Summary of Air Quality Monitoring Roundtable Discussion # 2

May 11ᵗʰ, 2015

Executive Summary - Key Discussions & Outcomes

The purpose of the Air Monitoring Roundtable # 2 meeting was to gather information about air quality monitoring actions being undertaken across the Greater Toronto and Hamilton Area (GTHA) and identify potential collaboration opportunities to advance air pollution monitoring and priorities across the region.

At the first roundtable, participants were interested in increasing their understanding of the variation in air quality within the GTHA. As such Greg Evans, Director of the Southern Ontario Centre for Atmospheric Aerosol Research (SOCAAR), presented the results from their mobile air monitoring study and the upcoming plans for air monitoring during the Pan Am Games. See detailed meeting notes attached for more information on Greg Evans' presentation or the presentation is recording available at: https://vimeo.com/129678214

The main goals of increased air monitoring that were identified are to:

- Understand the variation in air quality within urban areas;
- Increase air quality awareness and engagement among the public;
- Evaluate the effectiveness of smaller scale interventions on improving air quality; and
- Gather information on present and future air monitoring actions being undertaken.

Modeling and monitoring have identified significant variation in air quality between air monitoring sites, with transportation being a key factor affecting that variation. Quantifying this variation remains challenging due to the small number of monitoring sites that operate continuously across the GTHA. Developing monitoring networks with greater spatial coverage may build support for actions and policies that could result in air quality improvements, especially for those communities most affected.

Lastly, participants identified gaps in our knowledge surrounding how other jurisdictions garnered public and political support to expand their air quality monitoring networks and improve overall air quality. Participants supported gathering more information about the actions that increase public and political support for interventions and policies that improve air quality.

Potential Actions

- Gather insights from other jurisdictions on how they are using air monitoring to study air quality variation, increase public and political awareness, engagement and support for policy interventions, and evaluate effectiveness of interventions.
- Conduct pre and post air quality measurements for interventions including traffic calming, road closures, complete streets, active transportation, public transit, land use, etc.
- As monitors become more accurate and less expensive the following possible actions could be undertaken: mobile monitoring to undertake "a day in the life" studies (example, gathering exposure information for a car driver in traffic on a highway, using public transit, walking or cycling, jogging on main arterial or in a park and/or connecting air monitors to bike shares or public transit shelters.
- Identify and reach out to other potential air monitoring roundtable participants. Possible groups include the Goods Movement Working Group, Complete Streets Policy Group (City of Toronto),

Urban Freight Forum (Metrolinx), Ontario Professional Planners Institute, Municipal Planning Departments, School Safety Board Working Group and knowledge transfer experts.

Next Steps:

- Gather experiences and lessons learned from other jurisdictions expanding air monitoring networks and/or those having success implementing policies and actions to improve air quality.
- Expand the roundtable by identifying and reaching out to other groups with expertise on goods movement, complete streets, municipal planning, school safety and knowledge transfer.
- Share contact list for Air Monitoring Roundtable Participants (if you would **NOT** like your contact information shared please notify Gabriella at gkalapos@cleanairpartnership.org by August 11th, 2015.
- Convene Air Quality Monitoring Roundtable meetings every 6 months for updates from participants and sharing insights on the priority air monitoring priorities identified above.

Detailed Summary of the May 11th Meeting

A summary of the 1st roundtable was provided at the start of the meeting. The key points included:

- A primer was developed to give background on air quality monitoring and modeling actions in the Greater Toronto Hamilton Area (GTHA) over the last number of years. The Primer looked at new air monitoring technologies and how the nexus between modeling and monitoring could be better synergized. The Primer can be accessed here:
  http://www.cleanairpartnership.org/airqualitymonitoring
- The pros and cons about the new low cost sensor air monitoring technology were discussed.
- For the current air monitoring technology, participants found the level of information provided by the 14 monitoring stations acceptable. These help to evaluate the effectiveness of bigger policy change like coal phase out or vehicle emission standards improvements in longer term studies and the variation between air quality monitoring sites.
- There was an expressed interest in being able to better identify the variation of air pollution within and between communities.
- Interest to use air monitoring to gather information on the effectiveness of smaller scale interventions was expressed.
- Areas of interest included using monitoring to verify the results from modeling work and compiling all source data in one place.
- Participants expressed concerns that the credibility of air quality monitoring may come into question as the public embraces inexpensive but possibly inaccurate air quality monitors.
- Participants expressed concerns that the public is becoming more interested in air quality issues but that there is a lack of guidance on how to interpret and act on the measurements from inexpensive sensor devices.
- There is concern about building air quality concern among the public and then lacking interventions to address the concerns, which might not be the best route to citizen engagement.
- Participants want to have more insight on best practices in jurisdictions that have paired air monitoring and modeling with policy change/larger scale interventions like congestion charges.

Second Roundtable Summary:

At the second roundtable, Greg Evans, the Director of the Southern Ontario Centre for Atmospheric Aerosol Research (SOCAAR) gave a presentation focused on air quality in the Greater Toronto Area. Key points included:

- $PM_{2.5}$ in Toronto is a good news story because it has progressively improved due to both planned (coal phase out) and unplanned (fracking and recession) interventions.
- SOCAAR uses data from different sources, both receptor modeling and receptor monitoring data; a lot of it is from Environment Canada. SOCAAR looks at statistical association between a large numbers of pollutants, factors like sources and chemical processes and puts them together to look at different contributors to the change of $PM_{2.5}$ over time.
- Through 10 years of data, 11 factors contribute to $PM_{2.5}$.
- Emerging $PM_{2.5}$ factors include secondary organic compounds, road dust and zinc/manganese.
- Between 2007 and 2013 road dust has grown from 2% to 4%, sulphate and nitrate have decreased, while organic aerosol and biomass burning have risen.
- Ultrafine particles are an emerging pollutant largely produced by vehicles and is a pretty good marker for traffic pollution. Studies show ultrafine particles decline with distance from major roadways (100 meters impacted, 250 meters likely impacted). One in three Canadians and half of Torontonians live within 250 m of a major roadway.
- A study on the morbidity of Ontario lung transplant recipients found that those living in areas with higher densities of highways have worst health outcomes.
- SOCAAR is conducting a pilot study in partnership with MOECC, Environment Canada and Metro Vancouver on the exposure of Canadians to traffic pollution. Monitors are at ground level and roof level downtown at U of T; one on a typical Toronto roadway, one on the 401 highway and there's a Toronto Island station which provides excellent data on the wind coming into the city.
- The focus of the pilot monitoring stations has changed to much higher time resolution measurements; it's no longer about hourly measurements, it's trying to get measurements down to a minute or a second. There is also a big focus on unregulated pollutants related to traffic like ultrafine particles and black carbon. In Vancouver there's a background air monitoring site and a near road monitoring site coming. This data will be collected for a year.
- SOCAAR is focusing on gasoline injected vehicles which have a new engine that instead of having a carburetor, injects fuel directly into the cylinder, similar to diesel engines. These vehicles are more energy efficient because you don't get fuel sticking to the lines which is great for climate change but they produce about 10 times more particles and they are different types of particles than what seen previously.
- The air quality community needs to be able to monitor technological changes in the vehicle fleet and industrial sectors so that policymakers can be more aware of the repercussions.
- Chase studies focused on high emitting heavy-duty diesel vehicles were conducted (dump truck and flat beds)
- Ultrafine particles were mapped in neighbourhoods across Toronto at midday during the summer months. Maps show high concentrations and hot spots with concentrations about 10 times higher than other spots. This work was done via students walking around with monitors. Those measurements are related to the land use (how much traffic or park space in the surrounding area),

extrapolated across the city which gives us a map that is a product of modeling measurements. SOCAAR is trying to improve these maps and extend this work to other areas across the GTHA and to other pollutants - ultrafine particles, black carbon, and nitrogen oxide.

- This work is be of interest because it's not just about who gets exposed and how much pollution, it's also about our vulnerability due to who we are and our genetics; this determines our susceptibility.

- This added complexity and spatial temporal variability means that future analysis must involve much more spatially resolved individual monitoring. Units are expensive which limits the ability to give people their own air quality monitors.

- SOCAAR is working to create inexpensive sensors that detect a range of pollutants and couple together instruments. If people use these within the limitations of the instruments, they can offer a lot.

- SOCAAR has a network of 15 instruments that will be put out close to Pan Am Games activities (mostly at ground level businesses with an electric outlet and something we can lock it to) using a sensor array approach; which is how we mine the data they produce. Instead of using a single sensor for each pollutant which is most common multiple sensors can be used to incorporate temperature, relative humidity, interfering pollutants and mine data from 5 or 6 sensors for every monitored pollutant This method results in good agreement between the sensors and more expensive instrumentation, but not necessarily all the time. The sensors also drift and wear out.

- The sensor array monitors will produce live data and will be posted on a website. There's already data on the website from many of the MOECC sites pulled data and converted into Air Quality Health Index readings. The idea is to have a network of values that people can visit in real time that will help to inform people and encourage them to fill out a survey.

- SOCAAR is developing videos on air quality and the AQHI.

- In summary- concentrations of many regulated air pollutants are decreasing, however new pollutants and sources are emerging. There is movement toward micro-scale temporal and spatial monitoring from the population to individual scale and there is a role for sensor based devices in this movement.

Discussion

Following the presentation, there was an open group discussion. Key points raised by participants include:

Are we making maximum use of the air quality monitoring available?

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- Organizations like the Toronto Environmental Alliance (TEA) are a great bridge for this type of work because TEA tries to synthesize data and policy directions that are coming out to the public but also try to bring what the public is experiencing up through the channels. Valuable research question would be – where is there evidence of interventions changing air quality? This would help TEA in putting forward solutions to communities. So does a barrier on a highway or planting vegetation actually reduce ultrafine particle movement? Even thinking together about working on monitoring in areas where there are street festivals involving solely pedestrian and cycling traffic or Kensington Market where they close down the street to vehicle traffic on Sundays to see if there is a difference. Those are neat opportunities for our small air monitors that are not perfect but at least keep up people's curiosity with the possibility of these things.

- There's a need to connect new knowledge with potential areas of policy change and get this information to decision makers who influence policy. A list of feasible policies can be developed through which the gaps in knowledge and communication can be identified.
- In terms of mobile urban monitoring, transportation is the focus, however work needs to be done in smaller interventions and awareness among individuals because air quality professionals do not influence transportation policy areas enough. There is a nice interface between policy and people if the focus was on traffic.
- It would be worthwhile to look at provincial and federal regulations and how they could be customized to meet the needs of urban areas.
- In order to reduce the demand for vehicle miles, it falls down to regional and local governments and planners. A lot of this air quality information hasn't been pushed out to these groups, specifically local politicians and local land use planners (i.e. planning institute).
- Structuring pilot interventions and evaluating them, finding out what works to the extent that there is buy in to set up the interventions.
- Creating interventions in goods movement corridors or port areas by improving our understanding of their fleets, the use of these corridors, the population density around them – helping to encourage different routes and times these vehicles could be travelling.
- Goods movements in other communities and the interventions they're using to address this traffic – keeping in mind there may be strong local economic interests influencing goods movements in different communities. The Goods Movement Working Group in the City of Toronto has undertaken this research to improve understanding of the goods movement- types of trucks and where they're going. This group is part of a larger group- the GTHA Urban Freight Forum run by Metrolinx.
- If less expensive sensors are becoming more reliable – it makes sense to have people walk around with these monitors so people can understanding spatially of the pollutant concentration.
- There is a lack of reliable data on freight truck technology, classification and pollution emissions.
- If these sensors become reliable we can put them on bike shares or bus shelters to get a lot of information quickly.
- How do other jurisdictions deal with the resale of older trucks?
- Need for information on interventions for off-road sources (consumer products, two stroke engines used around the house, road construction and building construction) as easy wins and advocacy is possible in this area.

How can monitoring work better with modeling?
- The interplay between helps to identify missing sources in order to improve the model. There are efforts to fuse the two and understand exposure and spatial patterns at larger national scales and Environment Canada is trying to do with the Pan Am games at the local level.
- Modeling is only as good as your data so if you have lots of data sources its great but if there are a lot of gaps (i.e.: freight and train) then it can be a challenge. Modeling is harder to explain to communities. Monitoring can be more effective in activating communities to take action. From a community engagement perspective, on the ground monitoring gets people invested in asking questions, taking action and seeing results, despite its inaccuracies.

What actions are participants interested in pursuing and who else should we reach out to?
Participants identified diverse opportunities to collaborate and raise awareness about air quality. Ideas included:

Opportunities for Public Engagement
- Engaging the public through personal exposure monitoring. Volunteers would perform common tasks such as driving on major highways or jogging in a park while carrying air quality monitoring equipment.
- Showing the impacts of air pollution on others (e.g. children or asthmatics)
- Developing apps for vulnerable populations. For example, Asthma Canada is developing an app for asthmatics.
- Creating a more prominent system for the public to report heavy emitters

Opportunities for Policy
- Integrating the built environment and air quality through building green infrastructure including recreational facilities schools, and complete streets.
- Evaluating interventions such as procurement of new vehicles or performing emission control technology retrofits on health outcomes.

Opportunities for Research
- Engaging data scientists to create better data visualization tools for complex air quality data
- Performing research on emerging pollutants such as ultrafine particles
- Mapping air quality at intersections across the GTA
- Revising the environmental burden of illness calculations for Ontario to focus on a subset of cancer outcomes related to air pollution and diesel exhaust exposure

Next Steps

- TEA is doing the Initiative for Healthy Air and Local Economies (INHALE) project with funding from Metcalf Foundation and in partnership with Environment Hamilton. TEA is doing air monitoring to activate them and get them interested in and talking about solutions, coming to community forums and tying them into groups working on these initiatives. TEA is looking for data sources showing healthy air initiatives improve local economic development to engage local businesses involved in air monitoring initiatives.
- Policy interventions in other jurisdiction and messaging from other jurisdictions (i.e.: London) and recurring themes.
- Policy opportunities within Toronto and other regions where there is existing work where an air quality focus can be added.
- Keep up to date on new science and technology emerging from universities or Environment Canada.
- Meet every 6 months to exchange information.