

Ultrafine Particle (UFP) Advisory Group Meeting
Monday, August 8, 2022
11:30 am – 1:30 pm

1. Introduction and updates

- Attendees
 - Julie Fox (WA State Department of Health)
 - John Resing (Federal Way resident)
 - Alex Stone & Ty Brown (Congressman Adam Smith's office)
 - Debi Wagner (Quiet Skies Puget Sound)
 - Maria Bataloya (Beacon Hill Council, El Centro de la Raza, WA State EJ Council)
 - Jill Schulte (WA State Department of Ecology)
 - JC Harris (Des Moines City Council)
 - Marco Milanese (Port of SeaTac, filling in for Stephanie Meyn)
 - Kyle Moore (City of SeaTac)
 - Shirlee Tan (Public Health Seattle King County)
 - Erik Saganic & Graeme Carvlin (Puget Sound Clean Air Authority)
 - Kent Palosaari (Mira's Garden)
 - Karl Pepple (US EPA Region 10)
 - Paulina Lopez (DRCC)
 - UW Departments of Environmental & Occupational Health Sciences (DEOHS), Epidemiology (Epi), and Civil & Environmental Engineering (CEE)
 - Elena Austin (DEOHS)
 - Edmund Seto (DEOHS)
 - Tim Larson (CEE & DEOHS)
 - Nancy Carmona (DEOHS)
 - BJ Cummings (DEOHS)
 - Mariah Dittmore (DEOHS)
 - Tim Gould (CEE)
 - Lisa Hayward (DEOHS)
 - Jeff Shirai (DEOHS)
 - Anna Harrington (Epi)
 - Magali Blanco (DEOHS)
 - Lilian Liu (DEOHS)
 - Mike Yost (DEOHS)
 - Anjum Hajat (Epi)

Selected updates:

- Community interest in HEAL Act funding opportunities for community monitoring and new epidemiological work done around aircraft exposures & health effects
- PSCAA looking into siting of PM monitoring site near Sea-Tac airport.
- WA State Department of Health projects in Pierce and Kittitas Counties on indoor exposures to various pollutants

- Congressman Smith's office working on reauthorization of FAA programs and budget

2. Indoor air quality report and aircraft impacts on schools

- Main Phase I report finding: Reduction in UFP from 50% to 10% of outdoor particles inside the classroom environment with HEPA air purifier use
- Q&A
 - K Pepple: Does the age of the school provide a predictor of infiltration ratios?
 - E Austin: No. We found that a relatively new school exhibited average/above average infiltration; conversely, School B – which has an old HVAC system that does not move a lot of air (low air exchange rate) had low infiltration.
 - D Wagner: Other sourcing methods other than size?
 - E Austin: In addition to size distribution, we used black carbon content and CO2 levels to assess source of pollutants and air exchange rates. We also used a Principal Component Analysis (PCA) – like we did in the MOV-UP study – which allows us to distinguish features in datasets to identify specific significant sources.
 - D Wagner: discrepancy between 50% and 67% reductions presented in slides? Were there different infiltration rates by size of particles? Suggested looking at infiltration signal by particle size, specifically <35 nm UFPs that are characteristic of aircraft exhaust.
 - E Austin: 50% value shown in slide 9 is an average infiltration value across all schools and all sizes of particles; the 67% value in slide 11 is the average infiltration reduction of aircraft particles only, across all schools. We saw comparable infiltration rates for vehicle and aircraft particles.
 - J Fox: what was the range of outdoor PM concentrations during these measurements?
 - E Austin: Approximately 10,000 particles/cc which was in the medium to high range of concentrations seen in the MOV-UP study. We didn't have a nephelometer to measure site-specific PM concentrations, but we do have PSCAA regional PM values.
 - Paulina Lopez: When did monitoring take place?
 - E Austin/N Carmona/T Gould: First set of visits took place between March-June 2021; the second visits took place in July-August 2021. The order of visits to the schools was the same in each set.
 - JC Harris: Is the PCA method novel or has it been validated/replicated by other studies?

- E Austin: PCA has been used in other studies to discriminate between sources of air pollution. Other methods like positive matrix factorization will be considered and applied to make our results more robust.
- Mapping project
 - For schools in our pilot project, we had ~60K arrivals and ~50K departures at our participating schools vs 3 arrivals and 10 departures across all King County schools
- Reporting back results
 - Zoom meetings and website resources
 - Online survey based on perceptions of air and air pollution sources. Survey found that there is a concern with airports (likely selection bias in participating in study) and airborne infections. Major highways and factories were notably a higher concern than wildfire smoke.
- Distribution of portable air cleaners (PACs) by Public Health—Seattle King County to homeless shelters during the COVID-19 pandemic
 - Collaboration with the UW highlighted the benefit of energy use monitoring in understanding HEPA air cleaner usage
- Upcoming activities in Phase II
 - Will examine wildfire response
 - Distribute PACs, power consumption monitors and air quality sensors
 - Schools that already have PACs, will participate in assessing energy use
 - Outdoor monitoring in the Duwamish area and will be rotating the monitoring locations next year
 - Mobile monitoring

3. Short-term health effects of UFPs

- Evaluated short-term cardiorespiratory health effects from aircraft UFP exposures
- Experimental protocol tested at the SeaTac Community Center
 - Pilot crossover study involving exposed and not exposed individuals to UFPs
 - Participants included healthy and asthmatic adults (N=4)
 - Used PAPR with HEPA and VOC filter in non-exposure group and sham filter in exposure group
 - Scripted walk around Highline SeaTac Botanical Garden
 - Key takeaways
 - PAPR was effective in assigning experimental exposures
 - Some evidence of short-term cardiovascular and respiratory differences from limited elevated exposure under flight path

- Study was proof of concept; number of study participants was too small to make definitive conclusions; preliminary findings suggest a larger and longer-term study may be beneficial
- Q&A
 - A Harrington: Time between measurements? Where were the subjects prior to measurements? Where do they live?
 - E Seto: It would have been better to have a longer washout or pre-study exposure period, but there were a number of scheduling constraints (e.g., post-IRB approval time when study could take place, availability of operators and participants) that made that difficult. There was a 1-2 day period of washout and participants were asked to wear an N95 mask on there way to the study site. The activities (exposed or not exposed) were also randomized.
 - S Tan: Did they investigate PM2.5 effects?
 - E Seto: Not specifically as filters weren't collected. However, the optical particle sizer used to measure PM counts takes measurements from 0.3 – 10 um.
 - JC Harris: What is the stroop test? If a guy works in the auto field for example, would they test differently if they took the test after work?
 - E Seto: The stroop test probably can't be used in that way. The team consulted with a cognitive testing expert and learned that the short-term exposures being evaluated would likely be very difficult to assess. Effects would probably be subtle at best, and would require a more rigorous battery of tests (e.g., half-day worth of testing which was not feasible for this study).
 - J Fox: Do you think people where truly "blinded" to the sham? I wonder if there might be less resistance in breathing without the filter.
 - E Seto: This was a concern because there were activities going on that could compromise the blinded nature of the participants (e.g., nearby smokers). These lessons learned would have to be taken into consideration for any future study.
 - K Palosaari: Interested in looking at potential mental health impacts of exposure to aircraft pollution (e.g., impulse crime, aggression, cognitive decline). There are some animal studies, but they are limited.
 - E Seto: Not his area of expertise, but there are some zebrafish study results that might be suggestive.

4. Mobile monitoring update and site selection process

- Mobile monitoring goals discussed (see slide)
- Instruments and platform description/photos shared (e.g., particle analyzers and gas monitors)
- Considering school sites highly impacting by number of arrivals below 750 meters (mapping project described above)

- Update on 2019 Mobile Monitoring Campaign
 - Drs. Sheppard and Blanco developed monitoring model to estimate annual exposure concentrations and annual estimates of UFP and black carbon
 - 309 sites across Puget Sound that were measured ~ 25 times 2-minute sample each time
 - High concentrations seen in proximity to SeaTac airport; different pattern than with black carbon that more closely traces diesel truck traffic
 - New study will look at change in estimates now vs 2019 findings
- Current efforts
 - Finalizing 20 school sampling locations in the Seattle, Renton, Tukwila, and Highline School Districts

5. Discussion

- Site selection
 - K Palosaari: Interested in sampling around playgrounds (“where it is safe for kids to play”)
 - E Austin: Our study has a school focus, and some schools have playgrounds, but we can look into this.
 - D Wagner: Interested in monitoring maximum impact locations that occur on a regular basis; referenced the short-term health effects study that took place at the SeaTac Community Center and questioned whether that was a site of worst-case exposure. Also, how much disclosure will there be on schools chosen or mobile/fixed monitoring sites chosen.
 - E Austin & E Seto: High/worst-case exposures are difficult to capture as the location on the plume changes depending on meteorology. The transects utilized in the MOV-UP study showed that aircraft plumes did impact the SeaTac Community Center.
 - JC Harris: Lives on 12th street, where Debi Wagner is concerned. Bias towards north side of the airport? Can’t get car into the cul-de-sacs to measure transects near airport. Interest in fixed site monitor under 3-runway confluence.
 - K Palosaari: Differences in concentrations around the airport to help guide priorities?
- Public Health Goals
 - M Batayola: Thinking beyond exposure to health care access. Collaboration with other partners to create learning forum.
 - K Palosaari: Interested in involving Highline college.
 - D Wagner: Would be nice to see more transparency of where studies are at, not just the meeting. Recent study looked at noise and birth outcomes. Other study looked at UFP and pre-term birth.

- JC Harris: Issue getting parents to care. His residents do not see aviation emissions as an issue like roadway exposures in Tukwila. New airplanes don't have visual plumes like old planes, so we need to get more messaging. Elena suggested visiting Healthy Schools technical page and online survey, that could also be shared with JC's constituents.
- A Harrington: Racial and economic inequities in birth outcomes
 - What are the public health risk perceptions of air pollution exposure during pregnancy among airport community stakeholders?
 - What barriers and facilitators do airport community stakeholders face in implementing risk mitigation strategies?

6. Wrap up

- D Wagner: Would like to see a website for updating all on current projects and preliminary results from studies. Interested in SO₂ being monitored in the region.
- JC Harris: what is needed funding-wise to get UFP interest over the line and onto everyone's mind?
- JC Harris: for the site-selection question, given an area (e.g., <3000 ft), how well does a single monitor perform vs a network of monitors? Is a single monitor sufficient?