Metro Vancouver Near-Road Air Quality Monitoring Study

Summary

November 2019

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www.metrovancouver.org

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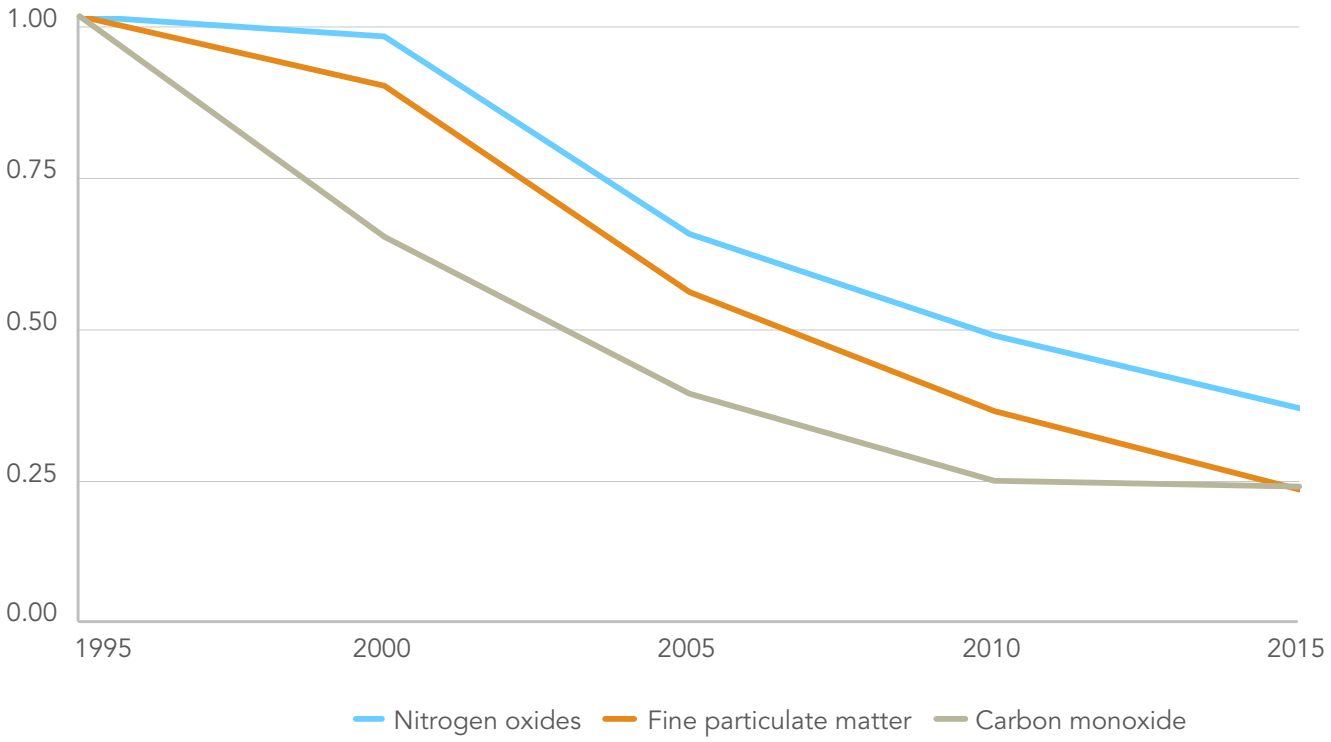
Clean air is vital to the livability of our region. It makes Metro Vancouver a desirable place to live, work and play. But our clean air doesn't happen on its own. Carefully monitoring and understanding the impacts of air contaminants is essential to protecting our air quality and minimizing risks to public health.

Most of the time Metro Vancouver residents enjoy good, and steadily improving, air quality. Even so, vehicle emissions are still a significant source of air contaminants in our region. And nearly half the population of Metro Vancouver now lives near a major roadway and within range of vehicle emissions – a known risk factor for a range of health issues.

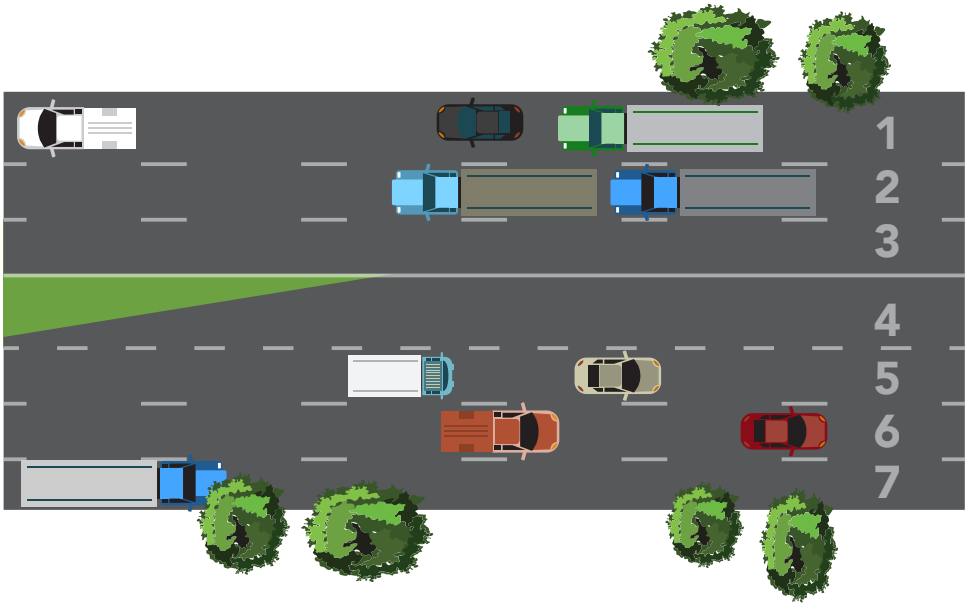
To better understand the impacts of traffic-related air pollution near major roads, Metro Vancouver collaborated with Environment and Climate Change Canada, the Ontario Ministry of the Environment, Conservation and Parks, and the University of Toronto on a two-year (2015 to 2017) monitoring study. This national study included new monitoring in both Vancouver and Toronto. Information from the study will help determine public exposure to air contaminants and will inform a national near-road monitoring strategy for urban areas in Canada.

Many of us live near major roads

Regional air quality in Metro Vancouver has improved steadily over the past several decades, in part because of stricter vehicle emission standards and the AirCare vehicle emissions inspection program that have reduced major air contaminants that cause smog and harm health.

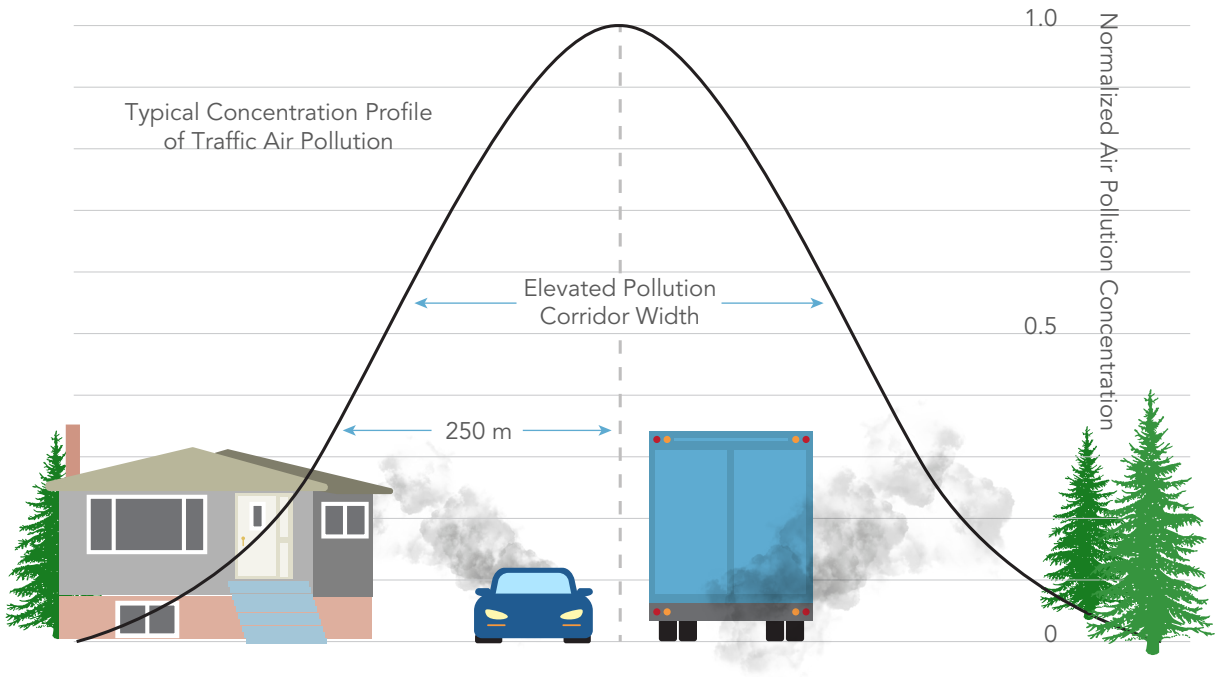


VEHICLE EMISSIONS OF TRAFFIC-RELATED AIR POLLUTANTS CONTINUE TO DECLINE IN METRO VANCOUVER, RELATIVE TO 1995.



MAJOR ROADWAYS HAVE AN AVERAGE DAILY TRAFFIC VOLUME OF 15,000 VEHICLES OR MORE AND ARE USED BY A VARIETY OF VEHICLE TYPES.

Despite local improvements in vehicle emissions, Canada's urban areas, population and use of vehicles continue to grow. Around 10 million Canadians, 32% of the total population, now live within 250 metres of a major roadway and in range of vehicle emissions. This percentage is higher in Metro Vancouver, where over one million people – nearly half the population – live within 250 metres of a major road.



TRAFFIC-RELATED AIR POLLUTANTS CAN BE ELEVATED UP TO 250 METRES FROM MAJOR ROADS.

Vehicle emissions have health impacts

Vehicles emit air contaminants from the combustion of fuel (mainly gasoline and diesel), as well as brake and tire wear. This traffic-related air pollution, while highest at its source, can have impacts up to 250 metres from a major road.

Exposure to traffic-related air pollution is a significant public health issue in Canada. Living or spending time near a major roadway is a known risk factor for a number of respiratory symptoms and cardiovascular problems.

Many air contaminants are linked to particular health impacts. Metro Vancouver monitors a range of health- and traffic-related air pollution at 31 air quality monitoring stations throughout the region.

Diesel vehicles are considered the most critical source of traffic-related air pollution. Diesel-exhaust particles are one of the most harmful vehicle-related air contaminants and a known carcinogen. Although diesel engines are more fuel-efficient than gasoline engines, they emit considerably more particulate matter.

Black carbon and ultrafine particles are both linked to diesel emissions, and are emerging as pollutants of significant public concern. Metro Vancouver has measured black carbon for many years, while ultrafine particles were measured in the region for the first time as part of the near-road monitoring study.

Black carbon is commonly emitted from diesel engines. It is a significant component of fine particulate matter and is small enough to be easily inhaled into the lungs. It is closely linked with cancer risk. Black carbon is also a major contributor to global climate change.

Ultrafine particles are both naturally occurring and emitted from combustion sources, including vehicle emissions. These microscopic particles, about 1/500th the width of a human hair, can penetrate the tissue of the lungs after inhalation and then enter the bloodstream and circulate throughout the body.

A 2019 study estimated that air emissions from transportation in Canada are associated with 1,400 deaths and 12 billion (USD) dollars of health damages.[1]

A separate 2019 study found that Canada has the third highest overall rate of traffic-related childhood asthma (per 100,000 children) cases behind only Kuwait and the United Arab Emirates, among 194 countries analyzed. The high rate in Canada is influenced by traffic-related pollution levels and overall asthma rates.[2]

[1] *Anenberg, S.; Miller, J.; Henze D.; Minjares, R.; and Achakulwisut, P., 2019. The global burden of transportation tailpipe emissions on air pollution- related mortality in 2010 and 2015.*

[2] *Achakulwisut, P.; Brauer, M.; Hystad, P.; Anenberg, S.C., 2019. Global, national, and urban burdens of paediatric asthma incidence attributable to ambient NO2 pollution: estimates from global datasets*

The Metro Vancouver Near-Road Air Quality Monitoring Study

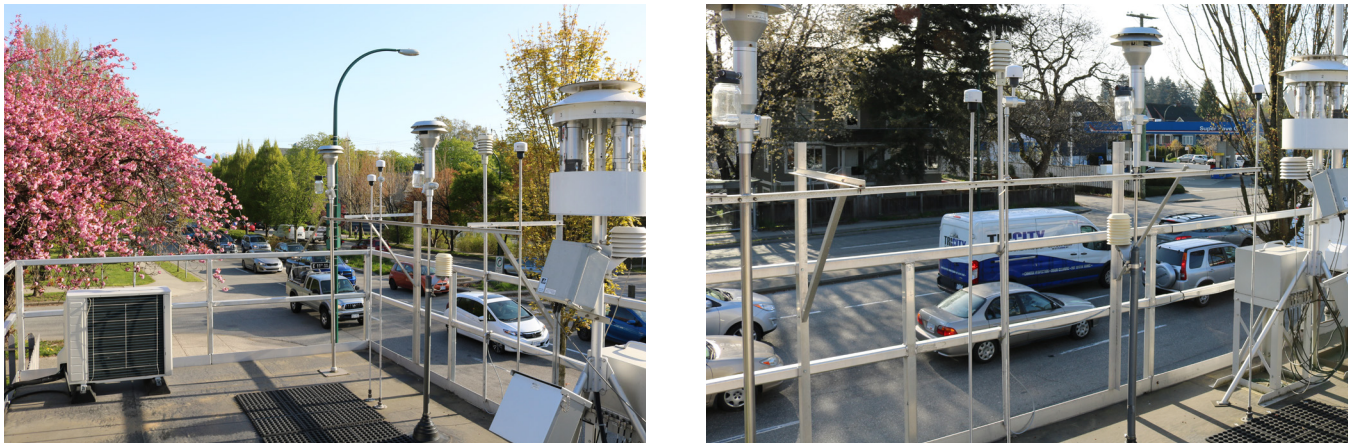
You may have driven past the near-road air quality monitoring station at Clark Drive and 11th Avenue in Vancouver without realizing. In fact, the station may have measured emissions from your vehicle. Metro Vancouver operates the station on Clark Drive, a busy roadway and truck route in a densely populated neighbourhood. The station measures near-road traffic-related air pollutants that impact health.

Metro Vancouver selected the Clark Drive station location based on traffic volume and neighbourhood population density. While the Clark Drive station is located in Vancouver, it is representative of other roads and neighbourhoods throughout the region with similar traffic. The Clark Drive station has been collecting data since May 2015.

A second air quality monitoring station was established three kilometres east of the Clark Drive station and away from heavy traffic routes for comparative purposes. Metro Vancouver also collected additional comparison data from sites within its regional air quality monitoring network.

The near-road monitoring station measured a wide range of air contaminants, along with weather and traffic, using many of the same specialized instruments found throughout Metro Vancouver's wider air quality monitoring network.

The monitoring instruments operated continuously, providing data every hour of the day on vehicle pollutants, weather and traffic.



CLARK DRIVE STATION AIR QUALITY MONITORING EQUIPMENT.

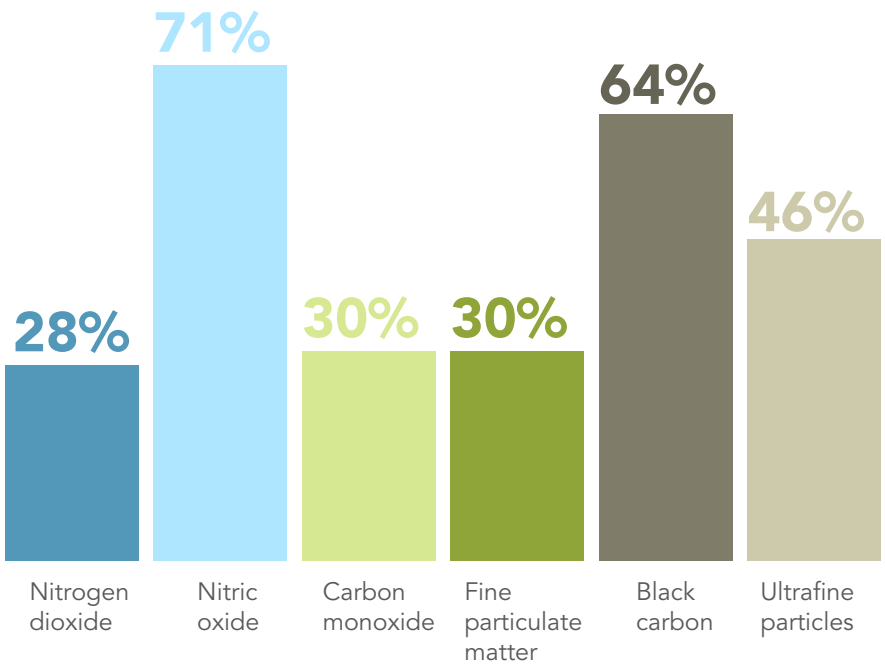
At the same time as the Metro Vancouver near-road study, Environment and Climate Change Canada, the Ontario Ministry of the Environment, Conservation and Parks, and the University of Toronto measured vehicle pollutants at two near-road sites in Toronto. One was located along Highway 401, an 18-lane highway described as the busiest in North America. The second monitoring station was near a four-lane roadway within downtown Toronto.

Together, the Vancouver and Toronto sites represent a trucking route, highway and downtown road, and bring into focus the current state of near-road pollution in Canada.

A summary of the Vancouver and Toronto study findings, prepared by the University of Toronto, is available at www.socaar.ca.

Air quality is worse near major roadways

Air quality monitoring at the Clark Drive site in Vancouver shows that air contaminant concentrations are considerably higher near major roadways. Comparing data collected from the comparison monitoring sites reveals that these elevated concentrations are a direct result of the volume and type of vehicles on Clark Drive, and diesel emissions in particular.



TRAFFIC CONTRIBUTED TO SIGNIFICANT INCREASES OF MEASURED AIR CONTAMINANTS AT THE CLARK DRIVE MONITORING STATION, RELATIVE TO THE COMPARISON STATION.

On occasion, the monitoring data exceeded Metro Vancouver's annual air quality objectives for nitrogen dioxide and fine particulate matter. Air quality objectives and standards are health-based targets which define the acceptable outdoor concentration of key air contaminants.

Given the elevated nitrogen dioxide concentrations, near-road environments with exposure to diesel traffic may be challenged to achieve the more stringent 2020 Canadian Ambient Air Quality Standards (CAAQS)[3] for this pollutant.

About a quarter of the fine particulate matter measured in the near-road environment was black carbon, an indicator of diesel exhaust. While there are no federal, provincial or Metro Vancouver objectives for black carbon, it is a pollutant that is a concern for its impacts on both health and climate change. The monitoring study also found twice the amount of ultrafine particles in the near-road environment compared to the comparison site farther away from traffic.

[3] *The Canadian Ambient Air Quality Standards (CAAQS) are national air quality management standards for key pollutants. Metro Vancouver is reviewing its air quality objectives to account for the more stringent CAAQS that come into effect in 2020.*

Large trucks are a main contributor to near-road air pollution

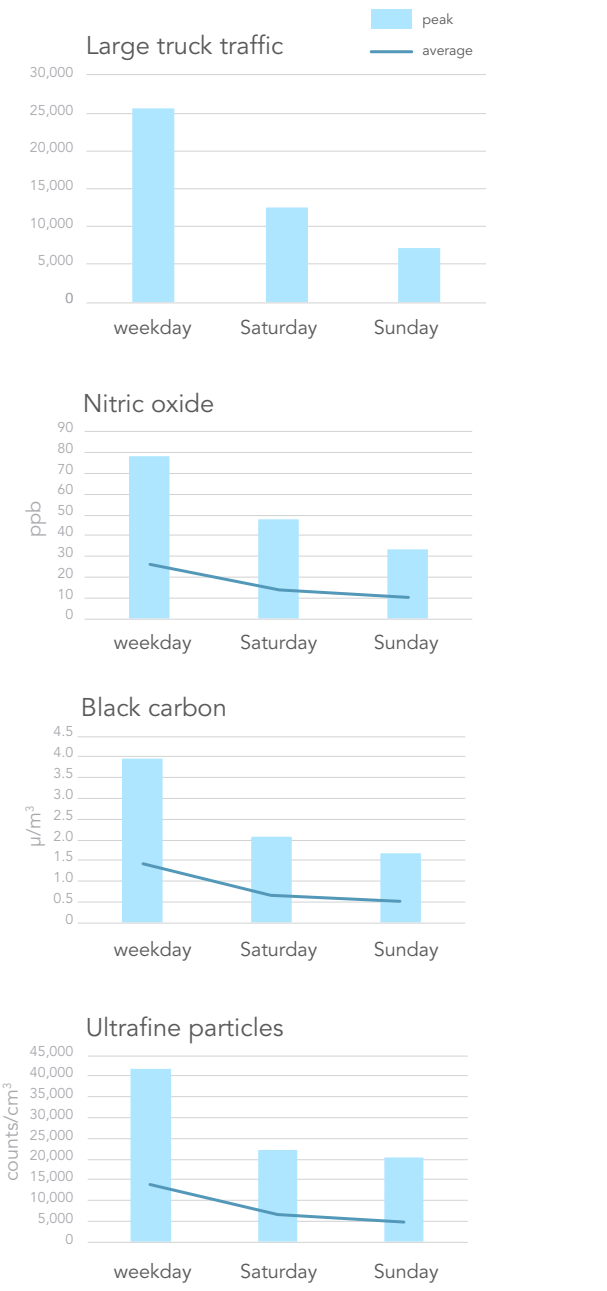
Emissions from different types of vehicles vary significantly. While most passenger vehicles on the road are fuelled by gasoline, the majority of large trucks (i.e., semi-trailer trucks) still consume diesel.

Large trucks make up only 6% of the total traffic measured at the Clark Drive monitoring station, but they contribute a disproportionate amount of vehicle-related emissions. The elevated air contaminant concentrations at the Clark Drive site, including nitrogen oxides, black carbon and ultrafine particles, are due more to the large trucks travelling this road, rather than total volumes of traffic.

The impact of diesel-fueled trucks on near-road air quality is supported by comparing the Clark Drive results with other monitoring sites used in the study. Although influenced by other factors, vehicle air contaminants at Clark Drive, a major truck route, were similar to results collected from the Toronto highway site, one of the busiest roads in North America.

The study results show that vehicle type, large trucks in particular, rather than traffic volume, is a main contributor to the amount and type of air contaminants associated with major roadways.

There is a clear correlation between elevated air contaminant levels and the hours and days when large trucks are typically on the roads. For example, concentrations of near-road air contaminants dropped significantly on weekends, when large truck traffic volumes also decline, even though the number of passenger vehicles remained relatively steady. On average, carbon monoxide and fine particulate matter concentrations were 1.5 times higher on weekdays compared with Sunday, nitrogen dioxide and nitric oxide concentrations were twice as high, and black carbon and ultrafine particle counts were nearly three times higher.



REDUCTION IN TRUCK TRAFFIC AND CORRESPONDING AIR CONTAMINANT CONCENTRATIONS DURING WEEKENDS.

Higher concentrations were also measured when winds were blowing from the direction of a major intersection near the monitoring site. **The study showed that concentrations near major roads can vary considerably from hour to hour and day to day.**

Next steps

Vehicle emissions have significantly improved over the last several decades, contributing to overall improvements in the region's air quality. These trends are expected to continue, as newer and cleaner vehicles, including electric vehicles, replace existing cars and trucks while use of public transit and active transportation increases.

Nonetheless, the results of the near-road monitoring study show that traffic-related air pollution near major roads continues to be significant. Many roadways throughout the region carry comparable amounts and types of traffic to those measured at the Clark Drive monitoring station, meaning that a significant portion of the population is exposed to similar concentrations of air contaminants. **Metro Vancouver is committed to continue monitoring the near-road environment at Clark Drive, to further understand the impacts of traffic-related air pollutants and track changes.**

A key recommendation of the *Metro Vancouver Near-Road Air Quality Monitoring Study* is to **develop a program to reduce emissions and exposure to traffic-related air pollutants.** This program would draw from a range of strategies, including land use policy, infrastructure design, and transportation management, and would require support from multiple levels of government, from individual municipalities to the provincial level.

A significant portion of any program to reduce emissions and public exposure to air contaminants will include **increased education about the health impacts of traffic-related air pollution and transportation decisions.** Key topics for public education include the benefits of active transportation, adverse effects of motorized transport, risks of exercising near busy roads and truck routes and short-term mitigation options such as upgrading heating and ventilation systems in nearby buildings to improve indoor air quality. Other groups, including the trucking community, could also be engaged on the impacts of vehicle pollution.

Metro Vancouver is currently developing an updated air quality management plan, the *Clean Air Plan*, which will identify opportunities for accelerated emissions reductions in our region, including near major roadways. The near-term actions in the *Clean Air Plan* will help protect human health and the environment, while reducing greenhouse gas emissions, through incentives, education and regulations. These emissions reductions align with *Climate 2050*, Metro Vancouver's long-term strategy to support achieving a carbon neutral and resilient region by 2050.

You can learn more about Metro Vancouver's air quality programs at metrovancouver.org.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