Young activists and NHS doctors warn 'breathing kills' as air pollution hits deprived areas and communities of colour

Environmental Defense Fund Europe methodology

Finding: NO_2 pollution is on average 24-31% higher in areas where people from Black, Asian or minority ethnic backgrounds are most likely to live, compared to areas where white people are most likely to live.

Population counts at the Lower Layer Super Output Area (LSOA) level were obtained from the Office for National Statistics[1], broken down into the following different ethnicity groups: Asian/Asian British, Black/African/Caribbean/Black British, Mixed/multiple, Other ethnic groups, and White. An LSOA is the smallest census geography of public statistics made available. Following methodology used in the Greater London Authority (GLA) Air Pollution Exposure in London report[2], each LSOA in London was allocated to an ethnicity decile for each of the five ethnicity groups, based on the percentage each ethnicity represents of the total LSOA population. Decile 10 areas for each ethnicity group therefore describe the 10% of LSOAs with the highest percentage of population in that group.

High resolution modelled NO_2 annual averages produced by Cambridge Environmental Research Consultants (CERC) using the ADMS-Urban model as part of the Breathe London pilot project estimate the NO_2 concentration at a 10m grid resolution across Greater London[3]. The average concentration of NO_2 across decile 10 LSOAs for each ethnicity group was determined by summing the concentration at each grid cell within all decile 10 LSOAs and dividing that total by the count of all grid cells within the same area.

The average NO_2 concentrations for decile 10 LSOAs for non-white ethnic groups are between 24-31% higher than the average for white decile 10 LSOAs.

Finding: The most deprived Londoners are over six times more likely to live in areas with higher pollution than the least deprived.

The Government's Index of Multiple Deprivation (IMD) data was used to determine the deprivation score for every LSOA in London[4]. These scores were used to allocate each

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

[2] https://www.london.gov.uk/what-we-do/environment/environment-publications/air-pollution-london-impact-environment-strategy

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

[4] https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

LSOA into one of ten equal groups, or deciles, such that decile 1 includes the most deprived 10% of LSOAs and decile 10 includes the least deprived 10% of LSOAs. High resolution modelled NO_2 annual averages produced by CERC using the ADMS-Urban model as part of the Breathe London pilot project were then used to determine the average NO_2 concentration for every LSOA[5].

A "higher pollution" NO_2 threshold was established independent of the LSOA areas. The high resolution modelled NO_2 annual average data were used to calculate the NO_2 concentration at a 100m grid resolution and the value for the 90th percentile of these measurements determined to be 31 µg/m3. LSOAs with an average NO_2 concentration above or equal to this 90th percentile threshold were flagged. This showed that 41% of all IMD decile 1 areas have average NO_2 concentrations equal to or above this high threshold, while only 6% of IMD decile 10 areas have average NO_2 concentrations in the same range.

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[6]. 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[7]; 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[8], 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 µg/m^3 compared to 30.5 µg/m^3 for all roads, and $PM_{2.5}$ on Red Routes is 14.6 µg/m^3 compared to 10.8 µg/m^3 for all roads; a difference of 57% and 35% higher respectively for Red Routes.

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

[6] https://www.ordnancesurvey.co.uk/business-government/products/open-map-roads

[7] https://tfl.gov.uk/info-for/open-data-users/our-open-data#on-this-page-4

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