Smoking for 75 minutes in a car could render you unconscious

February 25 2015

It was announced earlier this month that drivers in England will be banned from smoking in their cars from October if they are carrying children as passengers.

University of Leicester Physics students have estimated the consequences of smoking tobacco cigarettes in a car and how much opening a window would reduce the risk of carbon monoxide (CO) poisoning.

The work was done as one aspect of their degree course wherein students are encouraged to apply their understanding of physics to a topic of their own choosing.

A group of fourth year master's students from the Department of Physics and Astronomy calculated that you would need to smoke 15 cigarettes in 75 minutes for the level of carbon monoxide to reach levels of 1000 parts per minute (ppm) – enough to make you fall unconscious.

They have published their findings in the *Journal of Physics Special Topics*, a peer-reviewed student journal run by the University's Department of Physics and Astronomy.

Depending on smoking topography, defined as "puffing behaviour" including puff duration, inter-puff interval, maximum puff velocity etc., the amount of carbon monoxide released per cigarette varies.

Based on typical smoking behaviour the students found that the average mass of CO released per cigarette is 145mg. They then calculated the ratio of CO in comparison to air inside the car.

They calculated that the proportion of molecules of CO to air in the car is 0.0068% which is a very tiny proportion.

In order to fall unconscious in a closed car scenario, it would require 1000ppm or 0.01% of the air in the car to be composed of CO molecules.

Considering that the mass of CO released per cigarette is 145mg and the number of CO molecules released, the students calculated that a total of 15 cigarettes would need to be smoked to achieve the required CO level in the car.

If it takes five minutes to smoke one cigarette, then it would take at least 75 minutes to fill the car with this amount of harmful carbon monoxide, causing loss of consciousness.

If a window is open, it would take 2.5 hours to completely change the volume of air meaning that the carbon monoxide would not be completely removed, and may still be quite harmful as even lower levels of CO in the car can be damaging to your health.

One of the students, Jessica Patel, 21, from Leicester said: "In conclusion, we found that when smoking in a car you should always open a window to reduce the risk of carbon monoxide poisoning. Even a small concentration of CO in the air is harmful and could cause you to feel a slight headache.

"Of course for the first part of this investigation we assume that no air can escape or enter the car, however this is impossible.

"In addition, we assume that the cigarettes are smoked at a constant rate of one cigarette every five minutes and that all puffs emit the same concentration of CO – however the way in which people smoke differs."

Course tutor, Dr Mervyn Roy, a lecturer in the University of Leicester's Department of Physics and Astronomy, said: "The aim of the module is for the students to learn about peer review and scientific publishing.

"The students are encouraged to be imaginative with their topics, and find ways to apply basic physics to the weird, the wonderful and the everyday."

The students chose to investigate the effects of CO to a person's health – however there are thousands of harmful chemicals released by smoking cigarettes so the actual danger from smoking is far greater than calculated in the study.

More information: "P3_2 Don't smoke and drive!" *Journal of Physics Special Topics*. physics.le.ac.uk/journals/inde … article/view/727/523

Provided by University of Leicester