



LV Breathes Newsletter – October 2025

In this October 2025 newsletter, we provide some context and interpretation for the snapshot of air pollution data presented in last month's newsletter. We will start by providing background information on particulate pollution and how it is regulated by environmental laws, **which many of our readers may already be familiar with**. We will then compare the data presented in last month's newsletter to existing regulatory standards in the US, and the air quality guidelines recommended by the World Health Organization (WHO).

Particulate Pollution & Human Health

The Lehigh Valley Breathes project is studying fine particulate pollution (PM_{2.5}), which is pollution comprised of fine particles (particles of aerodynamic diameter 2.5 micrometers or less) that remain suspended in the air. Particles of this size are about 1/30th the width of a piece of human hair, making them invisible to the naked eye. PM_{2.5} pollution comes from many sources, such as wood fires, vehicle emissions, industrial processes, and construction and demolition activities. Cement plants and vehicle emissions are the most prevalent sources of PM_{2.5} pollution in the Lehigh Valley.

The fine size of these particles makes them especially dangerous to human health. Airways on the human body are lined with very tiny hair-like projections (cilia) that can trap larger particles as they enter the body, from where they can then be expelled when a person coughs. This protects the lungs from the larger particles. Particles as small as PM_{2.5} pollution can travel right through the cilia and get lodged in the lungs, where they can then pass into a person's bloodstream, causing inflammation that leads to more serious health problems related to the heart and brain, such as heart disease and cognitive decline. PM_{2.5} also has negative impacts on the body's respiratory system. It can irritate and inflame the airways and lungs, triggering asthma and shortness of breath, and causing more serious health problems like lung disease and COPD.

How Particulate Pollution is Regulated in the US

Because PM_{2.5} pollution poses a significant threat to human health, it is regulated by the Clean Air Act (CAA). This law requires that each individual state monitor concentrations of this pollutant in the ambient air on a daily basis. For a region within a state (e.g. Lehigh Valley) to be compliant with the Clean Air Act, it must maintain concentrations of PM_{2.5} pollution that are below levels that are necessary for protecting human health "with an adequate margin of safety." These levels are set out in health-based regulatory "standards" that air quality must meet, which are measured over a day and a year of

time. More specifically, the allowable concentrations for PM_{2.5} pollution are referred to as the “daily average” and the “annual average.” It’s important to understand that the allowable concentrations are averages, which means that short-term exposures to high-levels of PM_{2.5} are allowable if they are offset by lower levels that reduce average exposure over the time-period (a day or a year) that pollution is being measured. Current air pollution standards allow for exposure to an average of 35 micrograms of PM_{2.5} per cubic meter of air over a 24-hour period, and for exposure to an average of 9 micrograms per cubic meter of air of PM_{2.5} over an entire year.

Let’s consider a couple examples of what these standards mean. On a given day, if the amount of PM_{2.5} pollution measured during three hours of morning traffic is 40 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$), but below 30 $\mu\text{g}/\text{m}^3$ for the remaining hours **21 hours of that day, then the daily average would not be violated because the average level of PM_{2.5} pollution over the entire 24-hour period would still be less than 35 $\mu\text{g}/\text{m}^3$. Similarly, if there is a week of really bad PM_{2.5} pollution during a given year, with each day of that single week having an average concentration that is well above 9 $\mu\text{g}/\text{m}^3$, it can be offset by several weeks that have very lower daily concentrations of PM_{2.5} pollution, such that the annual average standard would not be violated. These examples demonstrate that short term spikes in PM_{2.5} pollution that are above 35 $\mu\text{g}/\text{m}^3$ (i.e. the allowable daily average) measured on an hourly basis, or short multi-day periods of elevated PM_{2.5} pollution measured over several days that are above the annual average of 9 $\mu\text{g}/\text{m}^3$, do not mean that an air pollution standard has been violated, since these higher concentrations can easily be offset when pollution is averaged over the whole day or year.**

The Lehigh Valley was not compliant with PM_{2.5} pollution standards between 2009 and 2015. Since then, data from the government air monitors show that we are compliant with both the daily average and annual average standards for PM_{2.5} pollution. However, over the last decade, the warehousing industry in the Lehigh Valley has grown significantly, bringing in many additional mobile sources of pollution—specifically, tractor-trailer trucks that transport goods to and from warehouses. The impact of these trucks is especially difficult to understand because they travel through many different areas of the Lehigh Valley, and the government is only sampling PM_{2.5} pollutions in two locations within the Valley. These two locations are centrally located in the Valley’s urban corridor, but they are also in low traffic areas, and trucks can now travel on almost all roads in the state of Pennsylvania. As many residents have noted, the truck traffic is now noticeable in many rural areas and off the major roadways in urban areas. A primary purpose of the Lehigh Valley Breathes project is to monitor air quality in areas that are distant from the government’s air monitors, which may not reflect the amount of pollution residents are exposed to in non-proximate locations. Our air monitoring network aims to develop an understanding of how pollution levels vary across the Valley and capture the small-scale variations that regulatory monitors often fail to detect. **In this respect, the fact that the Lehigh Valley air quality measured in two locations meets the standards of air quality required by the Clean Air Act is not sufficient affirmation that air quality is safe for Lehigh Valley residents.**

World Health Organization Recommended Standards for PM_{2.5} Pollution

There is an additional reason for concern about local air quality despite the apparent compliance with regulatory standards. Although PM_{2.5} pollution standards have been strengthened many times based on evolving science, even at low levels of exposure, this pollution poses serious harm to human health. This is why groups such as the American Heart Association question whether there is any “safe” level of exposure, and why organizations such as the World Health Organization (WHO) recommend setting standards that are stronger than those set by the US and many other countries.

The table below shows how the WHO’s recommended standards compare to the current standards for PM_{2.5} pollution in the US.

	Current Standard in the US	WHO Recommended Standard
PM _{2.5} Daily Average	35 µg/m ³	15 µg/m ³
PM _{2.5} Annual Average	9 µg/m ³	5 µg/m ³

As this comparison of USA and WHO standards shows, the US daily average standard allows for more than twice the amount of PM_{2.5} pollution that is recommended by the WHO. Similarly, the US annual average standard allows for almost twice as much PM_{2.5} pollution as recommended by the WHO. These standards provide two reference points for assessing air quality in any location. For example, people with developing respiratory systems (e.g. children) or with existing heart and respiratory problems may prefer to assess the safety of outdoor air quality in reference to the WHO recommended standards, since these people are more vulnerable to harms posed by PM_{2.5} pollution.

Understanding LV Breathes Data Snapshot

Before relating the data presented in last month’s newsletter to these standards, it’s important to remember that we described the data as a “snapshot” because it was only characterizing PM_{2.5} pollution for a single month of one year—the month of July in 2024. July is normally a month with relatively high levels of PM_{2.5} pollution, so it is unlikely that average pollution levels over the month presented in the data snapshot will reflect the level of PM_{2.5} over the whole year. For this reason, we will only relate the data from last month’s newsletter to the daily average standard for PM_{2.5} pollution. The daily average is based on assessment of 24-hour periods, and the snapshot looked at a full month of 24-hour periods. As explained previously, in the US, the daily average is a health-based standard that requires that the concentration of PM_{2.5} in the air we breathe does not exceed an average of 35 µg/m³ over each 24-hour period.

The daily average charts from last month’s newsletter, which are reproduced below, show that none of the locations we looked at during the month of July in 2024 exceeded this US daily average standard. However, as we explain below, we do not want to suggest that this means current air quality sufficiently protects the health of residents in the Lehigh Valley.

Figure 1 below, which compares the daily average of PM_{2.5} pollution at a rural site (Portland), an urban off-road site (Freemansburg), and an urban near-road site (PNLV), shows that the PNLV site came the closest to exceeding the US daily average standard. Specifically, at the PNLV location, the highest daily average in the month of July (2024) was 33.59 µg/m³, which is just below what is allowed by the Clean Air Act in the US. However, all three sites exceed what the WHO recommends as an allowable daily level of exposure to PM_{2.5} pollution. Furthermore, the solid line inside the colored boxes in Figure 1 shows the middle (median) value for all the daily averages, which means that half of the days for the month have averages above where the line is, and half of the days have averages below where the line is. Thus, not only the highest concentrations for a single day at all sites exceed the WHO recommended daily average level of exposure of 15 µg/m³, at least half the days of the entire month of July (2024) exceed the WHO recommended daily average of PM_{2.5} exposure.

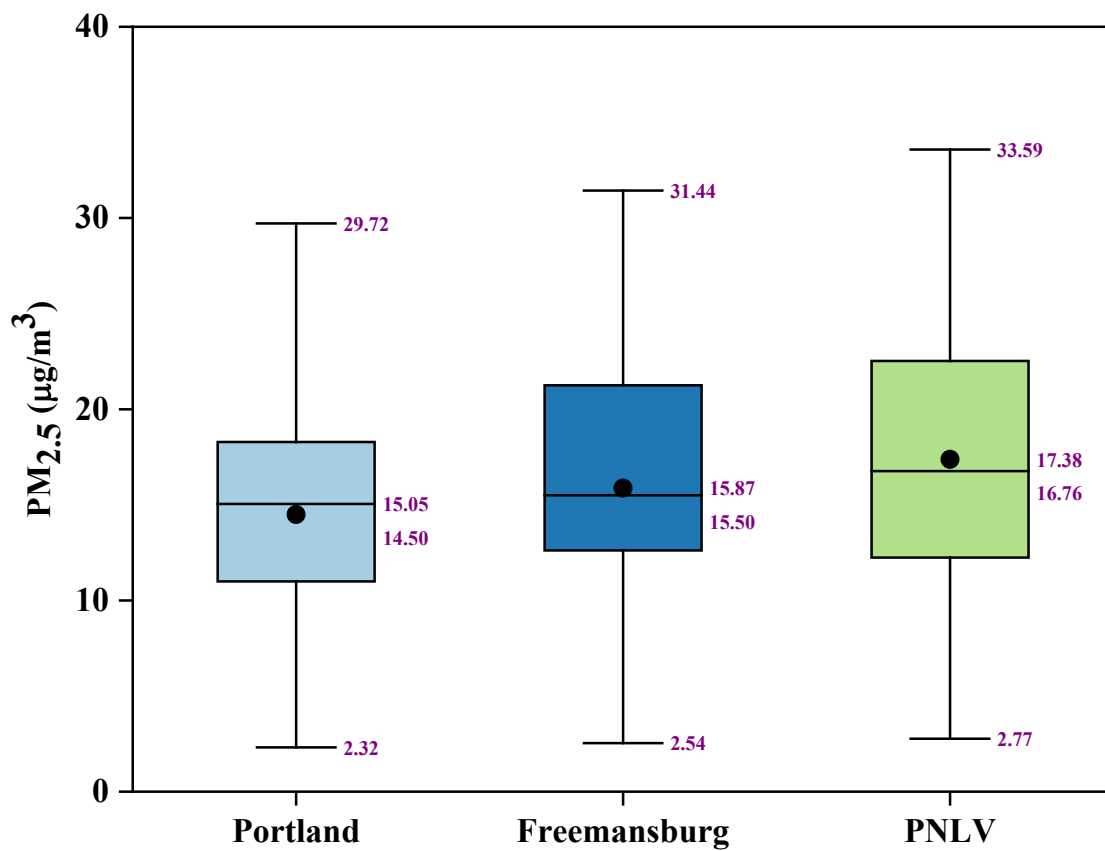


Figure 1: Comparison of daily average PM_{2.5} concentration distributions at a rural site (Portland), an urban off-road site (Freemansburg), and an urban near-road site (PNLV).

The data from the three warehouse locations discussed in last month's newsletter shows a similar relationship to health-based regulatory standards. As reproduced in **Figure 2** below, the highest daily average of PM_{2.5} pollution at each of the three warehouse sites was above 30 µg/m³ but below the allowable amount of average exposure over a 24-hour period, which is 35 µg/m³. However, in these locations, at least half of all days during the month of July (2024) exceeded the WHO recommended daily average standard.

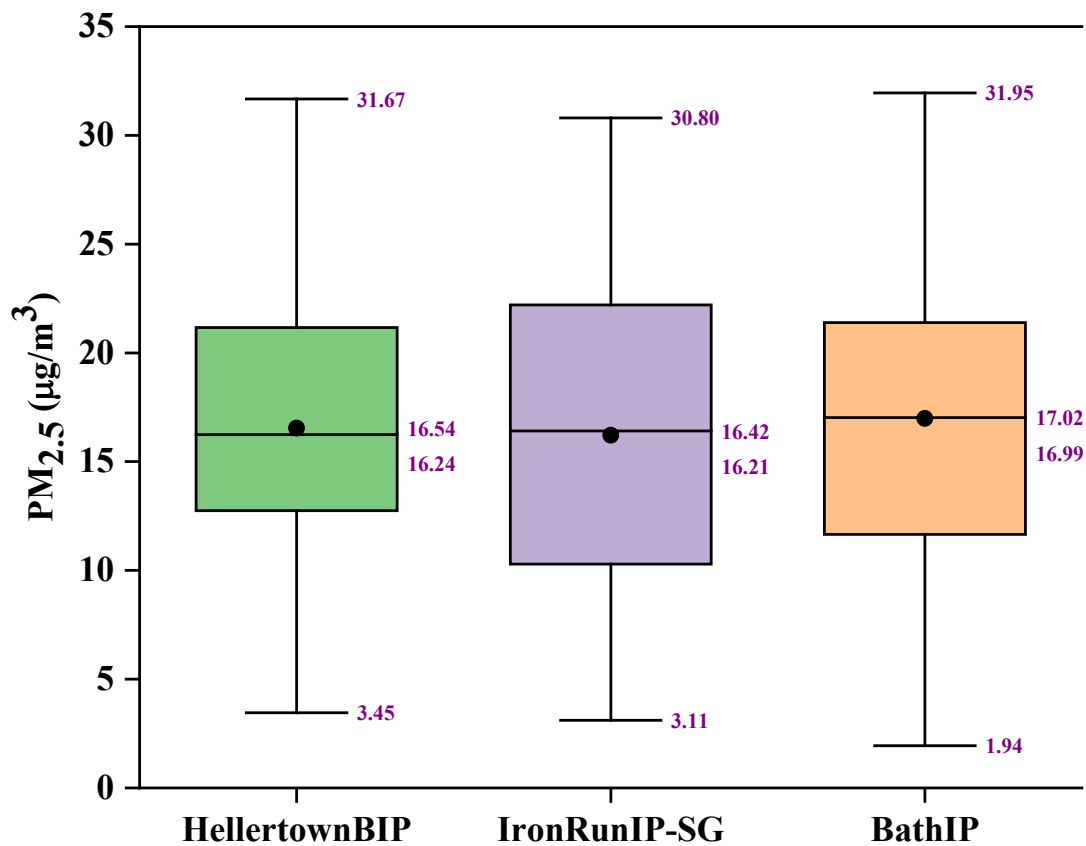


Figure 2: Comparison of daily average PM_{2.5} concentration distributions at HellertownBIP, IronRunIP-SG, and BathIP.

Interestingly, the only location in the data presented in last month's newsletter with more than half of the days of July 2024 meeting the WHO recommended level of exposure to PM_{2.5} pollution is Kirkland, which is a residential area in the city of Bethlehem that is somewhat isolated from traffic. Our previous comparison of the Kirkland location to another residential area (Brighton) that is near a major roadway in the city of Bethlehem is reproduced below in **Figure 3**. Like the other locations, both the Kirkland and Brighton locations experienced daily average concentrations of PM_{2.5} pollution that are above 30 µg/m³ but below the regulatory limit of 35 µg/m³. However, while the Brighton location had the second highest concentration for any single day (32.48 µg/m³) in July 2024 among all the sites assessed in last month's data snapshot, its relatively lower median value (12.27 µg/m³) conveys that this location experienced fewer days that exceeded the WHO daily average standard of 15 µg/m³ than all the other locations except for Kirkland. The median value at the Kirkland site was only 10.38 µg/m³, indicating that half the days of July 2024 were well below the 15 µg/m³ standard that the WHO recommends as a safe level of daily average exposure.

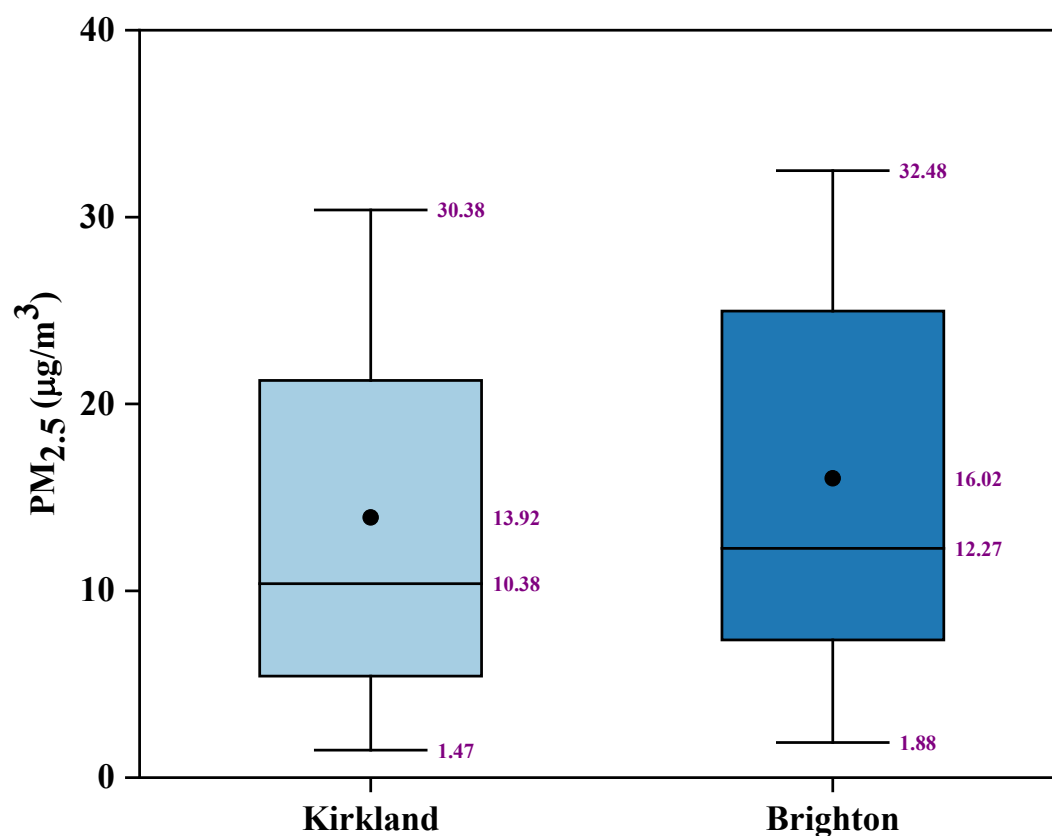


Figure 3: Comparison of daily average PM_{2.5} concentration distributions at Kirkland and Brighton.

Reflections

While none of the locations we evaluated in our previous snapshot exceeded the US daily average standard of 35 $\mu\text{g}/\text{m}^3$, all but one of the sites exceeded a daily average of 30 $\mu\text{g}/\text{m}^3$; and the one site (Portland) that was below this 30 $\mu\text{g}/\text{m}^3$ ceiling was still very close to it, with one day that had a daily average of 29.72 $\mu\text{g}/\text{m}^3$. This is nearly double the allowable amount of daily average exposure to PM_{2.5} pollution (of 15 $\mu\text{g}/\text{m}^3$) that the WHO recommends, and for most of the sites at least half of the days of July 2024 exceeded that standard.

Among all the sites assessed in this snapshot of July 2024, the lowest average levels of PM_{2.5} (reflected in the monthly mean concentration represented by a dot on the boxplots) occurred in residential areas removed from either high traffic roadways and/or warehouses; specifically, Kirkland (with a monthly mean concentration of 13.92 $\mu\text{g}/\text{m}^3$), Portland with a monthly mean concentration of 14.50 $\mu\text{g}/\text{m}^3$, and Freemansburg (with a monthly mean concentration of 15.87 $\mu\text{g}/\text{m}^3$) have the lowest average levels of PM_{2.5} pollution measured over the month of July 2024. Despite the lower levels of exposure at these sites during the month of July 2024, even these comparatively less-polluted sites experienced at least one day with a concentration that was near or above 30 $\mu\text{g}/\text{m}^3$, which is double what WHO recommends.

Although the US standards are based on expert assessments of the best available science on the health impacts of PM_{2.5} pollution, the standards are inevitably subject to a great deal of political and legal debate. Stronger standards impose higher costs on polluters because they require polluters to

reduce their emissions, whether this happens through the implementation of more expensive pollution control technologies or the higher cost of lower-emission vehicles. Ultimately, the difference between the US and WHO standards for PM_{2.5} pollution may reflect different views on how to balance this tradeoff between the cost of reducing emissions and the quality of air we breathe.

Even if one is comfortable rejecting the more precautionary stance on exposure taken by the WHO, one finding of note in the data discussed in this and our previous newsletter is the frequency of daily averages that are above 30 µg/m³. All but one site had daily averages that exceeded 30 µg/m³. We mention this because a number of health, medical, and nursing organizations urged the federal government to set the daily average standard well below this level of allowable exposure in the government's last updates to the PM_{2.5} standards that were promulgated in 2024.* Specifically, these organizations, which included the American Heart Association, the American Cancer Society, the American Lung Association, the American Academic of Pediatrics, the American Public Health Association (among others) urged the US government to set the daily average of allowable exposure at 25 µg/m³, which is 5 µg/m³ less than what most sites we assessed experienced, and 10 µg/m³ below the current standard.

Seeking Your Feedback:

Now that we are beginning to report specific findings from the Lehigh Valley Breathes project, we are curious if these updates are interesting and useful to our readers. While we realize that these are only updates and not the full, final report, are they meeting your needs for information or are they too detailed and complex? If you'd like to share your feedback with us, please feel free to email us at lvbreathes@gmail.com

How You Can Take Action:

While working on this project, many residents have asked us what they can do to get the government to improve air quality. For those readers who share this interest, we want to alert you that the American Lung Association has started a campaign to defend the experts and mission of the Environmental Protection Agency (EPA). It is the EPA that protects human health and the environment. Huge numbers of EPA staffers have been fired and many of their programs that enforce air quality standards have been gutted. If you want to take action against this governmental destruction, we urge you to join the American Lung Association's campaign. You can find more information and the means to take action at this link: <https://lung.quorum.us/campaign/DefendCleanAirProtections/>

Thank you for caring.

* See letter to Environmental Protection Agency Administrator Michael Regan dated March 8, 2023 at this address: https://www.lung.org/getmedia/54374d12-64a9-4f64-8eb6-1d8d93bc3586/GroupComments_PM25NAAQS_ProposedRule_03282023.pdf .