Parent and teen campaigners demand action after study reveals nearly 50,000 London school children exposed to dangerous pollution from Red Route roads

Environmental Defense Fund Europe methodology

Finding: Data from a new study by Environmental Defense Fund Europe shows that 47,500 primary school children are at schools within 100m of the city's Red Routes with dangerous levels of air pollution, which can stunt children's lung growth

> Data that gives the location - in latitude and longitude – and capacity of primary schools (sensitive receptors) in London were obtained from the Get Information About Schools service[1]. These locations define a point within the receptor site area or building, which might vary depending on the site size or shape. To make the location of each point consistent across different receptors, each location was snapped to the nearest road segment, determined with Ordnance Survey Open Roads data[2]. Data from Transport for London[3] defining the location of Red Routes was used to flag the sensitive receptor locations which are within 100m of a Red Route. The sum of the capacity for just these schools was then calculated in order to estimate the total number of school children attending them.

Finding: In some areas of the capital, as many as 1 in 5 primary schools are by Red Routes, where children breathe NOx pollution levels that are on average 25% higher than primary schools not by Red Routes.

> The high-resolution source apportionment modelling data, produced by Cambridge Environmental Research Consultants (CERC) using the ADMS-Urban model as part of for the Breathe London pilot project[4], estimates the concentration of NO_x produced by all sources at the locations of primary schools described above. The average total NO_x pollution level was calculated for all primary school locations within 100m of a Red Route and all primary school locations not within 100m of a Red Route. These two averages for were then used to calculate the percentage difference in pollution levels at primary school locations within 100m of a Red Route compared to those not within 100m of a Red Route.

[1] https://www.get-information-schools.service.gov.uk/
[2] https://www.ordnancesurvey.co.uk/business-government/products/open-map-roads
[3] https://tfl.gov.uk/info-for/open-data-users/our-open-data#on-this-page-4
[4] See Appendix 6 of the Breathe London technical report: https://www.globalcleanair.org/files/2021/02/BL-CERC-Final-Report.pdf

Finding: New analysis shows that NO_2 pollution levels on Red Routes are 57% higher than an average road and $PM_{2.5}$ levels are 35% higher.

Ordnance Survey Open Roads data was used to identify the approximate central alignment of the road carriageway for all roads of the following types in Greater London: A, B, Minor, and Local roads[5]. A dataset from Transport for London that identifies the geographic boundary of the GLA road network (Red Routes) was used to classify roads by whether they are Red Routes or not[6]; all defined Red Routes are of A road type. Next, a buffer area to each side of the road's central alignment was created of 10m for A roads and 5m for all other road types.

High resolution modelled NO_2 and $PM_{2.5}$ annual averages at a 10m grid resolution, produced by CERC using the ADMS-Urban model for the Breathe London pilot project[7], were then used to calculate the average pollution levels, by summing the concentration at each grid cell within each road type buffer and dividing the total by the count of all grid cells within the same road type buffer area. This was carried out for each road type separately (i.e. Red Route A roads, non-Red Route A roads, B roads, Minor roads, and Local roads) as well as for all road types combined to calculate an all-road London average.

These calculations showed that the average concentration of NO_2 on Red Routes is 47.9 $\mu g/m^3$ compared to 30.5 $\mu g/m^3$ for all roads, and $PM_{2.5}$ on Red Routes is 14.6 $\mu g/m^3$ compared to 10.8 $\mu g/m^3$ for all roads; a difference of 57% and 35% higher respectively for Red Routes.

Finding: Average NO_x levels at schools with pupils attending from the most deprived areas were 27% higher than those at schools with pupils attending from the least deprived areas.

The Government's Index of Multiple Deprivation (IMD) data was used to determine the deprivation score for every Lower Layer Super Output Area (LSOA) in London[8]. An LSOA is the smallest census geography of public statistics made available. Using London school catchment data from the Greater London Authority, an IMD score was created for each school based on the LSOAs that pupils reside in and the proportion of the school's pupils that reside in each of those LSOAs[9]. This created an estimate of deprivation level for each school based on the pupil's residential areas.

[5] https://www.ordnancesurvey.co.uk/business-government/products/open-map-roads
[6] https://tfl.gov.uk/info-for/open-data-users/our-open-data#on-this-page-4
[7] See Appendix 6 of the Breathe London technical report: https://www.globalcleanair.org/files/2021/02/BL-CERC-Final-Report.pdf
[8] https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019
[9] https://data.london.gov.uk/dataset/london-schools-atlas

The high-resolution source apportionment modelling data, produced by CERC using the ADMS-Urban model as part of the Breathe London pilot project[10], estimates the concentration of NO_x produced by all sources at the locations of primary schools in London. The average of total modelled NO_x concentrations was calculated for schools in each of the estimated IMD score deciles. This showed that average total modelled NO_x concentrations at schools with an estimated IMD decile of 1 (most deprived) are 27% higher than total modelled NO_x concentrations at schools with an estimated IMD decile of 10 (least deprived).

Finding: Schools with the highest percentage of non-white pupils have average NO_x levels that are 28% higher than schools with the lowest proportion of students from BAME backgrounds.

Population counts at the LSOA level were obtained from the Office for National Statistics[11], broken down into the following different ethnicity groups: Asian/Asian British, Black/African/Caribbean/Black British, Mixed/multiple, Other ethnic groups, and White. This data was used to calculate a total percentage of non-white - or Black, Asian and Minority Ethnic (BAME) - population for each LSOA. Using London school catchment data from the Greater London Authority, a weighted average of the percentage of BAME population where pupils at each school reside was created based on the school capacity, the LSOAs that pupils reside in, and the proportion of the school's pupils that reside in each of those LSOAs[12]. These scores were then grouped into deciles such that decile 10 schools represent the 10% of schools that have pupils from areas with the highest proportion of BAME population (65-93%), and decile 1 schools represent the 10% of schools that have pupils from areas with the lowest proportion of BAME population (3-16%).

The high-resolution source apportionment modelling data, produced by CERC using the ADMS-Urban model as part of for the Breathe London pilot project[13], estimates the concentration of NO_x produced by all sources at the locations of primary schools in London. The average of total modelled NO_x concentrations was calculated for schools in each of the weighted average percentage BAME population deciles. This showed that average total modelled NO_x concentrations at schools with a % BAME population decile of 10 are 28% higher than total modelled NO_x concentrations at schools with a % BAME population decile of 1.

[10] See Appendix 6 of the Breathe London technical report: https://www.globalcleanair.org/files/2021/02/BL-CERC-Final-Report.pdf

[11] https://www.nomisweb.co.uk/census/2011/ks201ew

[12] https://data.london.gov.uk/dataset/london-schools-atlas

[13] See Appendix 6 of the Breathe London technical report: https://www.globalcleanair.org/files/2021/02/BL-CERC-Final-Report.pdf

Finding: Road transport – specifically brake, tyre and road wear – is the single biggest local source of $PM_{2.5}$ at London primary schools.

The high-resolution source apportionment modelling data, produced by CERC using the ADMS-Urban model as part of for the Breathe London pilot project[14], estimates the concentration of $PM_{2.5}$ produced by all sources at the locations of primary schools in London. This data shows that brake, tyre & road wear from road transport makes up 52% of all $PM_{2.5}$ from local sources.

[14] See Appendix 6 of the Breathe London technical report: https://www.globalcleanair.org/files/2021/02/BL-CERC-Final-Report.pdf