



Understanding the health effects of jet pollution around Sea-Tac Airport

A policy brief for the Washington State Legislature

Summary

Communities underneath and downwind of jets landing at Seattle-Tacoma International Airport are exposed to a type of ultrafine particle pollution that is distinctly associated with aircraft, according to a 2019 University of Washington (UW) study that is the first to identify the unique signature of aircraft emissions in Washington.

The finding comes from the two-year Mobile Observations of Ultrafine Particles (MOV-UP) study funded by the Washington State Legislature and led by the UW Department of Environmental & Occupational Health Sciences and the Department of Civil and Environmental Engineering.

The MOV-UP study examined the air-quality impacts of aircraft traffic on communities located within 10 miles of Sea-Tac Airport.

The discovery creates opportunities to investigate the health effects of aircraft-related pollution, how different neighborhoods are impacted by it and specific interventions to reduce people's exposure to these pollutants.

Previous studies have linked exposure to ultrafine pollution particles to breast cancer, heart disease, prostate cancer and a variety of lung conditions.

This policy brief describes some of the remaining knowledge gaps about aircraft-related pollution.

It also proposes next steps that state legislators can take to better understand the health impacts of ultrafine particle pollution and to protect the health of people who live and work in the vicinity of Sea-Tac Airport.

Context

The term “ultrafine particles” refers to particles that are less than 0.1 micron in diameter—700 times thinner than the width of a human hair. Unlike particles that range in size up to 2.5 and 10 microns (known as PM2.5 and PM10, respectively), ultrafine particles are not currently regulated under federal or state air-quality standards.

Measuring ultrafine particles requires special instruments; thus, air quality agencies do not routinely monitor it.

UW researchers sampled air at numerous locations over the course of one year between 2018 and 2019 at fixed locations and through mobile monitoring, in which special instruments capable of measuring ultrafine particles were mounted on hybrid vehicles driven along selected routes.

The research team then developed a new method to distinguish between pollution from jet traffic and pollution from other sources such as roadway traffic. Ultrafine pollution particles are emitted from both sources, but the research team found key differences in the particle size and mixture of particles they emit.

Researchers then mapped each type of emission mixture to show its specific geographic footprint around the airport. They found that ultrafine particles are emitted from both roadway traffic and aircraft

sources, with the highest counts found nearest major roadways such as Interstate 5.¹ Key differences exist in the particle size distribution and the black carbon (soot) concentration that help distinguish between locations that may be more impacted by pollution from roadway traffic, aircraft emissions or both sources.

This study did not consider the health effects of exposure to roadway or aircraft-related pollution. However, other studies have linked exposure to breast cancer, heart disease, prostate cancer and a variety of lung conditions. A companion report produced by the Washington State Department of Health reviewed existing literature on the health effects associated with ultrafine particles.

The study findings raise questions about health equity and the potential health burden from jet-related air pollution that falls heaviest on South King County communities around the airport, which tend to be poorer, sicker, less educated and more racially and ethnically diverse than King County as a whole.²

The research team coordinated closely with local governments, community groups and state and federal agencies, soliciting feedback on the study design, analysis and next steps. UW researchers hope to continue their engagement with those groups as part of any future work.



Knowledge gaps

The research team identified three critical knowledge gaps that fell outside the scope of this study. The MOV-UP Study Advisory Board—including representatives from government agencies, cities and community organizations—prioritized future work to fill these knowledge gaps as follows:

Gap 1: What are the health effects of aircraft ultrafine particles?

Although many studies have identified health effects associated with roadway traffic pollutants, the potential health effects from aircraft-related pollution exposure still need major research. Research questions include:

- *What are the chemical differences between ultrafine particles from roadway traffic and aircraft sources?* Particles must be collected using an instrument capable of separating the smallest size fraction of particles from other ambient particles. We have identified instruments that could potentially separate and collect these particles for a study that examines the chemical toxicity of these different sources.
- *Are short-term health responses to roadway traffic and aircraft particles different?* We could conduct a study of short-term health impacts on sensitive populations, such as pregnant women, children, older adults or individuals with pre-existing diseases such as asthma, diabetes and cardiovascular disease.
- *Are there long-term health impacts of exposure to traffic and aircraft ultrafine particles?* Developing an appropriate cohort, health outcome and time-scale is possible, but requires consultation with the state Department of Health and community members to identify the most feasible and important populations and health outcomes.

Next steps

A new, two-year study would help fill in these knowledge gaps, build the evidence base around ultrafine particle pollution and provide data-based solutions for consideration by state and local policymakers. Specific research activities could include:

- Conduct short-term measurements of outdoor and indoor ultrafine particle levels at selected community sites (such as schools) to evaluate the effectiveness of indoor air filtration in reducing exposures.
- Gather drone measurements of vertical ultrafine particle profiles at up to 10 sites to confirm aircraft pollution impacts.
- Collect ultrafine particle pollution and analyze its toxicology at selected sites.
- Conduct a short-term human health effects study comparing health indicators when the same individuals are either exposed or not exposed to aircraft-related ultrafine particle pollution at different times.
- Initiate longer-term measurements at approximately 10 to 20 sites of community concern (schools, community centers, parks) to inform exposure modeling.

Separately, a larger epidemiological cohort study could investigate long-term health outcomes. The UW team is open to collaborating with the state Department of Health to lead this type of investigation.



Gap 2: What can we do to reduce human exposures to ultrafine particles?

Our study suggests that some neighborhoods may have more exposure to ultrafine particles than others due to proximity to roadway traffic and/or overlap with the plumes from aircraft emissions. Research questions include:

- *How much ultrafine particle pollution infiltrates indoor spaces?* We could measure particle pollution levels in specific locations, especially those where vulnerable populations may be most exposed (schools, daycares, elder care facilities and medical centers).
- *What interventions are effective in reducing exposures?* We could design a study that considers the effectiveness of HEPA filtration, whether noise mitigations might alter infiltration or whether LEED buildings or HVAC choices could alter infiltration.

- *What are the potential impacts of emissions reductions on exposure?* We could design a study that models how changes in emissions impact exposures to different populations.

Gap 3: How are exposures to ultrafine particles changing over time?

Roadway and aircraft traffic have changed in volume, travel patterns and per-unit emissions over time and will likely continue to change, creating uncertainties in the impacts of future ultrafine particle pollution exposures. Research questions include:

- *Are there important daily, seasonal and time trends in exposures?* We could design a study that monitors and models the impacts of changing roadway and aircraft traffic on ultrafine particle exposures. This could allow us to predict particle concentrations at locations and in time periods where data do not currently exist.

More information

- Contact Dr. Edmund Seto, UW Department of Environmental & Occupational Health Sciences: eseto@uw.edu
- Download the full MOV-UP report: <https://deohs.washington.edu/mov-up>

Acknowledgments

The UW gratefully acknowledges the contributions of our community, state and federal partners in the MOV-UP study, including: Beacon Hill CHAC; cities of Burien, Des Moines, Normandy Park, SeaTac and Tukwila; FAA Northwest Mountain Region; offices of Representative Tina Orwall and Representative Mike Pellicciotti, Washington State House of Representatives; office of US Congressman Adam Smith; office of US Congresswoman Pramila Jayapal; Port of Seattle; Public Health—Seattle & King County; Puget Sound Clean Air Agency; Quiet and Healthy Skies Task Force; US EPA Region X; Washington State Departments of Health, Ecology and Commerce.

References

1. University of Washington Department of Environmental & Occupational Health Sciences. Mobile Observations of Ultrafine Particles: The MOV-UP study report. Seattle; 2019.
2. King County Community Health Needs Assessment, 2018-19. Retrieved Dec. 31, 2019 from Public Health – Seattle & King County, Community Health Indicators. https://www.kingcounty.gov/depts/health/data/community-health-indicators/~/_media/depts/health/data/documents/2018-2019-Joint-CHNA-Report.ashx