United States Fact Sheet

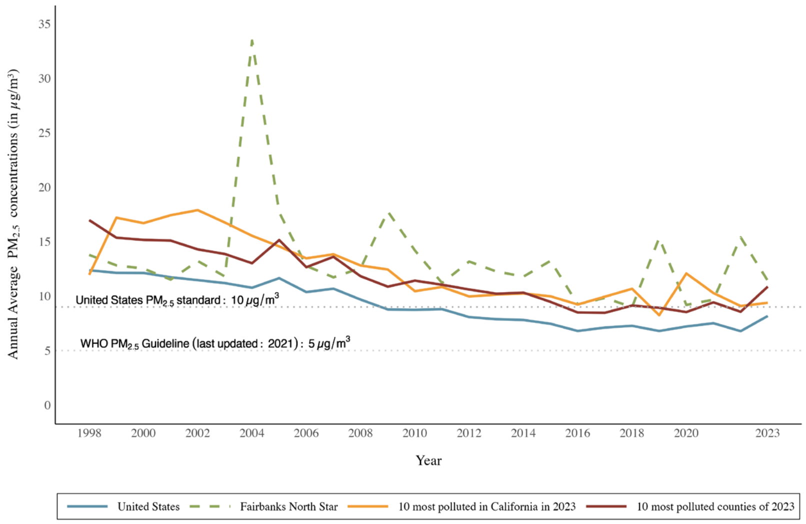
AQLI Air Quality Life Index®

Particulate pollution ($PM_{2.5}$) in the United States (US) rose 20 percent from 2022 to 2023—the highest year-on-year increase in the US since 1998 (when the AQLI data begins) (Figure 1).[1] The average American could live 3.8 months more— a combined 106.1 million total life years gained in the US—if particulate levels were permanently reduced to meet the WHO guideline of 5 µg/m³.[2]

KEY TAKE-AWAYS

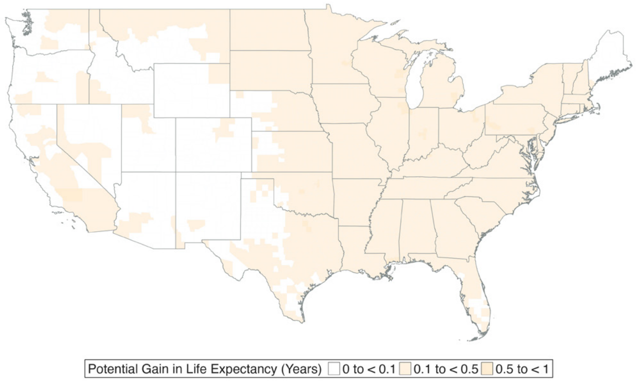
- With annual average particulate pollution being 8.2 µg/m³ in 2023, the US did not meet the WHO guideline, but did narrowly meet the country's recently revised national standard of 9 µg/m³.
- 94.7 percent of the population lives in regions that don't meet the WHO guideline. 308 out of 3,137 US counties did not meet the national standard (compared to 13 in 2022). Of these, 48 are in the state of Ohio, followed by 41 in Wisconsin, 31 in Pennsylvania, 26 in Indiana, and 19 in Illinois. If these counties were to meet the national standard, 54 million total life years would be gained.
- Pollution was more geographically spread than in the recent past (Figure 2). While in previous years, counties in California ranked the most polluted, in 2023, high-pollution counties were spread across 10 states: Alaska, Mississippi, Oklahoma, Wisconsin, Illinois, Indiana, Pennsylvania, Ohio, Michigan, and Texas. Many of these states were affected by the Canadian wildfires.
- Fairbanks North Star County in Alaska was the most polluted county in the United States (Figure 1). Wood smoke from space heating is the primary cause of particulate pollution in the county. Here, residents could add 7.5 months to their life expectancy if the particulate pollution level met the WHO guideline.

Figure 1.
Annual average $PM_{2.5}$ concentration in the United States



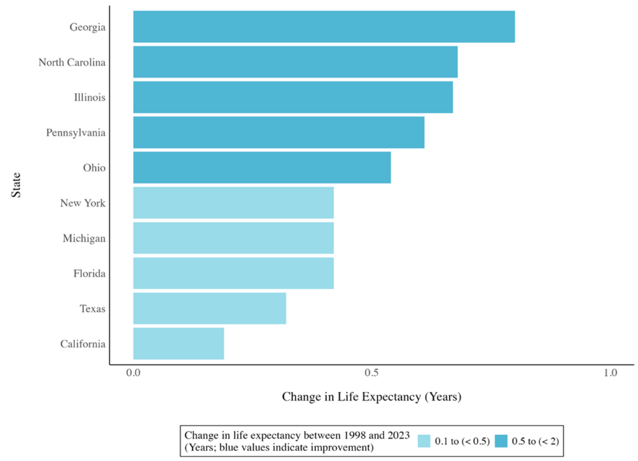
1 This data is based on the AQLI 2023 dataset. All annual average $PM_{2.5}$ values (measured in micrograms per cubic meter: µg/m³) are population weighted.
2 World Health Organization. WHO Global Air Quality Guidelines: Particulate Matter ($PM_{2.5}$ and PM_{10}), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide. Geneva, 2021. https://iris.who.int/bitstream/handle/10665/345329/9789240034228-eng.pdf
3 Boyce, Rod. 2024. "Research: Home Heating Fuels Fairbanks Direct Sulfate Pollution." University of Alaska Fairbanks News,, 2024. https://www.uaf.edu/news/research-shows-residential-heating-fuel-as-direct-source-of-sulfate-in-fairbanks-air.php

Figure 2 · Potential gain in life expectancy from permanently reducing $PM_{2.5}$ from the 2023 concentration to the WHO guideline[1]



1 This map excludes the states of Alaska and Hawaii due to space limitations, but, all underlying country-wide calculations and comparisons include these regions.

Figure 3 · Change in life expectancy due to change in $PM_{2.5}$ concentration in the 10 most populous US states between 1998 and 2023



POLICY PROGRESS TOWARDS CLEAN AIR

Notwithstanding the single-year increase in 2023, particulate pollution has decreased by 34 percent since 1998, adding 4.9 months to the average life expectancy. Georgia has seen the highest decline—47.6 percent—adding 9.6 months to the average life expectancy in the state (Figure 3).

The national-level improvement came with the introduction of strong pollution policies starting with the Clean Air Act in 1970. In subsequent years, the United States Environmental Protection Agency set emissions targets and pollution standards, and in 2024, tightened its annual PM2.5 standard to 9 µg/m³, replacing its old standard of 12 µg/m³.[4] Forty-two out of 50 states met the revised standard in 2023. If the remaining 8 states were to meet the revised standard, 4.2 million life years could be added to the population of the United States.[5]

4 USEPA. 2024. “Final Rule to Strengthen the National Air Quality Health Standard for Particulate Matter”. https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-overview.pdf

5 The eight states are: Illinois, Wisconsin, Ohio, Indiana, Pennsylvania, Michigan, Oklahoma, Minnesota.

Potential life expectancy impacts of particulate pollution reductions for all U.S. states

State	Population (millions)	Annual average $PM_{2.5}$ concentration, 1998 (in μg/m³)	Annual average $PM_{2.5}$ concentration, 2023 (in μg/m³)	Life Expectancy Gains from reducing $PM_{2.5}$ from 1998 concentrations to 2023 concentrations (Months)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2023 concentrations to the WHO guideline of 5 μg/m³ (Months)
Alabama	5.2	15.8	8.7	8.3	4.3
Alaska	0.7	4.4	3.6	0.8	0.0
Arizona	7.5	9.1	6.2	3.4	1.4
Arkansas	3.1	15.1	8.7	7.6	4.3
California	39.7	9.9	7.9	2.3	3.5
Colorado	6	6.1	6.2	0.0	1.3
Connecticut	3.7	12.1	7.8	5.1	3.2
Delaware	1	14.8	8.7	7.1	4.3
District of Columbia	0.9	14.4	9.4	5.9	5.2
Florida	22.4	11.2	7.0	5.0	2.3
Georgia	11.1	17.0	8.9	9.5	4.6
Hawaii	1.4	1.9	1.9	-0.1	0.0
Idaho	2	5.5	5.9	-0.5	1.1
Illinois	12.8	16.9	10.1	8.1	6.0
Indiana	7	16.4	9.5	8.1	5.3
Iowa	3.3	12.6	8.7	4.6	4.3
Kansas	3	11.4	7.9	4.1	3.5
Kentucky	4.6	15.8	8.6	8.5	4.2
Louisiana	4.7	12.7	8.8	4.6	4.4
Maine	1.4	8.0	5.5	2.9	0.6
Maryland	6.1	14.7	8.6	7.2	4.3
Massachusetts	7	10.7	7.1	4.2	2.4
Michigan	10.2	13.7	9.4	5.0	5.2
Minnesota	5.8	10.1	9.3	0.9	5.0
Mississippi	3	14.9	8.8	7.2	4.6
Missouri	6.3	14.0	8.5	6.4	4.1
Montana	1.1	5.8	6.5	-0.8	1.7
Nebraska	2	10.2	7.8	2.8	3.2
Nevada	3.2	5.6	5.2	0.5	0.2
New Hampshire	1.4	10.1	6.4	4.3	1.7
New Jersey	9.4	13.9	8.7	6.2	4.3
New Mexico	2.2	5.8	4.6	1.5	0.0
New York	19.8	12.9	8.6	5.0	4.2
North Carolina	10.9	15.0	8.1	8.1	3.6
North Dakota	0.8	7.3	8.0	-0.8	3.5
Ohio	12	15.1	9.6	6.5	5.4
Oklahoma	4.1	12.2	9.4	3.3	5.2
Oregon	4.3	5.5	5.0	0.6	0.0
Pennsylvania	13.2	15.7	9.5	7.3	5.3
Rhode Island	1.1	11.2	7.6	4.2	3.1
South Carolina	5.4	15.2	8.0	8.4	3.5
South Dakota	0.9	7.9	7.7	0.2	3.2
Tennessee	7.2	16.7	8.4	9.8	4.0
Texas	30.6	12.0	8.7	3.9	4.4
Utah	3.4	6.4	6.9	-0.6	2.2
Vermont	0.7	9.4	6.7	3.1	2.0
Virginia	8.7	13.9	8.4	6.4	4.1
Washington	7.9	6.4	5.2	1.4	0.2
West Virginia	1.8	15.5	8.6	8.1	4.2
Wisconsin	6	13.1	9.8	3.9	5.6
Wyoming	0.6	6.2	4.9	1.6	0.0

ABOUT THE AIR QUALITY LIFE INDEX (AQLI)

The AQLI is a pollution index that translates particulate air pollution into perhaps the most important metric that exists: its impact on life expectancy. Developed by the University of Chicago's Milton Friedman Distinguished Service Professor in Economics Michael Greenstone and his team at the Energy Policy Institute at the University of Chicago (EPIC), the AQLI is rooted in research that quantifies the causal relationship between long-term human exposure to air pollution and life expectancy. The Index then combines this research with hyper-localized, satellite measurements of global particulate matter ($PM_{2.5}$), yielding unprecedented insight into the true cost of pollution in communities around the world. The Index also illustrates how air pollution policies can increase life expectancy when they meet the World Health Organization's guideline for what is considered a safe level of exposure, existing national air quality standards, or user-defined air quality levels. This information can help to inform local communities and policymakers about the importance of air pollution policies in concrete terms.

Methodology: The life expectancy calculations made by the AQLI are based on a pair of peer-reviewed studies, Chen et al. (2013) and Ebenstein et al. (2017), co-authored by Michael Greenstone, that exploit a unique natural experiment in China. By comparing two subgroups of the population that experienced prolonged exposure to different levels of particulate air pollution, the studies were able to plausibly isolate the effect of particulate air pollution from other factors that affect health. Ebenstein et al. (2017) found that sustained exposure to an additional 10 μg/m³ of PM_{10} reduces life expectancy by 0.64 years. In terms of $PM_{2.5}$, this translates to the relationship that an additional 10 μg/m³ of $PM_{2.5}$ reduces life expectancy by 0.98 years. This metric is then combined with sea-salt and mineral dust removed satellite-derived $PM_{2.5}$ data. All 2023 annual average $PM_{2.5}$ values are population-weighted, and AQLI's source of population data is https://landscan.ornl.gov/. We are grateful to the Atmospheric Composition Analysis Group, based at Washington University in St. Louis, for providing us with the satellite data. The original dataset can be found here: https://sites.wustl.edu/acag/datasets/surface-pm2-5/. To learn more deeply about the methodology used by the AQLI, visit: aqli.epic.uchicago.edu/about/methodology.

aqli-info@uchicago.edu aqli.epic.uchicago.edu @UChiAir #AQLI