Why Reducing Transportation Emissions Matters!

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Transportation and Health

- Chronic diseases
  - Physical inactivity
  - **Air quality**
  - Noise
  - Stress
- Health inequity
- Injuries
- Environmental degradation
  - Climate change

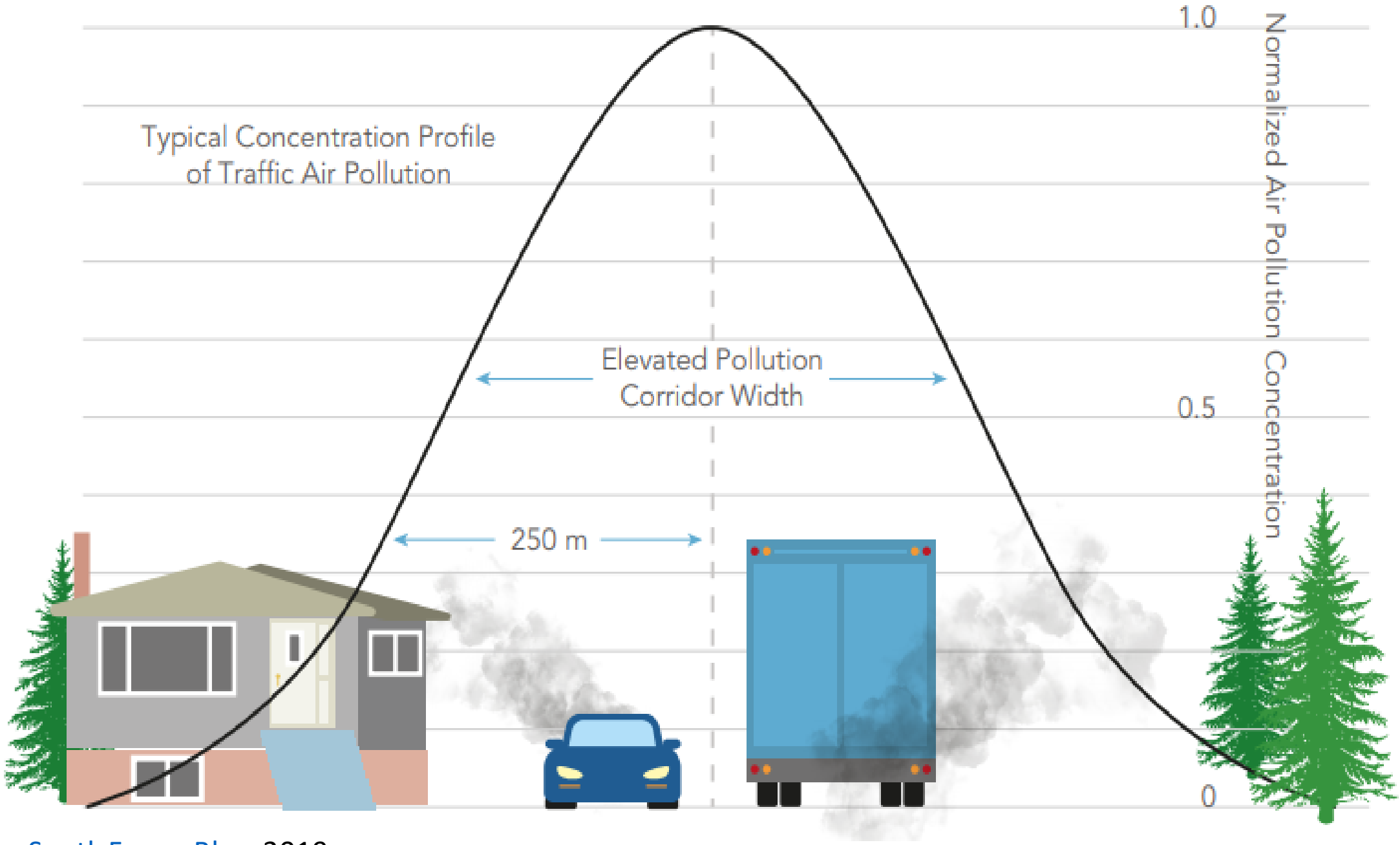
- The International Agency for Research on Cancer (IARC) classifies gasoline engine exhaust and diesel engine exhaust as possible and known human carcinogens, respectively (IARC, 2012)

Transportation Emissions

- Motor vehicles emit over 40 pollutants
- Combustion emissions:
  - carbon dioxide (CO_2)
  - carbon monoxide (CO)
  - oxides of nitrogen (NO_x)
  - black carbon (BC)
  - particulate matter (PM_{10}, $PM_{2.5}$, and ultrafine)
  - volatile organic compounds (VOCs)
- Non-combustion emissions include:
  - dust that is re-suspended or from tire and brake wear
  - evaporative emissions
- Atmospheric chemistry forms secondary pollutants
- Responsible for 28% of Peel's community greenhouse gas emissions

Transportation and Health

- Very difficult to study health impacts related to traffic-related air emissions
  - complex chemical mixture
  - secondary chemical reactions
  - high spatial and temporal variability
  - exposure and consequent health impacts dependent on proximity, wind, fleet type, age of vehicles and consequent maintenance, speed, fuel type, geography, etc.
- There is no one pollutant that is TRAP-specific



Source: South Fraser Blog, 2019

Living Near a Major Road – Traffic-Related Air Impacts

Higher risk of developing or worsening a range of health impacts:

- Adverse birth outcomes
  - Low birth weight
  - Small for gestational age
- Childhood asthma
- Respiratory infections
- Impaired lung function
- Premature mortality
- Cardiovascular morbidity
- Childhood leukemia

Transportation and Health

- Gradation of exposure within 300-500m
- Peel's population highly exposed

Population and Sites Located within 300 Metres of High Traffic Volume on Roads, Peel, 2012

Population or Site	Total Number	Number Within 300 Metres of High Traffic Volume Roads	Per Cent Within 300 Metres of High Traffic Volume Roads
Population, all ages	1,296,815	690,960	53.3
All recreational centres	1,541	439	28.5
Outdoor sports fields	1,439	403	28.0
Licensed daycares	544	175	32.2
Parks and playgrounds	643	163	25.3
Schools	391	103	26.3
Long-term care facilities	26	18	69.2

Sources: Block Population data from Esri Business Analyst v10.0.
Census, 2011, Statistics Canada.
Average Annual Daily Traffic data 2012. Cities of Brampton and Mississauga Transportation Departments, and Region of Peel Public Works.
GIS data shapefiles, 2013. Corporate Services Integrated Planning.

Source: Changing Landscape in Peel,2019, www.peelregion.ca/health/resources/pdf/CHSR-changing-landscape-health-peel-full-report.pdf

Off-Peak Delivery (OPD) Benefits

- Reduced emissions from trucks thanks to less congestion
  - 2019 Off-Peak Delivery pilot project showed an 11% decrease in emissions
- Improved safety as pedestrians and bicycles have fewer encounters with trucks during the daytime
- Higher travel speed during the off-peak hours compared with daytime, especially the peak hours; less stopping with less brake wear and tear
- Potentially less exposure

2019 OPD Modelling Exercise – Region of Peel

Assumptions:

- Retail sector only; deliveries by trucks
  - 43% of light trucks and 17% of medium heavy trucks are related to retail
  - Off-peak hours 7 pm to 7 am; 7 days a week
  - Modelled 100% participation of the retail sector
- Modelled atmospheric chemistry on a 1km by 1km using the Peel domain only

Implications

Preliminary Findings:

- **Temporal pattern of emissions changed** – impacted ground level ozone which is created between NO_x and VOCs in the presence of sunlight

Using the Air Quality Health Index

- Public reporting system: $PM_{2.5}$, Ozone, NO_2 based on 3-hour average concentrations
- **Overnight**: ozone concentrations were predicted to be lower in the OPD scenario, but NO_2 and $PM_{2.5}$ concentrations were predicted to be higher, resulting in the AQHI predictions being overall higher (slight increase) in the OPD scenario compared to the Base Case
- **Daytime:** the opposite was seen
- **Overall Results:** the number of high AQHI risk hours was modelled to be slightly higher

Implications

- **Preliminary study –** many assumptions and further work is needed

- **Further studies are needed** to understand the:
  - **Health impacts** - what do higher AQHI values at night mean for exposure and health impacts?
  - **Upwind and downwind context** – expand the domain beyond the Region of Peel
  - **Post-pandemic world**
    - changing retail landscape
    - more people working from home and changing traffic patterns