National Near Road Monitoring Workshop

November 4, 2019

Summary and Recommendations
Canada’s transportation infrastructure and vehicle technologies have entered a period of rapid transition, driven in part by the quest for increased energy efficiency, improved air quality and reduced carbon emissions. The Near Road Pilot Study demonstrated the need for real-world monitoring of traffic related air pollution, in order to guide Canada through this transition and quickly recognize unanticipated consequences.

This study demonstrated that vehicle emissions can be dramatically higher near major roads, creating concentrations of some air pollutants that are two to five times higher than that at locations with little traffic. A third of Canadians live close enough to major roads to be potentially affected. Highly polluting diesel trucks are making a disproportionate contribution, causing excessive exposure to diesel exhaust near roads with a significant proportion of truck traffic. Moreover, Canada’s seasons can increase concentrations: ultrafine particle and nitrogen oxide concentrations are higher in winter while black carbon concentrations are high in Toronto in summer. Finally, non-tailpipe emissions of particles from brakes and tires have been rising in Toronto since 2013 and now exceed primary particle emissions through tailpipes.

This study also highlighted the central role that monitoring of traffic related air pollution (TRAP) can play:

1. Assessing the current status and revealing unknowns.
2. Identifying and supporting implementation of policies and interventions.
3. Engaging the many stakeholders.
4. Tracking progress, supporting interim decisions, and evaluating if desired benefits are realized.

The Near Road Pilot Study was the focus of the National Near Road Monitoring Workshop held on November 4, 2019, which attracted 80 in-person and on-line participants from federal, provincial, regional and municipal government agencies, non-governmental organizations, and academia. Presentations by stakeholders in the morning summarized findings and provided context. More in-depth descriptions of research projects were provided through a poster session after lunch. Breakout discussions in the afternoon, both in person and on-line, identified many ways to further mobilize and follow-up on the findings from this study. These are compiled below in terms of 1) ways stakeholders can work together to reduce exposure, and 2) recommended follow-up actions. Some of these ideas and actions are already being explored or implemented by some stakeholders. Moving forward, a critical first step will be establishing a multi-stakeholder taskforce to shape these recommendations into a strategic plan.
Transportation is essential to thriving communities but needs to be done in ways that balance potential impacts on air quality and health. There are many ways that stakeholders can collectively make progress towards this goal, reducing emissions and exposure while enhancing the flow of people and freight across our communities.

**Municipalities and regional agencies can:**

**Freight and construction**
- Restrict freight travel near facilities for at-risk populations (e.g. schools) while they are in use.
- Expand freight delivery to off-hours and non-congestion periods.
- Create designated lanes for low-emitting trucks that would move freight more rapidly (e.g. allow them to use high occupancy lanes outside of rush hour).
- Require the use of low-emitting construction vehicles within populated areas, as a specification in the tendering process. Tenders should contain clear requirements to reduce dust on site; inspection and enforcement should be used to demonstrate compliance.
- Implement and enforce no-idling restrictions for construction vehicles.

**Urban and traffic planning**
- Install pollution mitigation barriers between at-risk populations and roads with high traffic emissions. Policy needs to be developed to guide the installation of these barriers.
- Require that new high truck traffic facilities (e.g. distribution warehouses) built near residential neighbourhoods only accept low-emitting trucks (similar to the Port of Vancouver’s Truck Licensing System).
- Plan for increased population density, including more urban canyons due to taller buildings closer to roads. Development needs to be enabled along roads, but dispersion pathways need to be included in planning to allow emissions to dissipate.
- Implement low or zero emission zones, or restricted access zones for neighbourhoods with high numbers of at-risk members, or even urban cores as they have done in London, England.
Reduce traffic in highly congested locations or times through congestion pricing and restricted parking.

Incorporate in traffic planning mechanisms to limit stop and go traffic, such as roundabouts.

Implement road-tolls for routes where viable transit alternatives exist. These tolls could reduce congestion and support the development of public transit.

Public buildings and facilities

Require school boards to work with public health agencies to assess air quality inside schools that are located near potential TRAP hot spots.

Consider TRAP early-on when identifying possible locations for new facilities for at-risk populations such as schools, daycares, playgrounds and parks. Restrict building such facilities within 250 m of a major road.

Require that outdoor air intakes on new public buildings to face away and be as far as feasible from traffic emissions.

Change operating procedures to reduce intake of outdoor air into public buildings during morning rush hour.

Enforce no-idling restrictions in bus terminals and improve ventilation when needed.

Active transportation, public transit and public awareness

Support greater access to and use of public transit.

Replace older buses with new low-emitting options.

Develop and implement plans to upgrade municipal and regional agencies’ fleets to low or zero-emission equipment and vehicles.

Promote active transportation, including creating bike-paths that are well-separated from vehicles.

Increase awareness to discourage idling in front of schools and enforce no-idling restrictions to promote uptake.

Develop policies to guide increasing use of personal e-transportation (e.g. scooters).

Provincial and federal agencies can:

Implement stronger programs to eliminate tampering with emission treatment systems.

Develop and implement inspection and maintenance programs for heavy trucks to ensure compliance with provide low-emitting certification for those achieving leading-edge emission standards.

Develop actions to promote retirement of highly-polluting trucks, complemented by additional incentives for smaller operators to update their fleet.

Promote using rail and shortsea shipping for long-range delivery when possible, instead of on-road shipping. Encourage anti-idling and/or electrification of drayage vehicles.

Mandate the use of low-emitting construction vehicles within populated areas. Make this a requirement within contract tendering processes to encourage fleet modernization. Require on-site fence-line monitoring of pollutant concentrations for large size construction projects, to demonstrate compliance with green construction practices.

Support development of NOx removal technologies that perform well under cold winter temperatures.

Require gasoline particulate filters for gasoline direct injection engines.
Support expansion of public transit infrastructure.

Support the transition away from fossil-fuel based transportation by supporting the adoption of electric commuter trains, electric and fuel-cell buses and trucks, electric government vehicle fleets, charging stations, and personal electric cars and trucks.

Change building codes to require that outdoor air intakes on buildings be as far as feasible from traffic emissions.

Establish monitoring at our borders to prevent entry of highly polluting vehicles into

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**Industry and business can:**

- Work with government partners to establish a low-emitting certification along with an easily recognizable logo that can be displayed on vehicles and websites. Together they should establish criteria for the retention or loss of this company certification.
- Retire highly polluting vehicles in their fleets.
- Adopt electric and fuel cell powered vehicles where feasible, and support technology development and innovation.
- Help educate their drivers and distribution-center workers as to how highly polluting trucks can increase their exposure and what steps they can take to reduce this exposure.
- Help identify unethical operators seeking to gain unfair advantage by tampering with their vehicles.
- Consider air quality and health early on when developing buildings and communities, including green construction practices, locating air intakes away from traffic, promoting walkability, co-locating amenities, providing EV charging stations, integrating public transit, identifying potential air quality hot spots, and separating residents and traffic.
- Develop in partnership with government agencies, programs to better publicly recognize highly socially responsible companies that achieve and surpass their commitments towards improving air quality, reducing energy use, and addressing climate change.

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**The public can:**

- Become more aware and engaged in the local and national impacts of transportation on air quality, climate, and health.
- Communicate their concerns to their political representatives and indicate their willingness to support implementing action.
- Support companies that use clean vehicles and report highly polluting operators.
- Learn how to reduce their own exposure to traffic pollution while commuting.
- Walk, ride, take transit, or ride share, whenever feasible.
- Use active transportation (including riding) and transit to go to school; discourage idling in front of their schools.
- Use apps to determine the greener walking or cycling route to a destination.
- When replacing vehicles, switch to an electric vehicle or the smallest vehicle that fits their needs.
The Near Road Pilot Study was made possible through collaboration across multiple levels of government and academia. Further and broader collaboration, along with additional effort and resources, are needed and can help mobilize this knowledge and leverage benefits. In particular, policy development coupled with further research and infrastructure is needed to enhance Canada’s regulatory frameworks, knowledge base, and expertise related to near and on-road monitoring. More specifically, the following follow-up actions were identified through the workshop discussions.

**Government agencies should:**

- Implement near road monitoring in additional Canadian cities, to track changes in TRAP exposure and benefits achieved through climate and air quality policies and regulations.
- Formalize guidelines to promote uniformity across near road monitoring stations in terms of locations, baseline measurements, data reporting formats and overall objectives.
- Develop a range of near road monitoring platforms to address different needs. Full stations are needed in a few selected sites for long term comprehensive assessment. Smaller platforms are needed for intermediate term (< 1 y) deployment to broaden spatiotemporal coverage across Canada. Small, simple and inexpensive tools to measure key pollutants (BC, UFP, NOx, CO, CO2), are needed to facilitate preliminary investigation of suspected hot spots, to assess proposed locations for new facilities for those at-risk, and to support mapping of the variability in TRAP exposure within communities.
- Develop a strategy to incorporate the low-cost air quality sensors being introduced into smart cities as an additional mechanism to estimate and measure exposure to TRAP in cities. This strategy should include processes to evaluate and validate the capabilities, strengths and limitations of this emerging technology.
- Create an expanded near road monitoring working group to promote collaboration and coordination across the many stakeholders including additional ministries and government agencies. This working group might also enable broader discussion of emissions from alternate transportation options such as rail, sea and air.
Consult with policy makers at all levels of governments to identify TRAP related policy questions and research challenges that could help shape the objectives of future work.

Better link government programs on air quality and climate so that addressing one leverages benefits for the other.

Develop more comprehensive urban screening and planning tools for estimating and balancing economic, energy, social and health outcome costs, as a guide to decision making.

Develop guidelines and best practices for installing pollution mitigation barriers beside roads with high truck emissions.

Reconsider the potential value of increased street cleaning, and different street-cleaner technologies, as a mechanism to mitigate increases in non-tailpipe emissions.

Engage a broader range of stakeholders to increase consideration of TRAP in planning processes. These stakeholders might include: urban planners, architecture firms, designers, Ontario Building Association annual meeting, Canadian Institute of Planners, and municipal affairs.

Introduce routine public reporting of traffic related pollutants such as black carbon and ultrafine particles across Canada.

Develop a TRAP specific exposure metric to contextualize reporting of TRAP data and inform site assessment (e.g. classify into quintiles relative to distribution of levels at sites across the country).

Develop messaging to communicate TRAP knowledge and data to the public in a way that is easy for people to understand and act upon.

Develop easy to understand fact sheets that help the public understand what they’re being exposed to and how they can change their habits to make improvements/reduce exposure.

Promote awareness of what drivers can do to reduce their exposure when in heavy traffic (e.g., roll up your windows, change the A/C to recirculation, change cabin filter).

Researchers should:

**Sources & characterization**

- Evaluate the contribution of non-tailpipe emissions to particulate matter in additional Canadian cities.

- Measure real-world emission factors for regions across Canada in order to evaluate the influence of differences in fuel composition, ambient temperature, fleet composition, and prevalence of highly polluting vehicles.

- Evaluate how the compositions and manufacturing of vehicles parts (e.g. brakes and tires) influence non-tailpipe emissions and whether changes can reduce these emissions.

- Assess potential for increased emissions of metals (e.g. copper) that may arise from widespread regenerative braking and vehicle electrification. Assess the capacity of near road monitoring platforms to monitor this transition.

- Identify potential TRAP hot spots across Canada’s communities, in order to select a sub-set of priority sites for this screening pro-
cess. These hot spots may be located at the intersection between high population density, high traffic and/or freight routes (e.g. highways near residential areas, distribution centers, etc.) and vulnerable citizens.

Methodology, technologies & other tools

- Develop and evaluate smaller, simpler and less expensive technologies to identify highly polluting vehicles both on-road and at near road locations.
- Develop and evaluate simpler, smaller and less expensive systems to allow short-term monitoring at suspected hot spots, and existing or proposed facilities for at-risk populations.
- Expand methods available for comprehensive chemical characterization of TRAP and apply these through near road stations, in order to identify changes due the ongoing changes in Canada's vehicle fleets. These methods might include more detailed speciation of metals and organic compounds such as PAHs.
- Develop better models to combine and compare data from short term TRAP monitoring. These models should enable estimation of long-term averages (e.g. annual average) and wider spatial averages or differences.
- Implement sampling campaigns to update Canada's land use regression model-based maps of TRAPs.
- Develop simple screening tools (e.g. outdoor window wipes) to assess relative TRAP concentrations outside of homes, schools and other buildings.
- Evaluate air quality inside schools and daycares located near busy traffic and develop better methods to relate indoor to outdoor concentrations.
- Develop better GPS tools to track the locations and routes of large trucks.

- Identify and evaluate better methods and tools to assess indoor exposure to TRAP within homes and workplaces, and how this can be reduced through interventions.

Evaluation & reduction of exposure

- Assess occupational exposure of those most exposed to traffic related diesel emissions, such as truck, bus, taxi, construction, warehouse, police, and border workers.
- Evaluate how traffic impacts exposure in tall buildings through the vertical dissipation of pollutants.
- Investigate how urban canyons can be designed, to limit increases in exposure to traffic pollution.
- Evaluate emerging technologies for filtration and capture of ambient pollutants, as a mitigation option when reducing emissions at a hot spot is not possible.
- Evaluate mechanisms to improve indoor air quality in buildings near traffic pollution hot spots. These might include improved filtration, changed operation timing, and modification to the air intake.
- Evaluate best practices and the effectiveness of installing pollution mitigation barriers beside roads with high traffic emissions.

Health and social impacts of traffic air pollution

- Investigate and better characterize the health risks associated with exposure to ultrafine particles, to help establish appropriate guidelines, mitigation strategies and public messaging.
- Conduct further epidemiology to better identify and understand health outcomes associated with TRAP exposure. These studies might seek to better determine the health impacts of living near busy roads and long commutes, whether individual components vs. the integrated exhaust mixture is more im-
important, and how acute exposures at high concentrations combine with prolonged chronic exposures at moderately elevated concentrations influence different outcomes.

- Develop and apply integrated analysis tools to estimate the social costs of current TRAP exposure and the benefits of implementing changes in vehicle technologies, urban planning and greenhouse gas emissions reductions. These social costs and benefits could include years of life lost, illnesses, premature deaths and climate co-benefits.

- Develop methodology to apportion TRAP to different activities (e.g. errands, commuting, local shipping, local construction, long haul/pass through shipping) in individual communities so as to better link choices with emissions.

- Assess the potential air quality and climate benefits of increased remote/teleworking.

A critical first step will be establishing a multi-stakeholder taskforce to shape these recommendations into a strategic plan and implement strategy that reflects individual provincial interests and supports the Canada-wide Air Quality Management System.