



Urban Ultrafine – Advisory Group Meeting

August 2022



MEETING AGENDA

1. Introductions
2. Group activities and updates
3. Indoor air quality report and aircraft impacts in schools
3. Short term health effects of UFP
4. Mobile monitoring update and site selection process
5. Discussion
6. Wrap up



Timothy Gould



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Dr. Elena Austin



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Group Introductions and Updates

UFP Advisory Meeting Updates

- EPA community air monitoring grant opportunity in Spring 2022
 - PSCAA
 - Community applications
- EPA proposal to align US emissions standards with ICAO PM standards
 - Testimony by may UFP advisory group members
- 2019 Puget Sound UFP monitoring study (Dr. Lianne Sheppard) published

Healthy Schools, Healthy Air

- Inform schools, districts and state legislators on the current ability of building ventilation systems to effectively remove outdoor sources of particles.
- Quantify the current ability of ventilation solutions to remove indoor generated particles.
- Identify any additional benefit and cost of in-room filtration.
- Based on the experimental measures in an unoccupied classroom, describe the size fractionated infiltration rates of 1) ultrafine particles of aircraft origin 2) ultrafine particles of traffic origin and 3) wildfire smoke.
- Communicate study results to partners.

* Funded (50k) by cities of the cities of SeaTac, Burien, Federal Way, Normandy Park and Des Moines and by the State of Washington



Study Methods

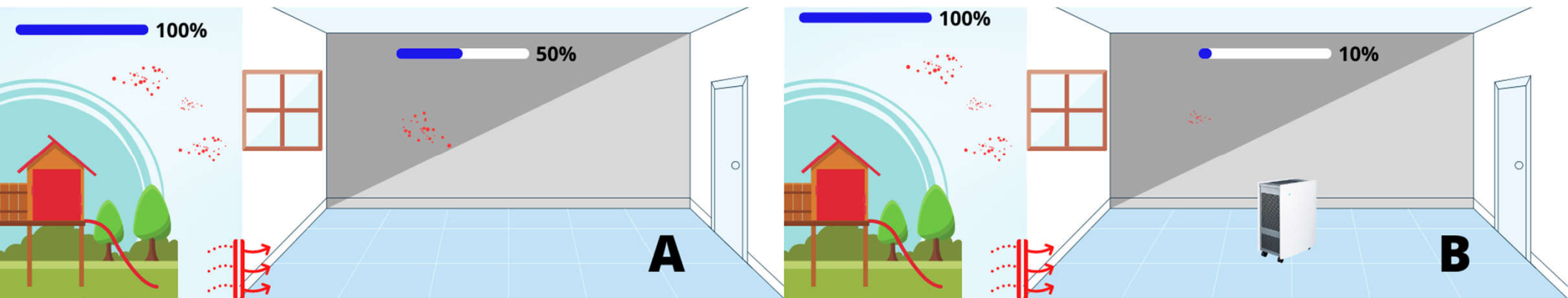
Methodology – Phase I

- Recruited 5 schools across 2 participating school districts
- Sampled at each location twice. Each session lasted 48 hours.
- Measured air exchange rate and infiltration before and after short-term HEPA filter intervention
- Develop a method to report-back key results
 - Stakeholder meetings
 - Key informant interviews

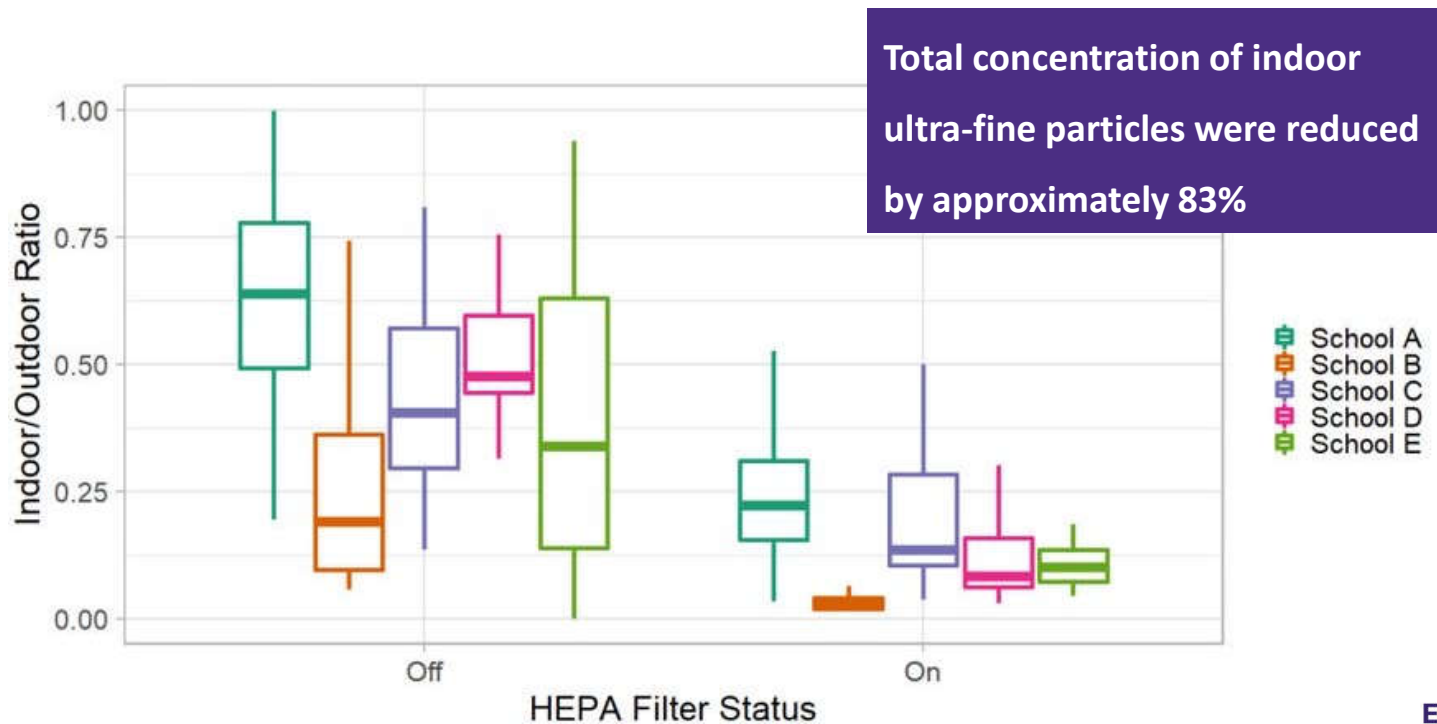
Main Finding - Phase 1

Results

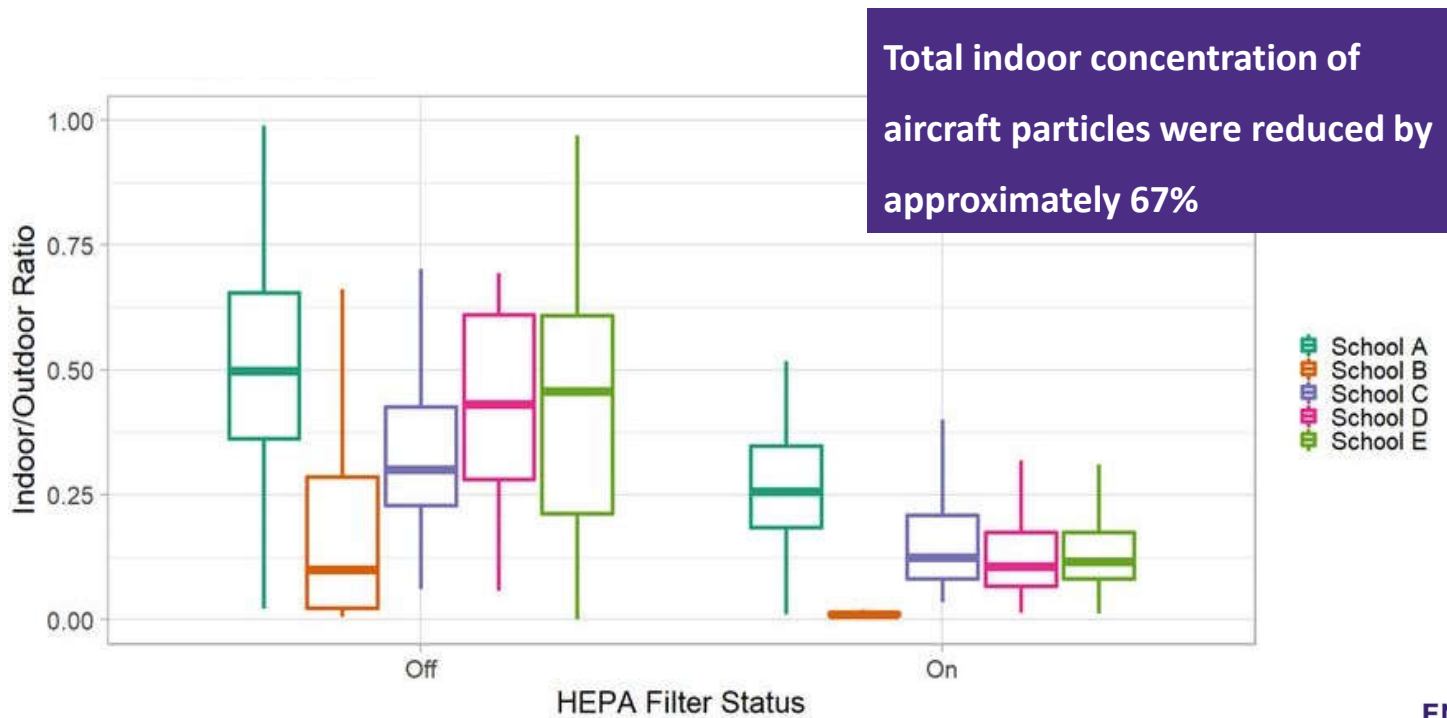
- Ultrafine particles were about 50% of outdoor levels before HEPA air purifiers were installed.
- Ultrafine particles dropped to about 10% of outdoor levels after HEPA purifiers were installed.



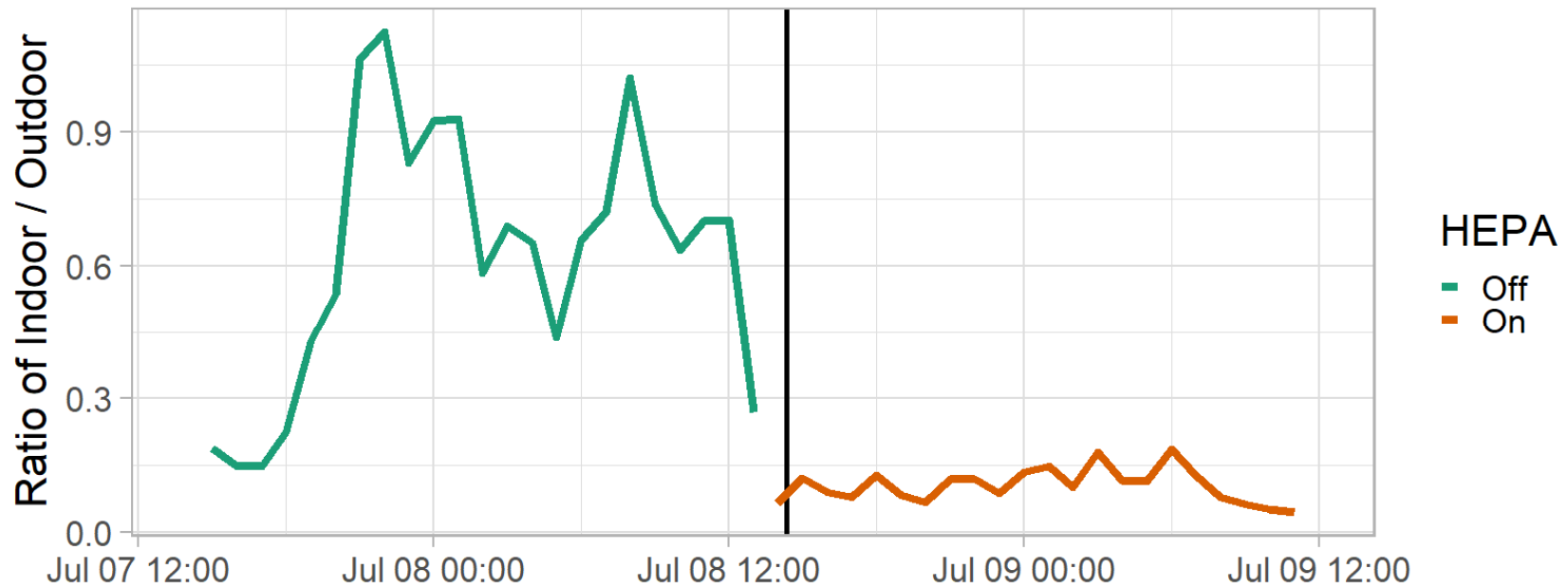
Portable Air Cleaner HEPA Intervention Total UFPs: Ratio of Indoor/Outdoor



Portable Air Cleaner HEPA Intervention Aircraft UFPs: Ratio of Indoor/Outdoor



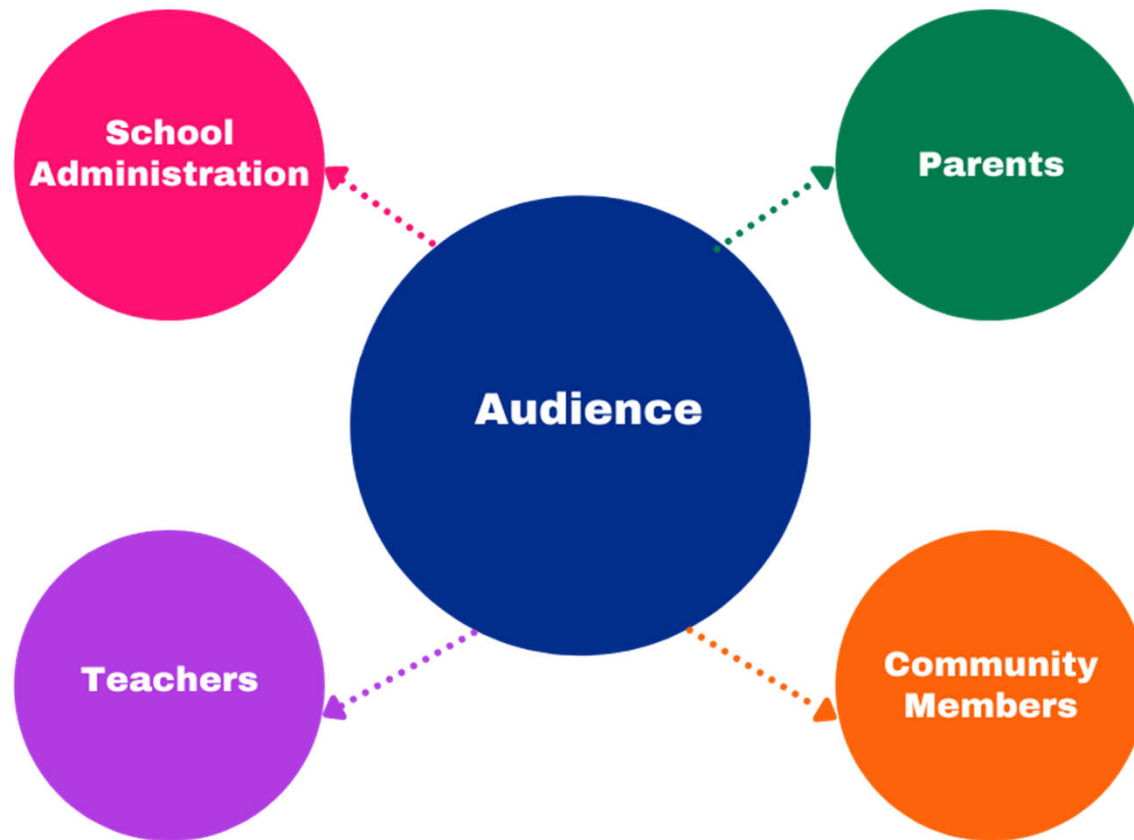
Ratio of Indoor to Outdoor Concentration



How impacted are schools by Sea-Tac Flights?

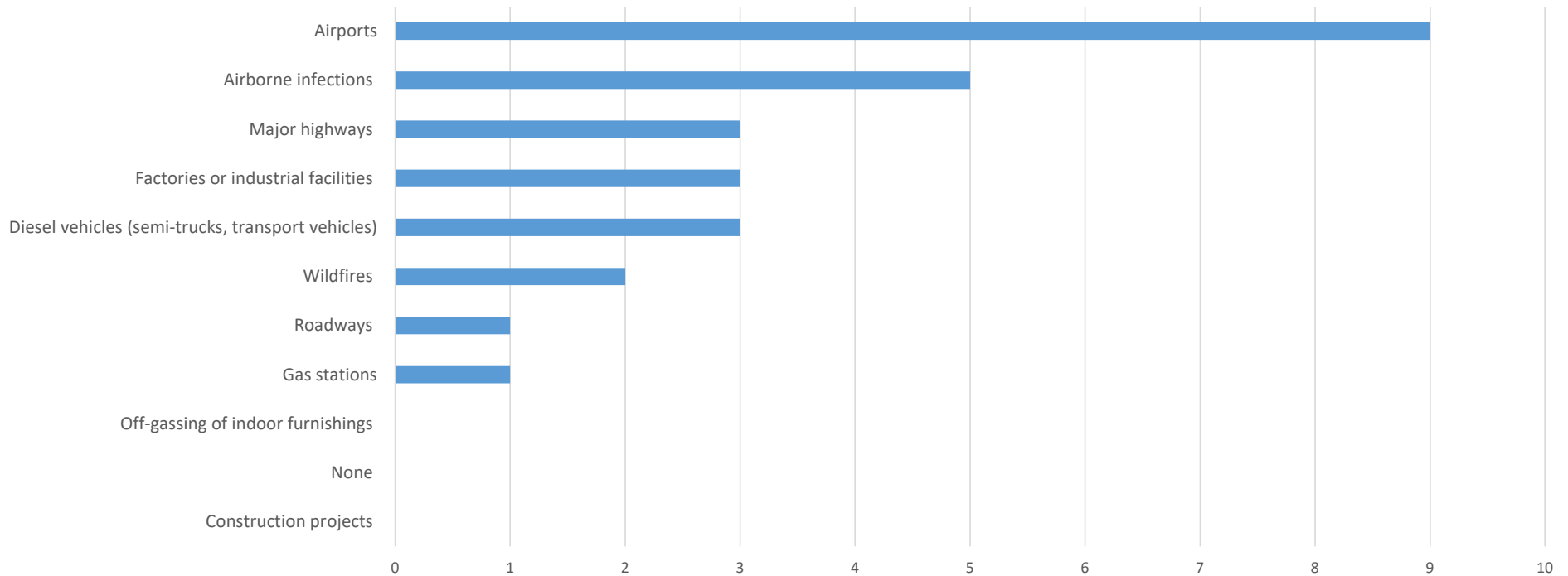
	All King County Schools			
Airport	# Arrivals (Median)		# Departures (Median)	
	All Schools	Pilot Study Schools	All Schools	Pilot Study Schools
Sea-Tac Airport	3	61,234	10	53,313
Boeing Field	44.5	18	11	26
Renton Municipal Airport	0	0	0	0
All Airports	102.5	61,240	35	53,547

Engaging a Wide Audience



Parent Concerns based on online survey – Phase 1

What types of air pollution sources near or around your school are you most concerned about?

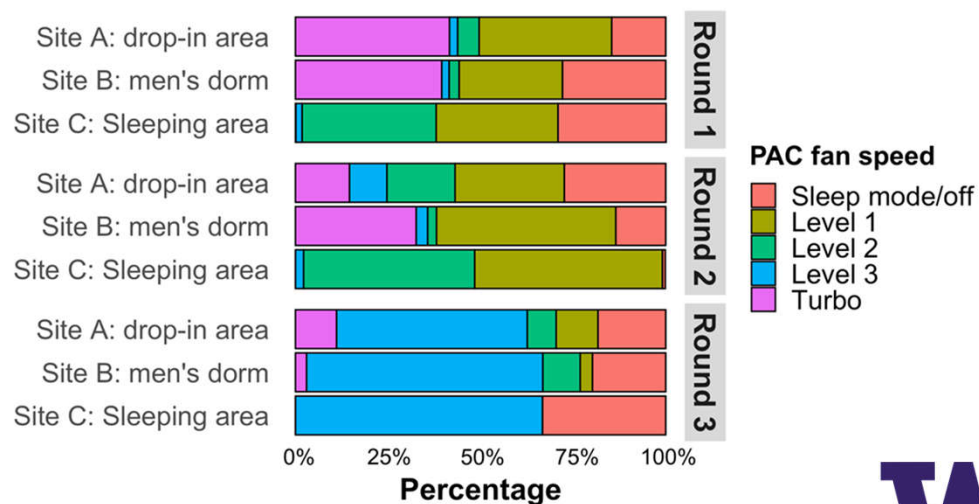


Homeless shelter deployments with King County Public Health

Shirley Huang, Elena Austin and Edmund Seto (ASICS 2022)

Over three thousand portable air cleaners (PACs) with high-efficiency particulate air (HEPA) filters were distributed by Public Health Seattle & King County (PHSKC) to homeless shelters during the COVID-19 pandemic to control SARS-CoV-2 transmission.

Highlighting the benefit of energy use monitoring in understanding usage.



Upcoming Activities in Phase II

- Wildfire rapid response and sampling (Summer 2022)
- Distribution of intervention equipment to schools (20 schools)
 - Portable HEPA cleaner (if applicable)
 - Power consumption monitors (if applicable)
 - Air quality sensor package
- Outdoor monitoring
- Mobile monitoring

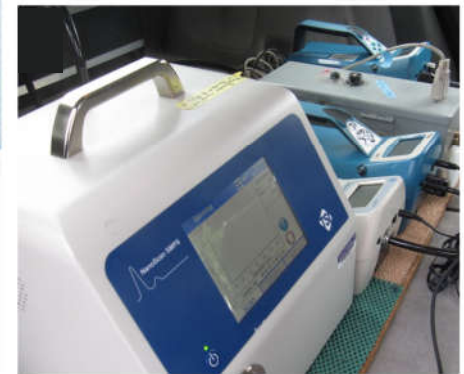
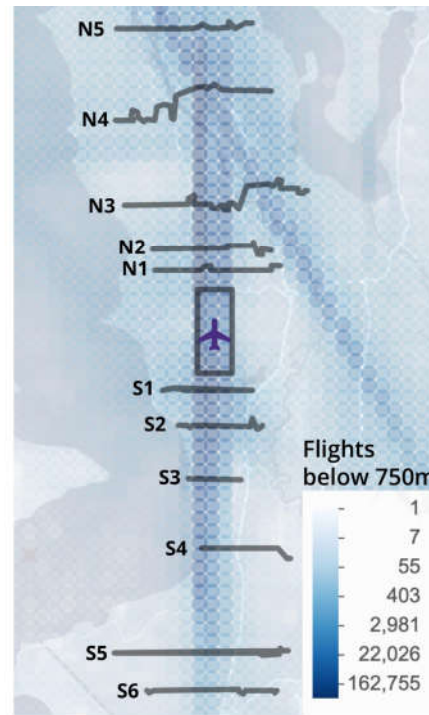


Pilot study – Short Term Health

Mobile Monitoring Updates

Mobile Monitoring Goals

- Developing and refining mobile monitoring to estimate annual exposure concentrations to traffic and aviation air pollutants including NO_x , Black Carbon and size-resolved particles.
- Engage with State and local agencies to develop plans for long-term monitoring
- Identify emissions factors and spatial variations across the area of interest



Mobile Monitoring System Instruments

Particle Detectors

Scanning Mobility Particle Sizer (SMPS) – UFP size distribution

Condensation Particle Counter (CPC) – UFP >10 nm count

Nephelometer – proxy PM_{2.5}

MicroAeth – Black Carbon

Gas Analyzers

Aerodyne Cavity Attenuation

Phase Shift (CAPS) – NO₂

Ecotech Serinus 30 -- CO

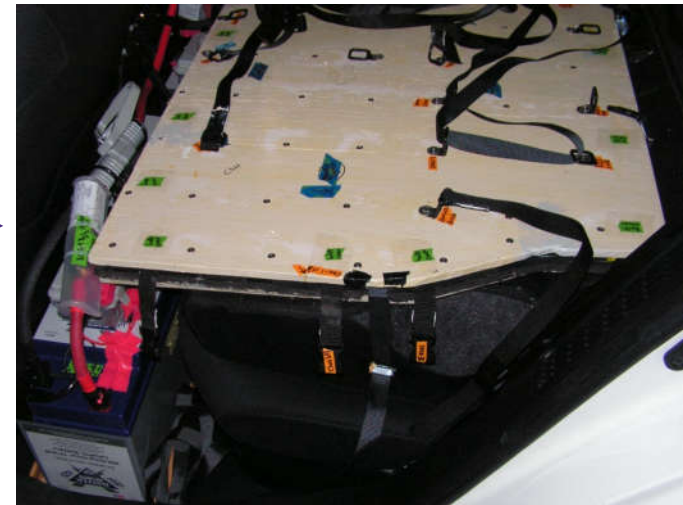
Li-Cor LI-850 – CO₂

Battery / Inverter System to Power Instruments



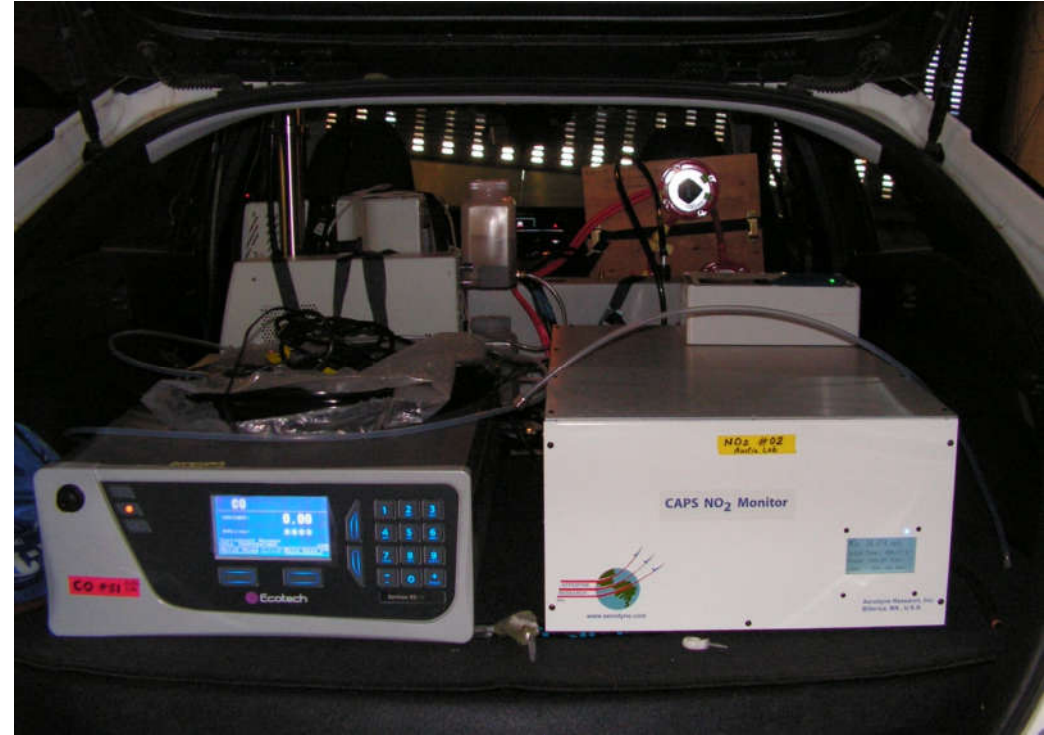
← High-capacity electrical power system

Vibration resistant platform →



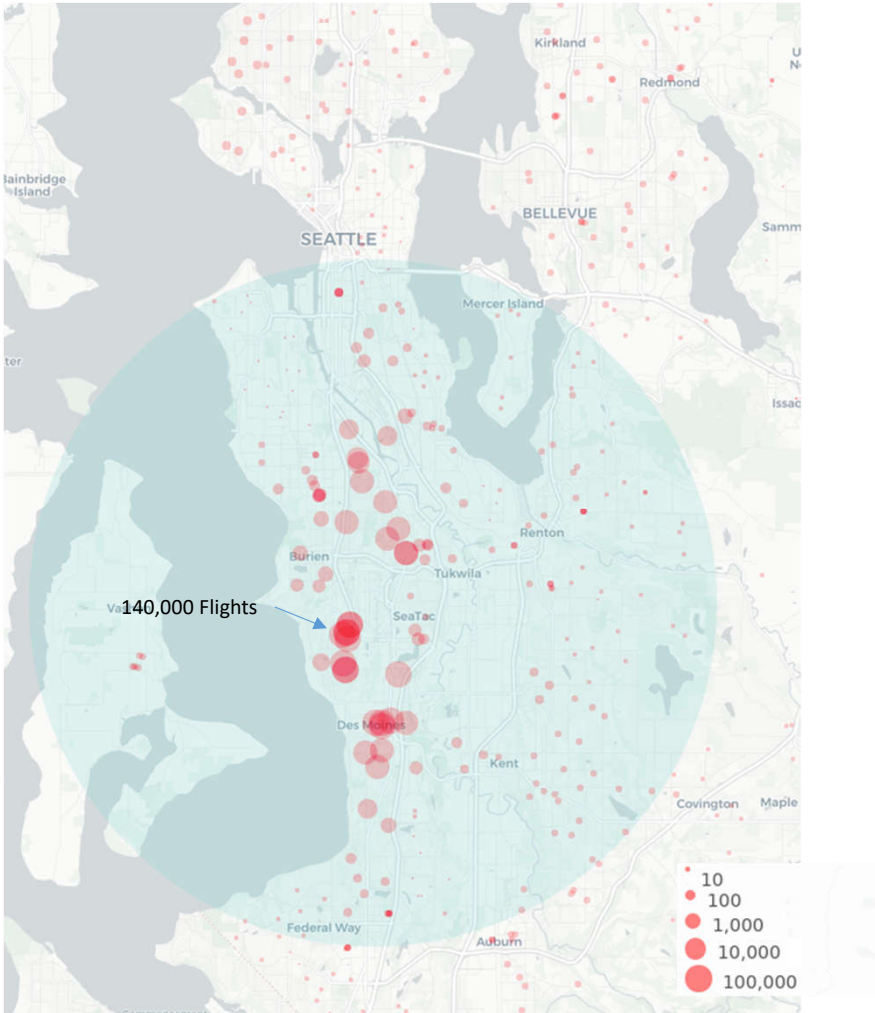
Platform Modifications and System Testing

Particle Analyzers



Gas Analyzers

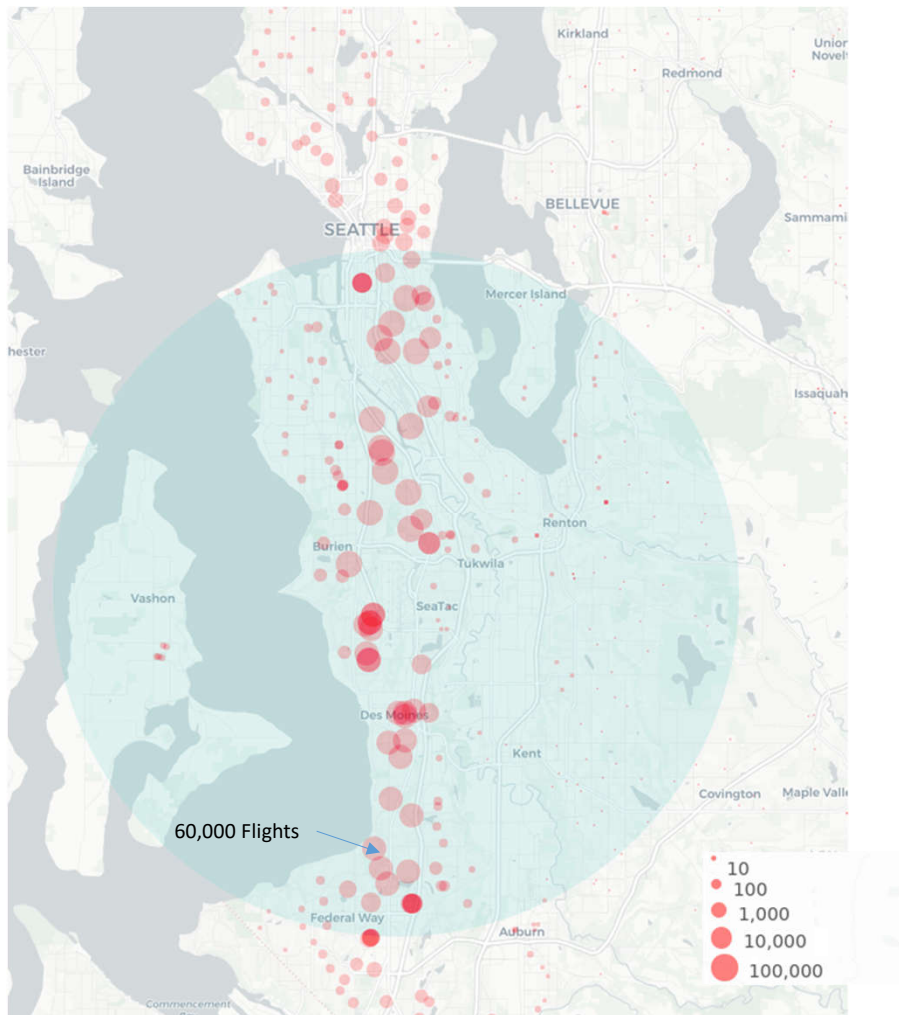
Sea-Tac DEPARTURES (10 mi) below 750 meters per year



All King County Schools		
Airport	# Departures	
	Median	(25 th – 75 th percentile)
Sea-Tac Airport	10	(3 – 24.75)
Boeing Field	11	(0 – 60)
All Airports	35	(5, 204.75)

Pilot Study Schools		
Airport	# Departures	
	Median	(25 th – 75 th percentile)
Sea-Tac Airport	53,313	(6,157 – 55,589)
Boeing Field	26	(25 – 104)
All Airports	53,547	(6,183 – 55,693)

Sea-Tac ARRIVALS (10 mi) below 750 meters per year

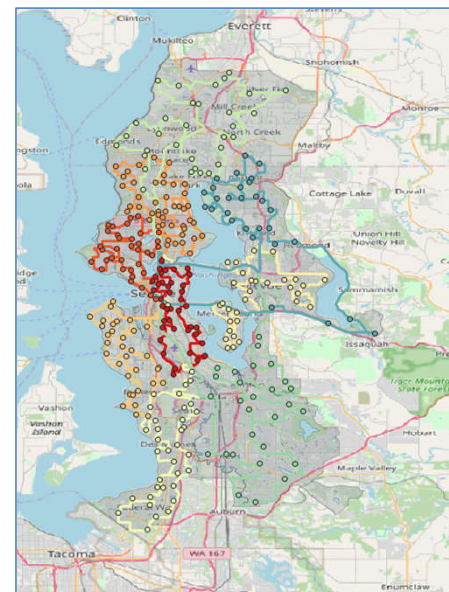
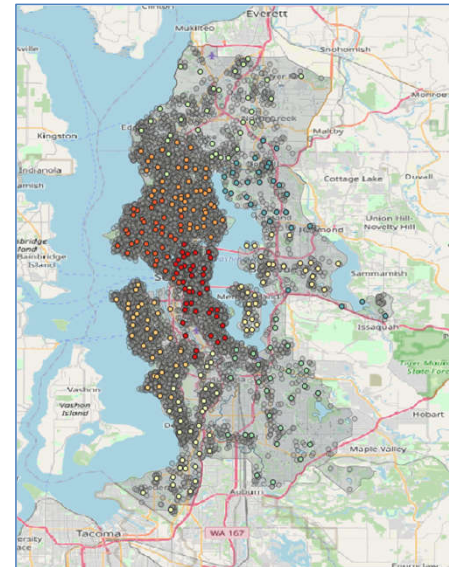


All King County Schools		
Airport	# Arrivals	
	Median	(25 th – 75 th percentile)
Sea-Tac Airport	3	(0 – 36)
Boeing Field	44.5	(7 – 232)
All Airports	102.5	(18 – 589)

Pilot Study Schools		
Airport	# Arrivals	
	Median	(25 th – 75 th percentile)
Sea-Tac Airport	61,234	(59,529 – 154,962)
Boeing Field	18	(8 – 89)
All Airports	61,240	(59,537 – 155,094)

2019 ACT Mobile Monitoring Campaign

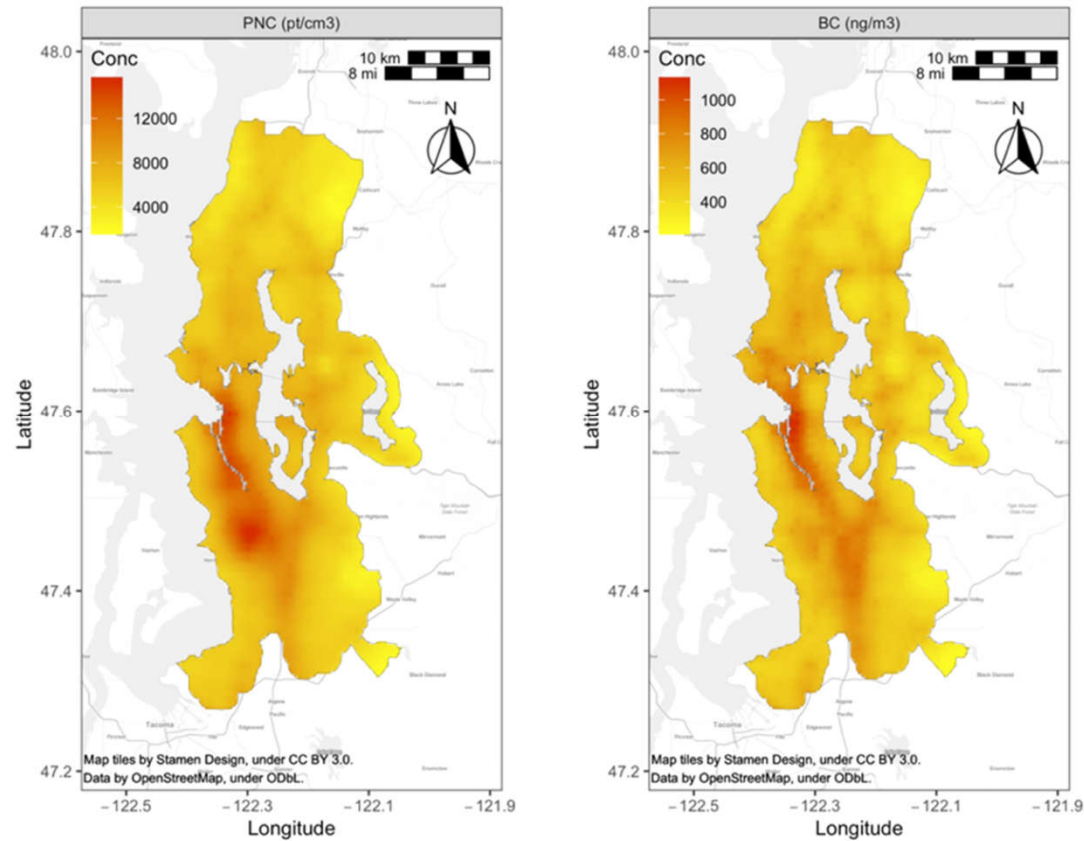
- > 309 stop locations representative of ACT cohort (large, geographically diverse area)
- > 9 fixed driving routes
- > 2-min samples per stop
- > Measured UFPs, BC, PM_{2.5}, CO, CO₂, NO₂
- > A driving schedule ensured temporally balanced sampling



Top: Jittered ACT locations and monitoring stops. **Bottom:** Mobile monitoring routes and stops



Baseline UFP in Puget Sound



PI: Dr. Lianne Sheppard, Citation: <https://doi.org/10.1021/acs.est.2c01077>

Current Efforts

- Finalizing 20 sampling locations within the school districts of Seattle, Renton, Tukwila, Highline
- Engaging with agencies to transfer knowledge and instrumentation
- Deploying instruments at fixed site locations to characterize air quality

Semi-structured Discussion

- Public Health Goals
 - KCPH report on health outcomes
 - Short-term health effects
 - Interventions
 - Health disparities and equity
 - Epidemiology
- Community Involvement
- Collaborations

THANK YOU!

Short Test Drive Data Examples

Measurement	Test drive 1	Test drive 2
SMPS total UFP count average (pt/cm ³) median (pt/cm ³)	11,802 9,700	15,889 10,500
SMPS Median particle size average (nm) median (nm)	51.6 52.9	40.4 38.9
Nephelometer b-scat average (m ⁻¹) median (m ⁻¹)	1.74 e-5 1.75 e-5	0.91 e-5 0.79 e-5
MicroAeth Black Carbon average (ng/m ³) median (ng/m ³)	1,669 814	1,319 321