TDSB Air Quality: *An Analysis of* ***outdoor CO_2, O_3,*** *and* ***PAHs****, and* ***in-car PAHs*** *during dro[illegible]ime*

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Parents choosing to drive instead of walking their children to school

Olivia Rook

Monday, September 23, 2019

One in 10 parents worry about the pollution their kids would inhale if they were to walk to school.

Health risk of the school run: Driving children exposes them to three times as much pollution as walking

- Toxic fumes are three times higher inside cars than outside,
- Driving children to school can 'poison them' and rob them of socialisation
- Pollution is the second 'avoidable' cause of death, causing 40,000 in the UK

1. Correspondent, C. F. E. *Driving children to school exposes them to more pollution than walking*. Mail Online. http://www.dailymail.co.uk/~/article-5112753/index.html (accessed 2023-11-30).

2. *Parents choosing to drive instead of walking their children to school*. Early Years Educator. https://www.earlyyearseducator.co.uk/news/article/parents-choosing-to-drive-instead-of-walking-their-children-to-school (accessed 2023-11-30).

3. easyecotips. *Air quality inside your car is worse than outside - EasyEcoTips*. https://easyecotips.com/air-quality-inside-your-car-is-worse-than-outside/, https://easyecotips.com/air-quality-inside-your-car-is-worse-than-outside/ (accessed 2023-11-30).

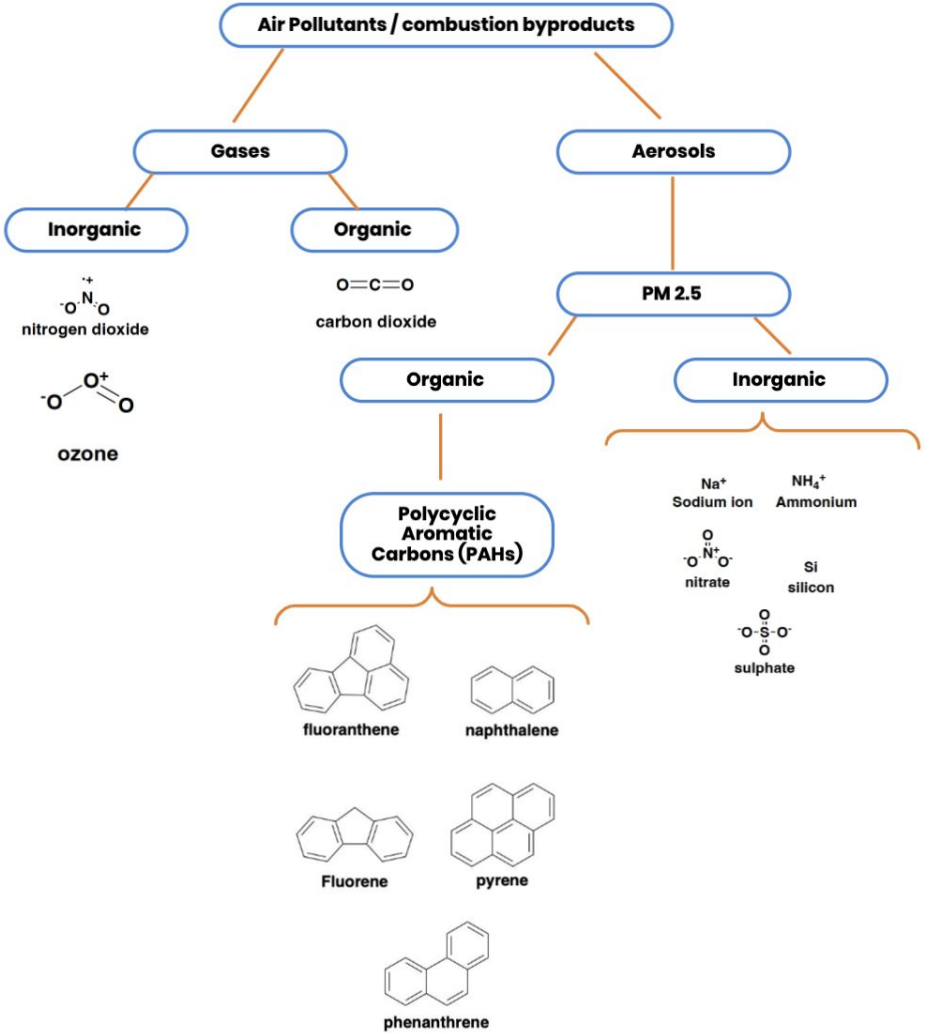
4. *How to Draw Air Pollution of City Road Scene Drawing for Environment Pollution Easy*; 2019. https://www.youtube.com/watch?v=YASDvpul9YA (accessed 2023-11-30).

Research Questions:

1. Is there a significant difference in outdoor air pollution levels ($PM_{2.5}$, O_3, CO_2) at a TDSB on weekdays vs. weekend during school during drop-off time?
2. Is there a significant difference in vehicle self-pollution of various PAHs on weekdays vs. weekend during school during drop-off time?

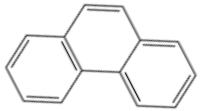
Our hypotheses:

1. We hypothesize that concentrations of all air pollutants will be higher in the outdoor air on weekdays.
2. We hypothesize that PAH concentrations will be higher inside vehicle during the weekday.

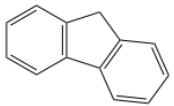


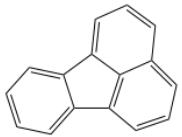
Sampling Methods

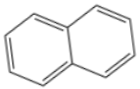
- Six days of sampling over a month
  - Weekdays and weekends
- Measurements done between 8:30-10:00 am
- In vehicle
  - PAH



- Outdoor air
  - O_3
  - CO_2
  - PAH
  - $PM_{2.5}$

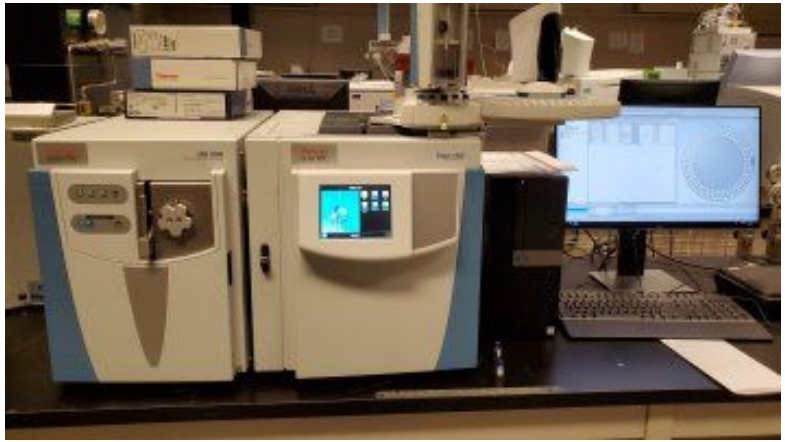




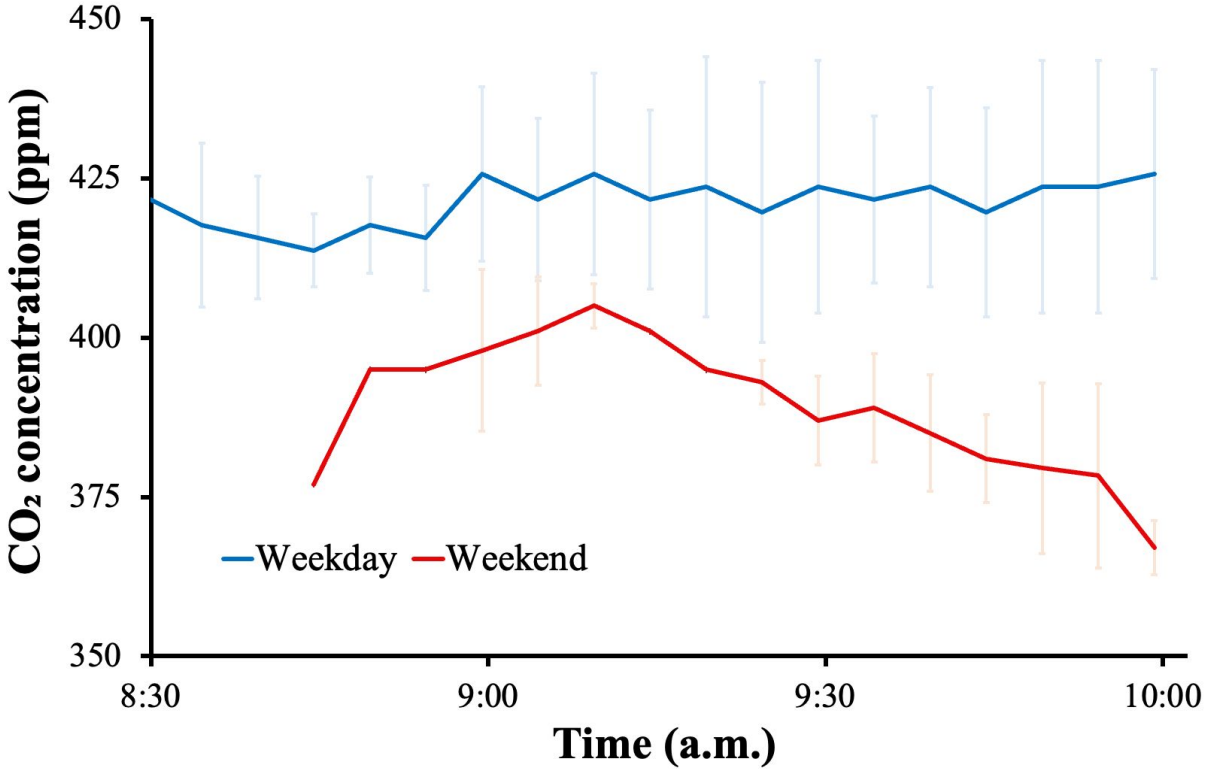


Extraction and Analysis

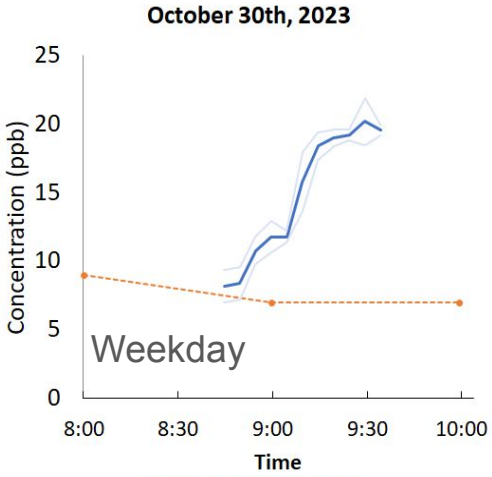
- PAH
  - Used ethyl acetate to elute
  - GCMS
    - Method adapted from previous group
- O_3, CO_2, $PM_{2.5}$
  - Downloaded data

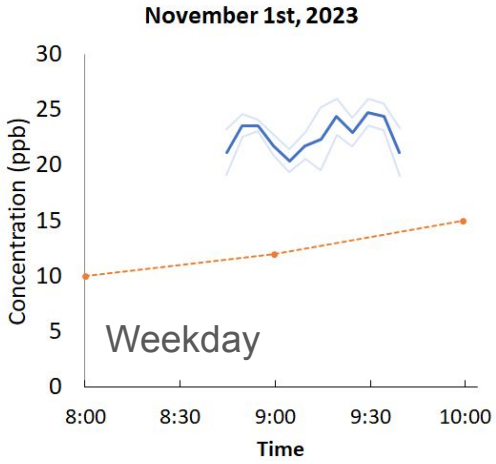


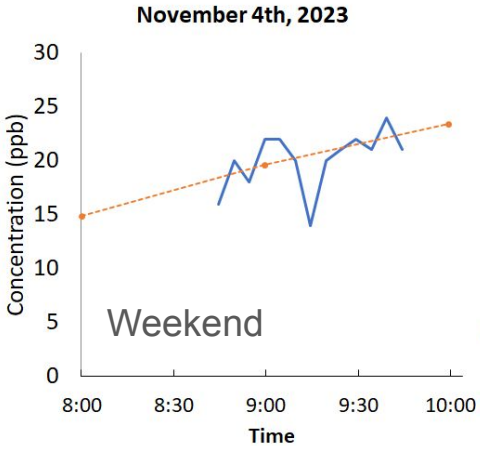
CO_2 Levels on Weekdays vs. Weekends

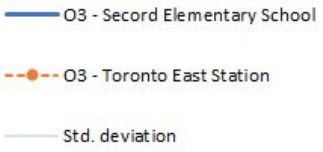


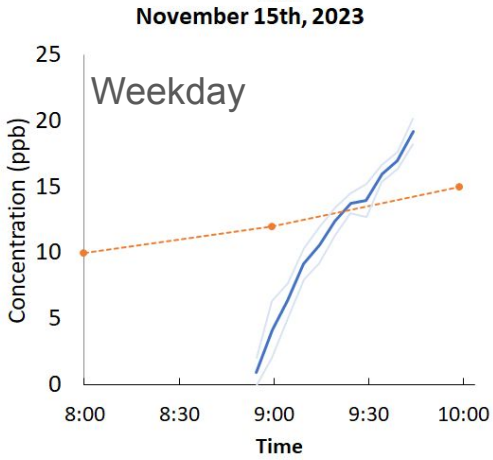
O_3 Levels on Weekdays vs. Weekends

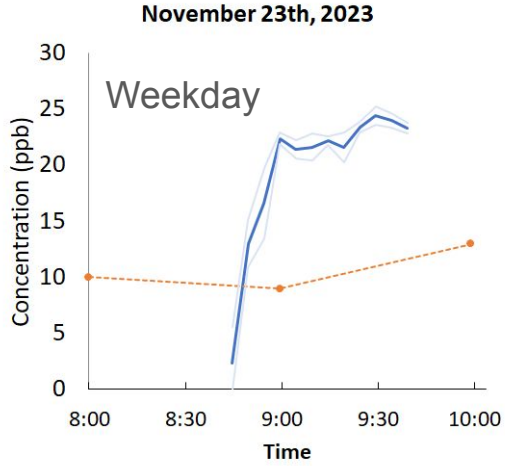


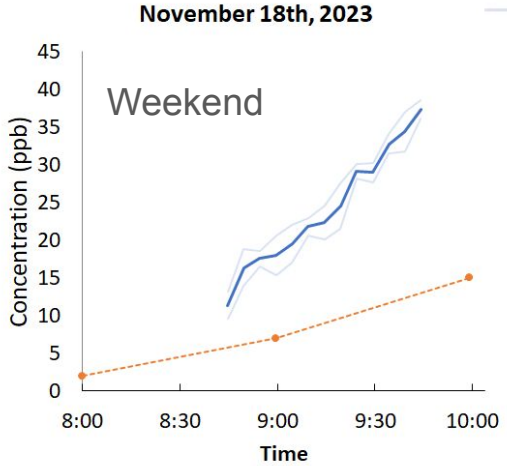




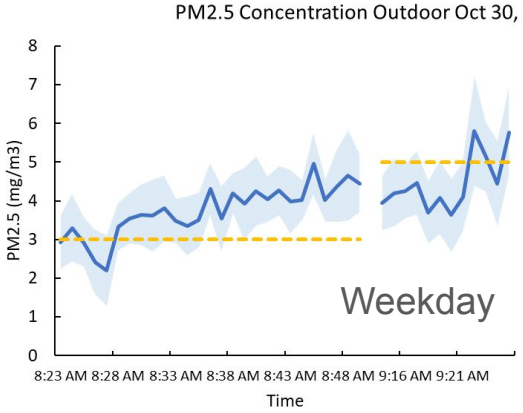


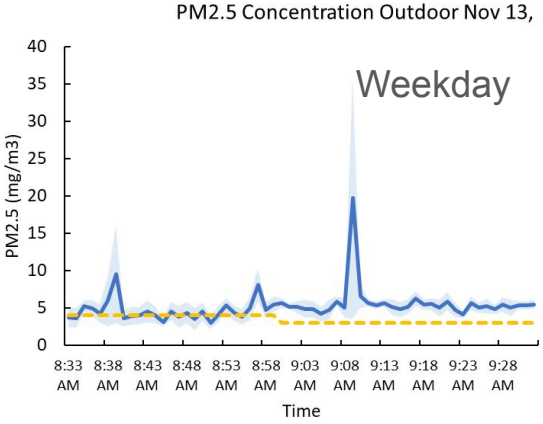


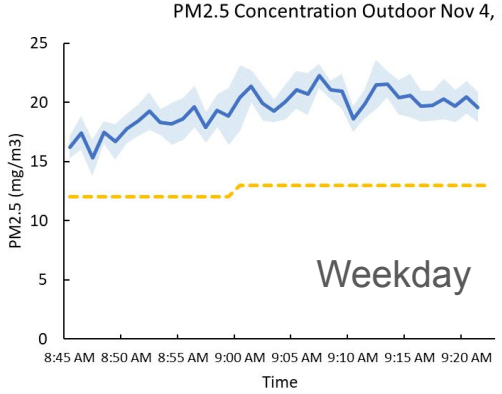


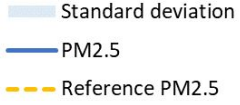


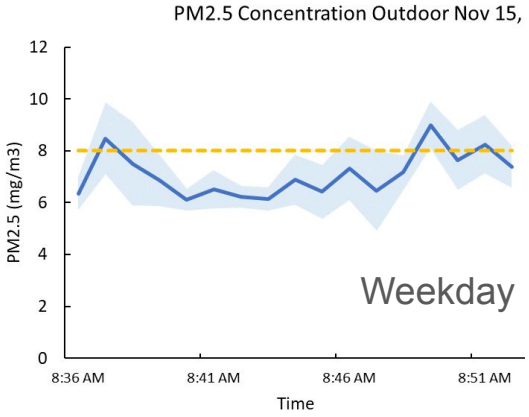
$PM_{2.5}$ Levels on Weekdays vs. Weekends

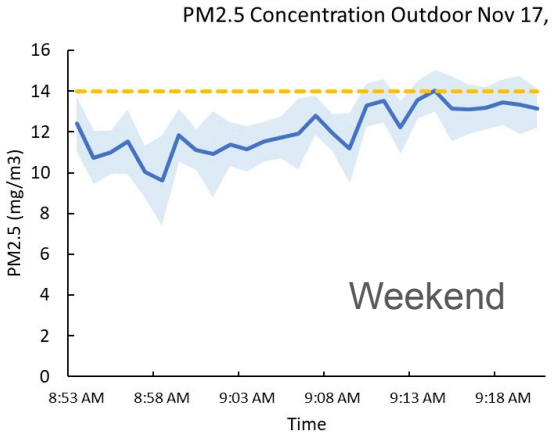


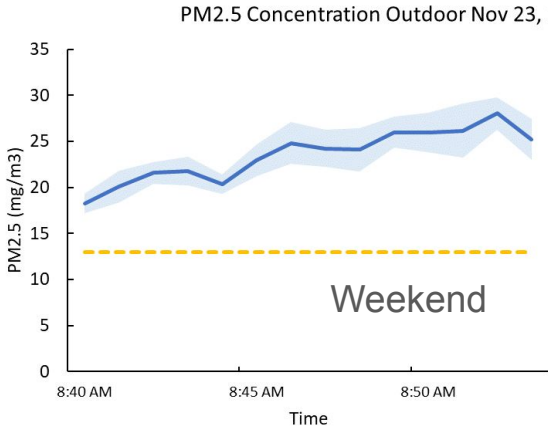




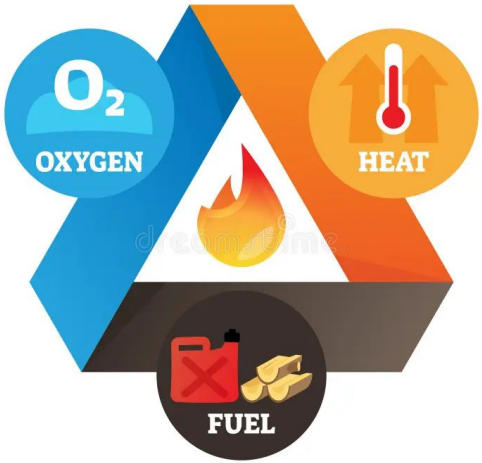


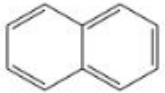
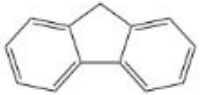




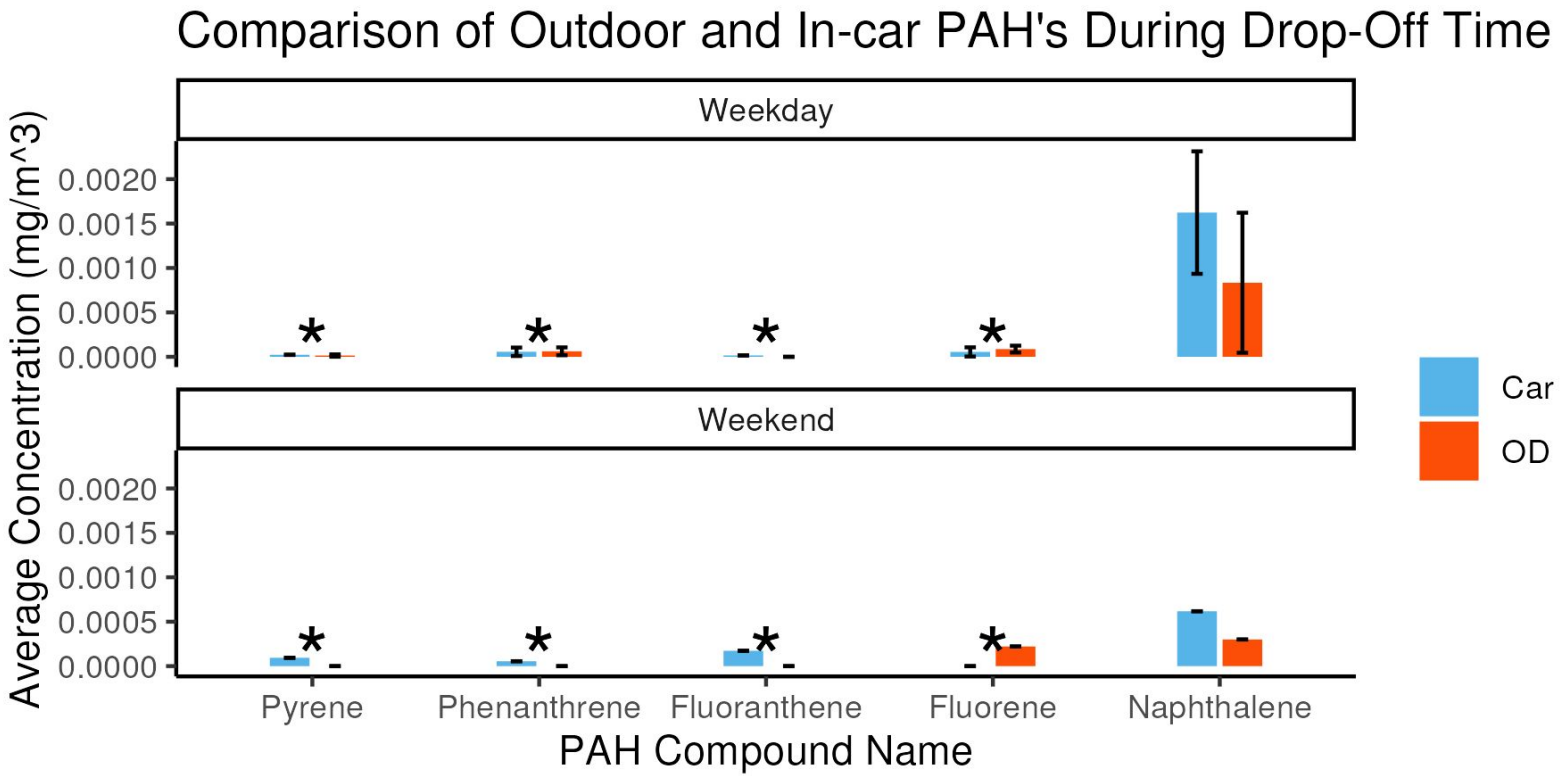


PAH Sources and Partitioning



Compound	Structure	Vapor Pressure (mm Hg) at 25°C
Naphthalene		$8.5 * 10^{-2}$
Fluorene		$6.0 * 10^{-4}$
Phenanthrene		$1.21 * 10^{-4}$
Fluoranthene		$9.22 * 10^{-6}$
Pyrene		$4.5 * 10^{-6}$

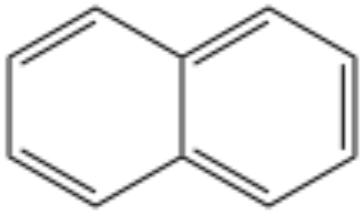
PAH In-Car vs. Outside Results



Naphthalene Health Effects and Exposures

Health Canada

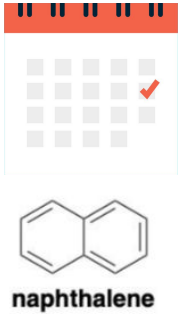
0.010 mg/m^3



3.0x10^{-4} to 6.3x10 $^{-3}$ mg/m^3

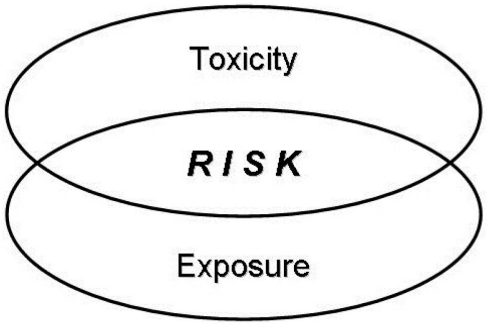
	Concentration (mg/m^3)	**Concentration (mg/m^3)**
Weekdays	1.6x10^{-3} +/- 6.89x10^{-4}	8.34x10^{-4} +/- 7.88x10^{-5}
Weekends	6.2x10^{-4}+/- 0.00	3.0x10^{-4} +/- 0.00

Conclusions and Future Direction



- RQ1.There is **no significant difference** in outdoor air quality in weekday vs. weekends
- RQ2. Naphthalene concentrations were **higher on weekdays** vs. weekends, **higher inside car** vs. outside

- It is better for children to walk to school than driving in the long-term.
- Future Direction
  - Compare near the school, and the same neighbourhood to properly assess traffic based differences
  - Measurements of other compounds (e.g. CO, $PM_{2.5}$, O_3, NO_2) inside the car
  - Exposure and/or risk assessment



Thank You!