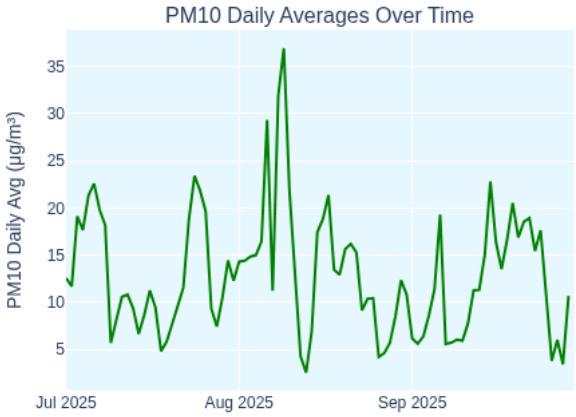


2025-01-01 to 2025-03-31 Report for Sensor 199027: AV-44, McDowell_County, WV



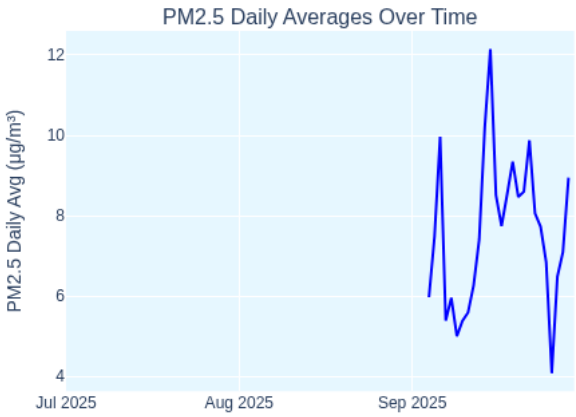


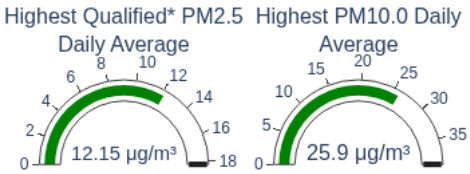


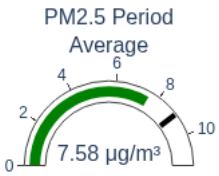


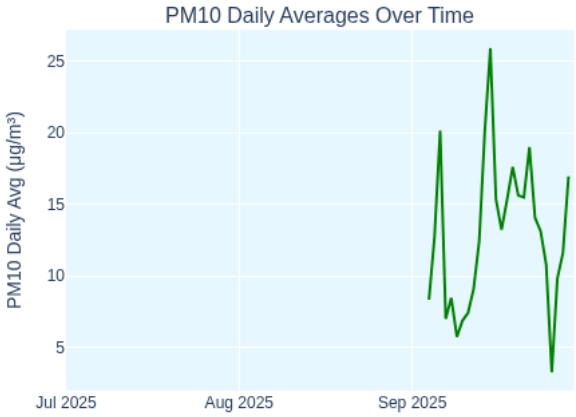
2025-01-01 to 2025-03-31 Report for Sensor 183769: AV-08, Raleigh_County, WV

Note: This report has been flagged as possibly returning insufficient data.

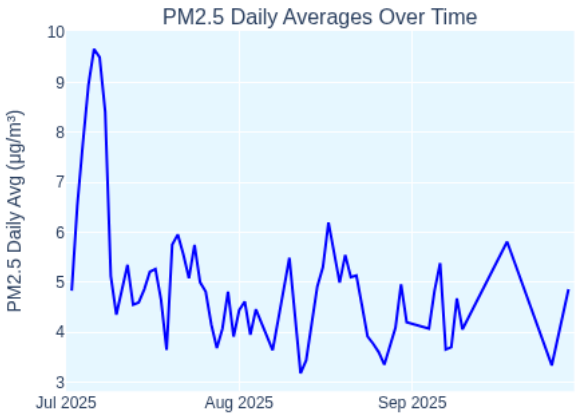


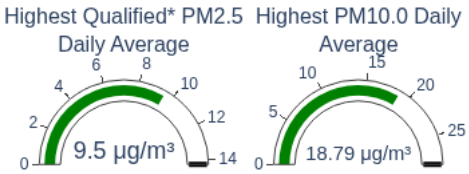


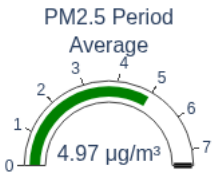


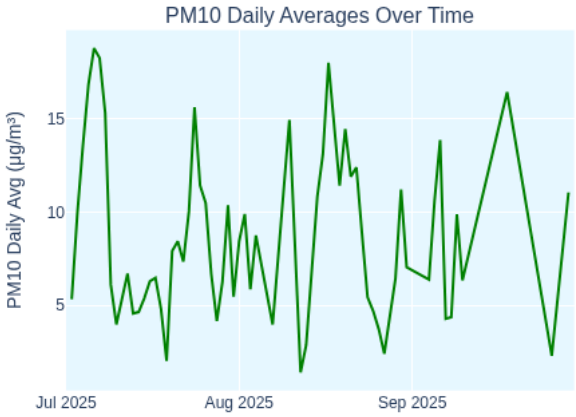


2025-01-01 to 2025-03-31 Report for Sensor 198477: AV-43, Raleigh County, WV

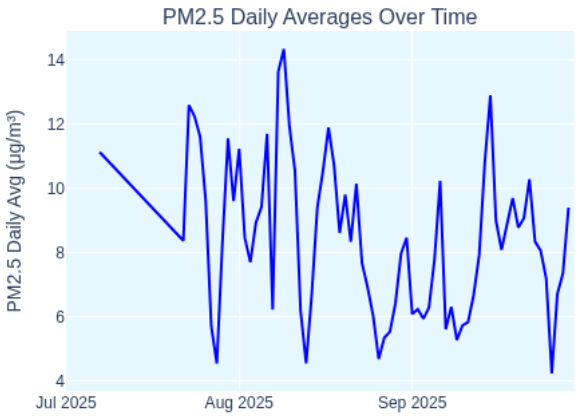


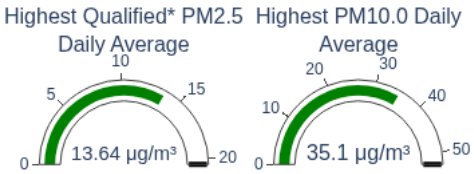


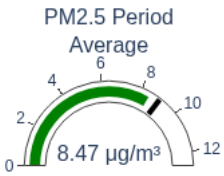


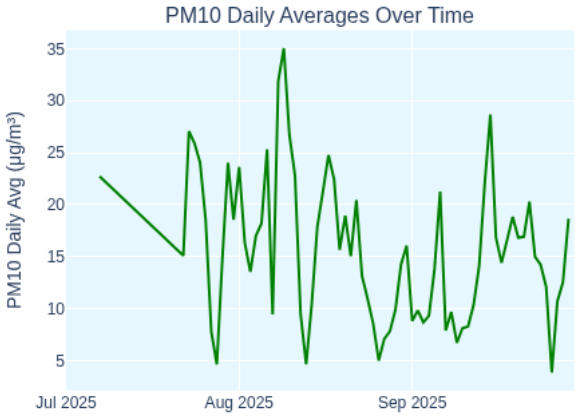


2025-01-01 to 2025-03-31 Report for Sensor 199037: AV-54, Raleigh_County, WV

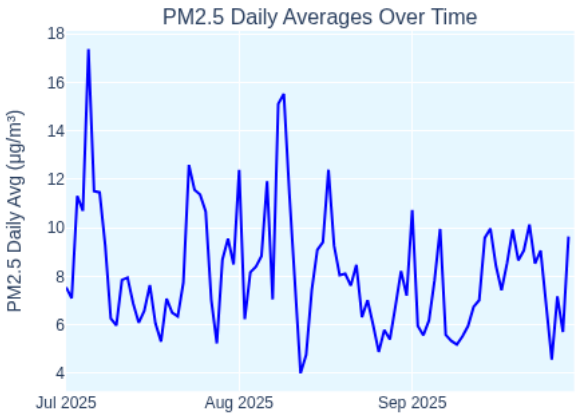


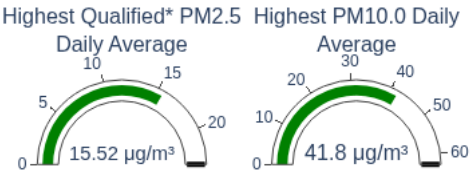


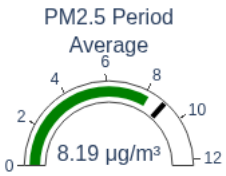


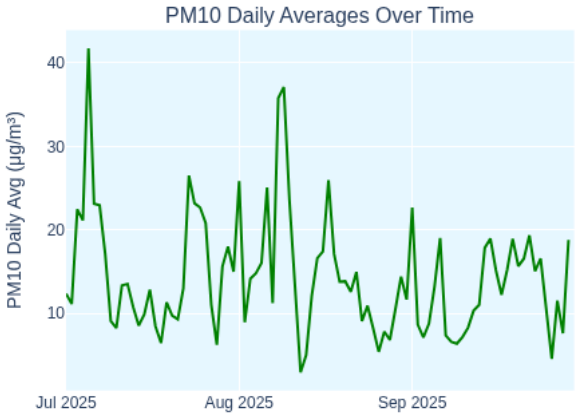


2025-01-01 to 2025-03-31 Report for Sensor 212029: AV-61, Raleigh_County, WV

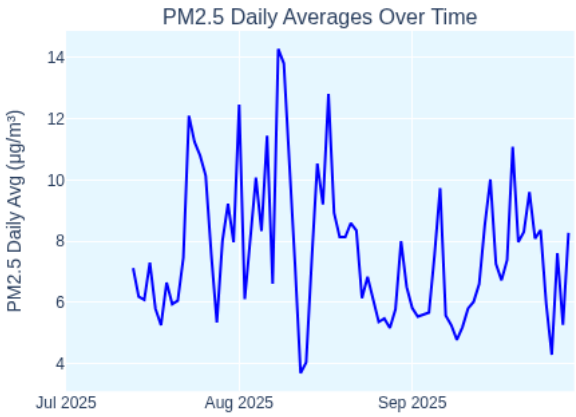


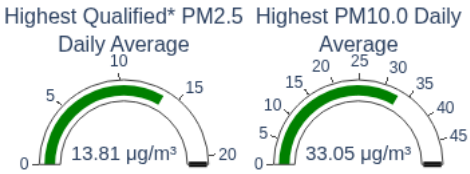


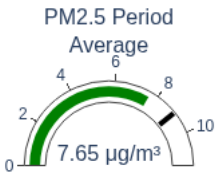


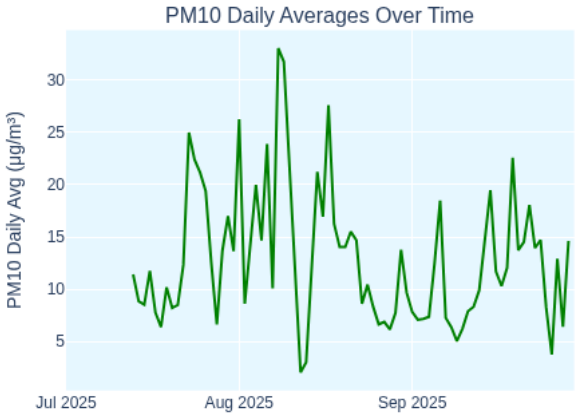


2025-01-01 to 2025-03-31 Report for Sensor 211969: AV-69, Raleigh County, WV









The following monitors are either offline or received insufficient data to include in this quarter's report:

AV-01, sensor 183803 — Test monitor. No longer receiving data.

AV-02, sensor 183791 — Lee County, VA. Replaced.

AV-06, sensor 183739 — Raleigh County, WV.

AV-07, sensor 183755 — Naoma, Raleigh County, WV — No data. Removed.

AV-11, sensor 183781 — Lackawanna, PA — No data. Removed.

AV-13, sensor 183777 — Permanently removed.

AV-17, sensor 183799 — Wise County, VA — Insufficient data.

AV-18, sensor 183753 — Wise County VA — Removed. Replaced by AV-25.

AV-19, sensor 184351 — Wise County VA — No data.

AV-20, sensor 183741 — McDowell County, WV — No data. Removed.

AV-21, sensor 183779 — McDowell County, WV.

AV-22, sensor 184511 — Clark County, KY.

AV-23, sensor 184345 — White Oak, Campbell County, TN — No data. Removed.

AV-27, sensor 184537 — Letcher County, KY.

AV-28

AV-31, Sensor 184567 — Pittsylvania County, VA.

AV-33, sensor 184553

AV-37, sensor 183783 — Eagan, Claiborne County, TN.

AV-41, sensor 198821 — McDowell County, WV.

AV-45, sensor 198977, Cocke County, TN.

AV-46

AV-48 — Permanently removed.

AV-50, sensor 196153 — Grundy, TN

AV-51, sensor 198479 — Harlan County, KY.

AV-56, sensor 199033 — Raleigh County, WV. Removed. Replaced by AV-06.

AV-58

AV-66, sensor 211961 — Buchanan County, VA. Permanently removed.

AV-67

AV-68, sensor 211957 — Shelby_County, TN.