

Outdoor Air Quality

Particulate matter ($PM_{2.5}$) is a measure of outdoor air quality. Exposures to $PM_{2.5}$ are associated with adverse cardiovascular and respiratory health effects. People with pre-existing conditions, children and the elderly have increased risk of adverse health effects from breathing $PM_{2.5}$.

For most areas in Washington, $PM_{2.5}$ levels are not considered to contribute to an elevated risk to health. In some areas, however, with higher levels or that have isolated daily events of high $PM_{2.5}$ concentrations, $PM_{2.5}$ levels do pose an increased health risk to local residents.

DOH, along with partner agencies, is working to evaluate risks from air pollution across the state so that we can identify at-risk populations and provide recommendations to reduce exposure.



Since 2000, levels of fine particulate matter ($PM_{2.5}$ or less) have generally declined in Washington

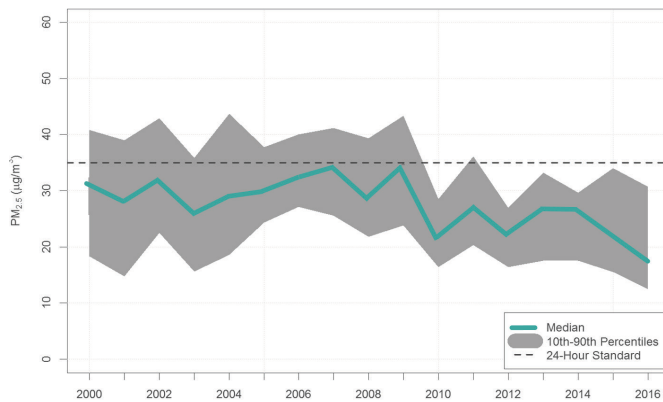


Residential wood burning, vehicle emissions, road dust and wildfires are major contributors to particulate matter

Particulate Matter

- Levels of fine particulate matter (particles with a diameter less than 2.5 μm , or $\text{PM}_{2.5}$) generally declined in Washington State since 2000.
- The U.S. had a similar decreasing trend—credited to previous reductions in industrial emissions as well as more recent reductions in vehicle emissions and increased adoption of improved woodstoves.

Peak 24-hour $\text{PM}_{2.5}$ Concentrations Regulatory Monitoring Network Washington State



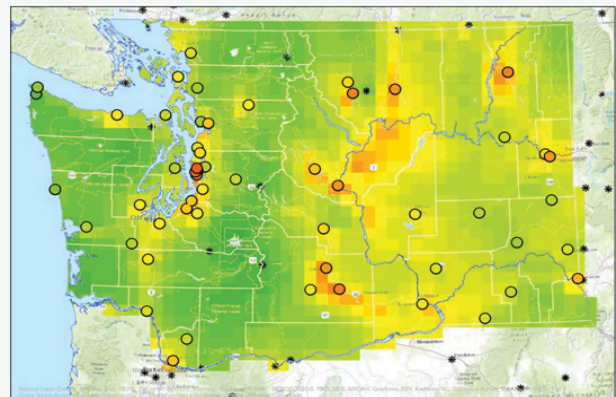
Source: Department of Ecology, Air Quality Program

Geographic Variation

- Most areas in Washington had annual $\text{PM}_{2.5}$ concentrations that are well below the federal standard. However, even in areas with relatively low annual $\text{PM}_{2.5}$ levels, on a short-term basis air pollution can reach levels that are unhealthy for sensitive groups and the general public.
- Different sources contribute to elevated $\text{PM}_{2.5}$ levels. In 2011 for example, the top two sources of emissions varied by county:
 - King County - residential wood burning and vehicle emissions
 - Yakima County - residential wood burning and road dust
 - Okanogan County - road dust and agricultural/forest prescribed burns (followed closely by smoke from wildfires)
- The composition of $\text{PM}_{2.5}$ changes throughout the year as many sources have a seasonal component. Wildfires generally occur in summer months. Road dust concentrations are higher when the ground is drier, typically in the summer. Residential wood burning occurs in the fall, winter and spring.

Modeled/Monitored Annual Average $\text{PM}_{2.5}$ Concentrations Washington State

Regulatory Monitoring Network, 2010-2014



Annual Mean $\text{PM}_{2.5}$ ($\mu\text{g}/\text{m}^3$):
 Low (0-6) Medium (6-12) Federal Standard (12)

- 2010-2014 Design value (network site)
- * Non-network site used for map development

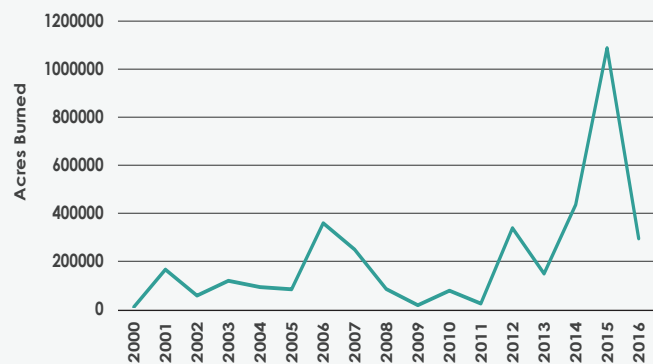
Note: The shading reflect the range of average concentrations from 0 to the federal standard for annual mean $\text{PM}_{2.5}$

Source: Department of Ecology, Air Quality Program

Smoke from Wildfires

- The highest 24-hour PM_{2.5} levels are mainly attributed to residential wood burning and wildfires. In part, residential wood burning levels are higher because people burn wood for heat in the colder months when there is more air stagnation and less mixing of air, leading to greater build-up of pollutants. In contrast, wildfires typically occur in the summer and there can be very high levels of smoke that last for a relatively short time.
- Smoke from wildfires contains many different pollutants, including PM_{2.5}.
- Wildfires have increased in size and intensity in Washington, as in other parts of the western United States over the past decades. The increasing intensity of wildfires is thought to be due mainly to a combination of forest management practices and climate change.¹
 - Historically, forest management practices have suppressed wildfires. More recent practices recognize that allowing for more regular small wildfires and controlled burns is needed to prevent large scale wildfires.²
 - Climate change is bringing drier, warmer conditions that are increasing the size of total area burned by forest fires most years.^{3, 4}
- During the 2012 wildfires in central Washington, PM_{2.5} concentrations were hazardous as defined by the Washington Air Quality Advisory. An evaluation found increased hospital and outpatient clinic visits for asthma, respiratory and chest symptoms, especially among children.⁵

**Land Burned by Wildfires
Washington State
Washington Tracking Network, 2000-2016**



Source: Department of Health, Washington Tracking Network, 'wildfires'. Data obtained from the Northwest Interagency Coordination Center, July 10, 2017.

How is Washington promoting improved outdoor air quality?

DOH works with local health jurisdictions (LHJs), Washington State Department of Ecology, Local Air Authorities, and others to identify when and where ambient air pollution reaches levels of concern, and to identify and alert populations that are most affected. DOH integrates these data with scientific evidence to provide several services, including:

- Maintaining updated websites about air quality that provide descriptions and health guidelines such as steps individuals can take to reduce exposure to air pollution.
 - Providing air quality and health data on the Washington Tracking Network for public use.
 - Collaborating with LHJs to develop health messaging about air pollution that is relevant at a local level.
 - Responding to citizen complaints and emerging issue concerns about air pollution with evaluations that identify a level of risk (when possible), and options for mitigation.
- Coordinating with climate change specialists to identify and prepare for impacts on health due to changes in air quality.

Ambient PM^{2.5} levels are regulated at the federal level by the Environmental Protection Agency, the state level by the Washington Department of Ecology, and regionally by clean air authorities. Numerous strategies are employed to address various sources of PM_{2.5}, such as vehicle emissions testing and standards, and requirements to use technological controls to reduce industrial emissions.

The public can also help reduce ambient PM_{2.5} levels by taking steps like reducing vehicle use, replacing uncertified woodstoves, not burning yard waste, and using electric yard equipment as an alternative to gas-powered equipment.

Through each of these activities at the local, state and federal level, we contribute to efforts to reduce air pollution for the protection public health.

Technical Notes

Confidence Intervals: Definition and examples are described in [Appendix C](#)

Particulate Matter. Particulate matter refers to fine particles in the air. PM_{2.5} refers to airborne particles that are 2.5 micrometers or smaller in size. These particles are so small they can be inhaled deep into the lungs and cause a variety of serious health problems. PM_{2.5} is measured at point sources throughout Washington.

Endnotes

¹McKenzie D, and Littell JS. Climate change and the eco-hydrology of fire: will area burned increase in a warming western USA? *Ecol Appl* 2016; 27(1):26-36. [doi: 10.1002/eap.1420](https://doi.org/10.1002/eap.1420)

²Vegetation and Fuels. The Science Analysis of the National Cohesive Wildland Fire Management Strategy Web site. <https://cohesivewildfire.nemac.org/vegetation-fuels>. Accessed September 1, 2017.

³Snover AK, Mauger GS, Whitely Binder LC, Krosby M, and Tohver I. Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers. State of Knowledge Report prepared for the Washington State Department of Ecology. Climate Impacts Group, University of Washington, Seattle; 2013.

⁴Littell, JS et al. Forest Ecosystems: Vegetation, Disturbance, and Economics. Chapter 5 in Dalton MM, Mote PW, and Snover AK, eds. Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities. Washington, D.C.: Island Press; 2013.

⁵Washington State Department of Health. Surveillance Investigation of the Cardiopulmonary Health Effects of the 2012 Wildfires in North Central Washington State. www.doh.wa.gov/Portals/1/Documents/Pubs/334-385.pdf. Published December 2015. Accessed September 1, 2017.