WORKING FOR A HEALTHY FUTURE

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Report on estimation of mortality impacts of particulate air pollution in London

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Summary

It is widely accepted by the medical and scientific communities that there is a link between exposure to air pollution and the effects on health. These effects can vary in severity including mortality (death) and morbidity (the occurrence of illnesses throughout a life time). The evidence base from scientific studies shows that increased levels of fine particles in the air can increase risks of death. Increased exposure to particulates aggravates respiratory and cardio vascular conditions and research has shown that these particles can be inhaled deep into the respiratory tract. Less, however, is known about the health effects from long-term exposure to other pollutants such as sulphur dioxide, nitrogen dioxide and ozone. For this reason, this study has focused on the estimation of the mortality impact of fine particulate matter in London over a long-term basis. Airborne pollution in the form of fine particles ($PM_{2.5}$) comes mostly from combustion sources; transport, domestic and industrial.

The relationship between concentration and mortality rates, as recommended by the Committee on the Medical Effects of Air Pollution, is based on a large US study which estimated that for every 10 $\mu g/m^3$ increase in average $PM_{2.5}$ concentration there is a 6% increase in annual all-cause death rates. Applying this to population size data, average modelled $PM_{2.5}$ concentrations and mortality rates for Greater London, we have estimated the mortality impacts of fine particles in London, and their geographical distribution. The study estimates the number of deaths in each Ward attributable to fine particles using average concentrations and demographic data by Ward. The study also estimates the change in life expectancy caused by pollution for the entire current London population.

It is estimated that fine particles have an impact on mortality equivalent to 4,267 deaths in London in 2008, within a range of 756 to 7,965. A permanent reduction in $PM_{2.5}$ concentrations of $1\mu g/m^3$ would gain 400,000 years of life for the current population (2008) in London and a further 200,000 years for those born during that period, followed for the lifetime of the current population. For the current population, this is equivalent to an average 3 weeks per member of the 2008 population, with the expected gains differing by age.

It is unrealistic to believe that the estimated attributable deaths represent a subset of deaths solely caused by $PM_{2.5}$, while all the remaining deaths were unaffected by pollution. Since everyone breathes the air where they are, a more realistic interpretation is that the risks are distributed across the whole population, with a total mortality impact of the concentrations equivalent to that number of deaths. Since the effects are long-term, there is also an implicit assumption that the results represent the impacts for concentrations that existed at the same levels in previous years. Those modelled concentrations include a proportion from natural sources that could never be eliminated, and it is unrealistic to expect even the man-made portion to be reduced to zero.

CONTENTS

1 INTRODUCTION

1.1 SCOPE

The Greater London Authority has identified a need to estimate the impacts of air quality (specifically particulate matter) on the annual number of deaths for all of London and its constituent areas.

The broad requirements of this project were:

- To develop and agree a methodology to estimate the number of life-years lost or the number of deaths over time (or other appropriate metric) attributable to air pollution in Greater London.

- To apply this methodology to estimate the total number of life-years lost or the number of deaths over time (or other appropriate metric) attributable to air pollution in Greater London.

- To apply this methodology to quantify the number of life-year or numbers of deaths over time attributable to air pollution in Greater London.

The main purposes of the Study were:

- To provide a high-level estimate of overall health impacts of poor air quality in London, to support the key air quality messages to be given to public and stakeholder.

- To provide data to inform the development of the Mayor's Air Quality Strategy.

- To provide information on locations in London where exposure to high levels of pollution could be high, allowing policies to be targeted.

1.2 BACKGROUND INFORMATION

Much scientific research has been published on the relationship(s) between air pollution and health effects of varying severity, including deaths (mortality). It is now widely acknowledged that long-term exposure to air pollution (exposure to pollution over the entire life span of an individual) increases mortality risk and thus decreases life expectancy.

The results from these studies show a relationship between long-term exposure to fine particulate matter ($PM_{2.5}$) and mortality rates. Particulate matter aggravates respiratory and cardio vascular conditions and research shows that these particles are likely to be inhaled deep into the respiratory tract. Evidence relating to the possible effects of long term exposure to other common air pollutants (such as sulphur dioxide, nitrogen dioxide and ozone) is less well developed and so the focus of the present study remains on $PM_{2.5}$ and its effects on mortality, although it may be possible to look at other pollutants in the future once more evidence becomes available.

The Committee on the Medical Effects of Air Pollutants (COMEAP) published a report in 2009 that looked to quantify the long-term exposure to air pollution and the possible

effect on mortality. This was based on risk coefficients identified from cohort studies (where a large group of selected individuals are followed up over time and their health is studied over time in relation to risk factors).

These studies have compared mortality rates in areas with varying levels of pollution. They have shown that estimates of the impact of pollution on mortality on annual death rates are larger than estimates based on daily variations in pollution and mortality. This is consistent with the understanding that pollution can have gradual and cumulative effects on an individual's health. COMEAP (2009) recommended basing impact assessments on these long-term effects, using annual death rates.

The COMEAP (2009) report made use of results from the American Cancer Society (ACS) study. This study involved several hundred thousand adults in metropolitan areas across the US; initiated in 1982, it gathered information for over ten years and looked at the health of adults in more than 100 US cities. The study was one of two US cohort studies used in the 1997 debate on the National Ambient Air Quality Standards for fine particulate matter in the US, and therefore has been subject to much review and discussion. Because of its size, the ACS study was considered the most reliable source of risk coefficients suitable for use across the UK and elsewhere. Follow up studies and analysis (by Pope, Krewski *et al* (2009) and a Dutch study by Brunkereef (2009)) have produced more data and risk coefficients consistent with these earlier studies. This is further discussed in section 2.1.

2 METHODS

2.1 GENERAL METHODOLOGICAL APPROACH

To estimate the effects of long term exposure to $PM_{2.5}$ the following approach has been used:

- Use of the risk coefficients as recommended by COMEAP (2009) to estimate the mortality risk for the Greater London population

- Calculation of predicted survival curves using 'life table' methods to estimate the effect of reducing $PM_{2.5}$ concentrations on years of life lost or saved.

2.1.1 Risk coefficients

Studies of mortality such as the ACS estimate risk coefficients using proportional hazard models; these quantify a link between air pollution and death, where increasing airborne concentrations of particulate pollution increases the death rates.

The COMEAP report recommended, as a best estimate, use of a coefficient factor where a 10 $\mu g/m^3$ increase in average annual $PM_{2.5}$ (taking into account the influence of different population sizes and concentrations by calculating a population weighted average), is associated with a 6% increase in deaths from all causes. Statistical uncertainty intervals were between 1% and 12% based on the work from Pope *et al* (2002) and other studies. This relationship is assumed to be proportional and, following recognised methodology from the World Health Organisation and United Nation's Economic Commission for Europe Task force on Health and Clean Air For Europe, COMEAP recommended this approach for the UK. This study therefore follows COMEAP (2009) in assuming that the link between deaths associated with $PM_{2.5}$ continues throughout the concentration range, down to complete removal (zero concentration of $PM_{2.5}$).

2.1.2 Survival curves and life tables

Calculations can also be performed to estimate the impact of pollution on life expectancy. Life tables are increasingly used to quantify the predicted mortality impacts of proposed changes in environmental conditions that are believed to affect life expectancy. A survival curve shows the relationship between the chance of survival and the age of a population, and is calculated by cumulating the effects of annual death rates over a lifetime. As shown in Figure 1, initially at age zero there is 100% probability of survival; this decreases with increasing age as different causes of mortality take their toll. Using this as the basis for calculations, the survival curves can be calculated from hazard rates altered to take into account different mortality risks, such as those associated with long-term exposure to pollution; this in turn will alter the life expectancy of a population.

Any change in mortality patterns will then change the subsequent distribution of the population. Differences between predicted survival curves can be used to quantify the changes in life expectancy saved or lost by changes in the mortality rate and are usually expressed in life years (or just 'years').

If we alter mortality rates, we alter survival curves and hence life expectancy. Life expectancy of a birth cohort (a group of people born during a particular year or period) is calculated by long-established arithmetical methods, from a series of mortality hazard rates that are assumed to apply at different ages.

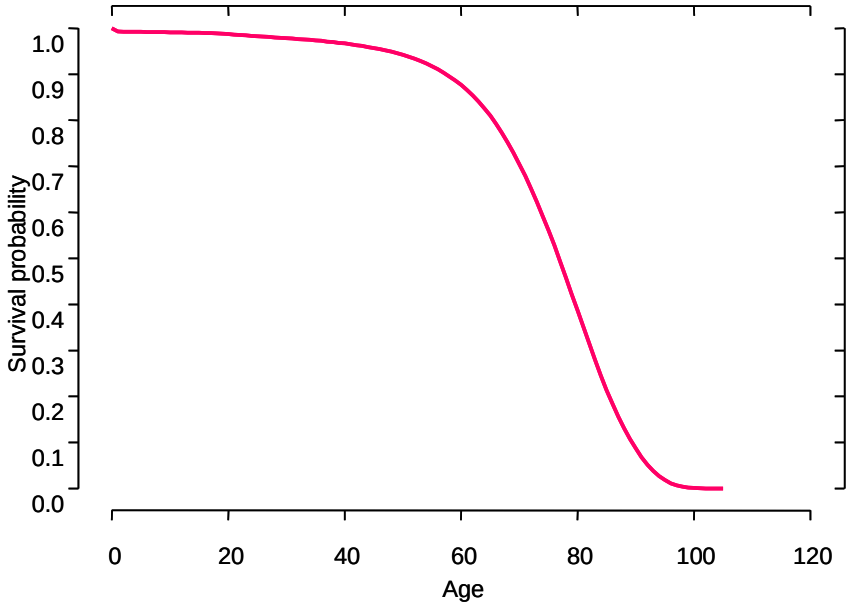

Figure 1 Typical shape of a survival curve showing the cumulative effect of mortality risks on the probability of surviving to various ages.

2.2 AVAILABLE DATA

In order to calculate the mortality burden (number of attributable deaths) associated with long term exposure to $PM_{2.5}$ in London, we need data on populations, deaths and pollution concentrations. Files containing those data were supplied by the GLA, sourced from the Data Management and Analysis Group, in line with the London Plan projections.

Population projection data were provided for the years 2001-2031 inclusive, by sex, and in 1-year age bands. With the exception of the City of London, they were given separately by Borough, each broken down also by Ward, and given as 'High' and 'Low' projections. The 'High' population projections were used as a worse case scenario. For City of London, there was no Ward breakdown. The City of London has a resident population of less than 10,000 confined in a small geographic area.

Mortality data was represented by numbers of deaths, by sex and 5-year age group, for the year 2008. The data were broken down by Borough, and were given as totals (including non-neonatal total) and also by detailed cause-groups.

Modelled annual mean $PM_{2.5}$ concentrations were supplied for the years 2006, 2010 and 2015, with a value given for each Ward (including Wards within the City of London). These total annual mean concentrations are made up of particles from human and natural sources, as well as particles from sources outside London that have travelled windborne into the area. Data for the year 2006 were used for the

calculations. (It should be noted that the base year for mortality data was for 2008 and the annual mean $PM_{2.5}$ concentrations were for the year 2006.)

2.3 REORGANISATION OF DATA

Life-table calculations for scenarios in the future require age-specific mortality rates. These were based on population projections in 2008 summarised at 5 year age groups. Deaths used exclude the neonatal, i.e. those in the first month after birth.

Projections of total populations for males and females in 2008 were extracted for each Ward[1]. From the file of estimated particulate concentrations, the mean annual $PM_{2.5}$ concentrations per ward for 2006 were extracted.

2.4 CALCULATIONS OF ATTRIBUTABLE DEATHS

Within each Borough in Greater London, a population-weighted mean $PM_{2.5}$ concentration was calculated, weighting the concentration for each Ward by its total population[2]. From this, the corresponding proportional change in hazard rate was computed (see Appendix A) and applied to the all-cause deaths for the Borough to estimate attributable deaths corresponding to the mean concentration. These deaths were then allocated to Wards in proportion to their total populations.

The main estimate used the coefficient recommended by COMEAP (2009), that there is a 6% change in deaths from all causes for every 10 $\mu g/m^3$ change in average $PM_{2.5}$ concentrations. To inform sensitivity analysis, as recommended by COMEAP, the calculations were repeated replacing the 6% figure with wide limits of 1% and 12%. Details of the calculations are included in Appendix A.

2.5 LIFE-TABLE CALCULATIONS

IOM's spreadsheet suite IOMLIFET was used to carry out life-table-based comparisons of different imagined future scenarios, i.e. permanent and a one year reduction of 1 $\mu g/m^3$ of $PM_{2.5}$ in London. The baseline scenario assumed future age-specific mortality rates based on the 2008 data for all London, calculated from all-cause death numbers, excluding neonatal deaths, and the total population figures totalled over all Wards. The IOMLIFET spreadsheets operate in 1-year age-groups, but deaths were available only in five-year groups (plus <1 and the 4-year group 1-4). This was reconciled by allocating the hazard rate for each age group to individual years within it.

Pollution impacts were calculated for scenarios representing both temporary reductions in hazard for a single year, after which the hazards revert to their previous values; and scenarios where the reduction is permanent. The notion that a change in pollution will have an immediate effect is widely accepted as unrealistic. However, there are only limited data to indicate over what timescale the benefits might accrue. This study has made additional estimates adopting a time profile adopted by the US EPA for some of their impact assessments. This models the phasing-in of the effects over 20 years as

[1] A Ward breakdown was not available for the City of London

[2] Since Ward populations were not available within the City of London, a Borough mean was calculated unweighted.

30% in the first year, 12.5% in each of the next four years, and the final 20% phased in gradually over years 6-20.

The life-table calculations were performed separately for males and females and then combined. The impacts were very similar for both sexes, despite their known differences in life expectancy. Estimates for other changes in $PM_{2.5}$ concentration can be estimated, to a very good approximation, in direct proportion to the amount of change.

Details of the calculations performed are included in Appendix B.

3 RESULTS

3.1 TOTAL ATTRIBUTABLE DEATHS

Table 1 shows the total population-weighted mean annual concentration of $PM_{2.5}$ ($\mu g/m^3$) for Greater London, and implied attributable deaths, calculated as described above, at concentration-response coefficients of 6%, 1% and 12% per $10\mu g/m^3$ of $PM_{2.5}$. Totalled over Wards, the calculations predict a total of 4,267 attributable deaths for the Greater London Area.

3.2 ATTRIBUTABLE DEATHS BY WARD

The table in Appendix C shows the estimates of population-weighted mean annual $PM_{2.5}$ concentrations and attributable deaths per annum by Ward, based on the mortality information supplied for 2008. In each ward, the estimate depends on the size of the underlying population; on the annual number of deaths (which in turn will depend partly on the local age distribution); and on the estimate of population-weighted mean $PM_{2.5}$ concentration.

3.3 RESULTS OF LIFE-TABLE CALCULATIONS

Table 2 summarises the results of carrying out life-table calculations in IOMLIFET for the whole population of London, and also for the extended population that includes new births each year. A temporary elimination in one year of 1 $\mu g/m^3$ of $PM_{2.5}$ pollution is predicted to save over 3,900 years of life in the current population, followed up to death of the entire cohort over 106 years. If the reduction in pollution were permanent, however, the total saving over that period would be over 400,000 life-years for the current population, and over 600,000 when including new births. For the current population, this is equivalent to an average 3 weeks per member of the 2008 population, with the gains differing by age.

Table 1 Population and population-weighted mean annual $PM_{2.5}$ ($\mu g/m^3$) for Greater London, and estimated attributable deaths (rounded to whole numbers) per annum (based on 2008 rates), at concentration-response coefficients of 6%, 1% and 12% per $10\mu g/m^3$ of $PM_{2.5}$.

Area Code	Area	Total Popn	$PM_{2.5}$ Conc ($\mu g/m^{-3}$)	Attributable Deaths at coeff^t (change for 10 $\mu g/m^3$ $PM_{2.5}$) 6%	1%	12%
C000R	**Greater London**	7,673,217	15.34	4,267	756	7,965

Table 2 Estimated total impacts on life expectancy (years) of changes in $PM_{2.5}$ air pollution, for the current population of London in 2008 followed up through 2113, and for the extended population including new births in that period.

Reduction in $PM_{2.5}$	Impact Pattern	Population 2008 current	extended
1	1 year temporary	3,932	3,932
	Permanent	421,430	614,496
	20 year EPA phase in	405,659	598,333

4 DISCUSSION

The attributable deaths were estimated from data representing the actual mortality of the population of London in 2008; they are the theoretical difference from a scenario in which all-cause mortality is reduced by an amount related a certain reduction in annual concentration of fine particulate matter, $PM_{2.5}$. In a sense, they answer a question like 'how many extra deaths can be attributed to current levels of $PM_{2.5}$? However, a more probing answer to this question would need to consider the temporal relationship between the accumulation of exposure to PM and changes in mortality risk, because the current level of risk may be due largely to e.g. gradual damage from past exposures.

The term 'attributable' may itself cause some confusion. It is easy to see how this technical term may imply to some readers that there are a number of deaths that are directly (and solely) caused by, or attributed to, air pollution. However, the definition is based purely on a comparison of two scenarios with different mortality risks, and could reflect the situation where the risk to the whole populations differs by the same relative amount. As an example, if we weight one side of a die so that the probability of throwing a 6 is 1 in 5 rather than 1 in 6, then in say 600 throws we will get an average of 1200 6s rather than the 1000 expected of a fair die. The changed probability structure of the crooked die is responsible for 200 'attributable' or extra 6s, but it is not possible to identify the throws that produced the extra ones. We are simply comparing the outcomes of two different risk structures, and thus it is with mortality scenarios in humans. Levine (2007) overviews different possible uses of the 'attributable' concept, depending on the context.

Here, it is unrealistic to believe that the estimated attributable deaths represent a subset of deaths that are solely caused by $PM_{2.5}$, while all remaining deaths were unaffected by pollution. Since everyone breathes the air where they are, a more realistic interpretation is that the risks are distributed across the whole population, with a total mortality impact of the concentrations equivalent to that number of deaths. What we do not know is exactly how the excess risk is distributed across the population; whether the figure of 1.06 for 10µg/m^3 applies equally to all, or varies according to factors either measurable or unseen and simply averages to this figure. One way or another, we prefer the notion that air pollution affects everyone's mortality risk to the idea that there is a specific subset of individuals who are the only ones affected.

Here, the context of the 'attributable' deaths is that of comparing a baseline scenario based on current (or very recent) mortality rates, with another where the rates have been reduced by some impact factor. If we imagine that the response to changes in pollution concentrations may not be immediate, then we may have to consider the effects of a lag before the effects begin or before they are fully realised. The calculation of deaths attributable to a particular concentration should then be interpreted as relating to the unrealistic situation where that concentration has been constant over the previous years.

The issue of lag in response to a change is important in considering policies to reduce air pollution; it is an easy step from observing a concentration-response relationship in cohort studies to imagining that eliminating or reducing the pollution source would reduce death rates, but the speed with which this might happen will be a function of the damage already done to individuals and their capacity for internal self-repair. A useful analogy is with tobacco smoking, where it is known that following smoking cessation it

takes several years for risks in the ex-smoker to approach those of the lifelong non-smoker.

It is fact that not all of measured $PM_{2.5}$ is man-made, and there is a portion that is from the natural background and that cannot be controlled by policy or human action. In addition, in current society the removal of all anthropogenic PM in a conurbation such as London may not be considered a realistic goal. However, the life-year values given in Table 3 for a 1µg/m^3 reduction in $PM_{2.5}$ concentrations could be scaled proportionally to predict impacts for any smaller reductions envisaged. Predictions for changes down to a $PM_{2.5}$ concentration of 7µg/m^3 remain within the range of the data from the ACS study, while quantification to levels lower than this rest on the assumptions that the same risk coefficient applies below this level and that there is no population threshold to the relationship.

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APPENDIX A: CALCULATION OF ATTRIBUTABLE DEATHS

The core estimate of concentration-response recommended by COMEAP is a 6% change in all-cause mortality hazard per 10μg/m^3 change in mean airborne $PM_{2.5}$ concentration. If we extend this to associate a change in mortality with the entirety of a geographically specific mean concentration x, in the knowledge that this coefficient came from a study that fitted its response to the logarithm of exposure, then the relative risk for the impact scales to

$$rr(x) = (1.06)^{x/10}$$

Relative risks were calculated in this way from x=mean $PM_{2.5}$ concentration for each Borough.

From a relative risk, the attributable fraction of deaths corresponding to a concentration of x is given by

$$f_{attr} = (1 - 1/rr(x))$$

This was calculated for each Borough, and multiplied by the total deaths in that Borough to estimate a figure for attributable deaths corresponding to a mean concentration x. Finally, the total attributable deaths for each Borough were allocated to their constituent Wards in proportion to the total population of each Ward.

The reorganisation, summarising and calculation were carried out using a mixture of the facilities of the MS Excel software and the statistical package Genstat.

APPENDIX B: LIFE TABLE CALCULATIONS

In the context of a health impact assessment, we make further assumptions, e.g. that some policy change will affect the future mortality rates. We can then compare the survival curves for two scenarios, calculated with and without the policy impact, and the difference in life expectancy is a measure of the impact. For a defined cohort, the temporal patterns of deaths under the baseline (no change) and impacted scenarios will differ, as will the total life expectancy implied. The difference in the number of deaths expected each year can be displayed graphically. However, the total deaths over a lifetime follow-up must be the same as the initial size of the cohort, so there are no 'saved' deaths overall (Brunekreef *et al*, 2007).

Assessing the impact on a current population, we need to take into account that they have a distribution of ages. Miller and Hurley (2003, 2006) showed in detail how this could be accommodated within standard spreadsheet packages. A two-dimensional array is constructed, indexed by both age and calendar year, and life-table calculations are performed for every age-specific sub-cohort, down diagonals of the array. If this is done for two scenarios one baseline and another representing the impact of some change, then the results of the change can be compared. Using spreadsheets means that there is great flexibility in summarising the results. For each age-year combination, there are available estimates of expected deaths and survivors, from which can be derived the total person-years (or 'life-years') contributed. Summary figures, tables or graphical displays can be constructed in numerous ways. Just as for a single cohort, comparison of the patterns of deaths in two scenarios applying to a current population may redistribute their expect pattern in time, but the eventual total numbers of deaths must be the same. (This will not be the case, however, if we summarise the impact over an extended population comprising the current population and future birth cohorts).

The IOMLIFET system allows for complete flexibility in how impacts are assumed to affect future mortality hazard rates; these can be manipulated over any combination of age and calendar year. We have calculated the effect of a change in hazard rates corresponding to a reduction in air pollution of just 1 $\mu g/m^3$, which gives

$$(1.06)^{-1/10} = 0.994190$$

It would be possible to repeat these calculations for a change equal to the population-weighted average over London, 15.34 $\mu g/m^3$. This yields a mortality impact factor

$$(1.06)^{-15.34/10} = 0.914494$$

Theoretical and empirical evidence, however, shows that the impact in life-years scales very nearly with the amount of change in the mean concentration, so estimates for other changes may, to a very good approximation, be obtained by proportional scaling based on the result for 1 $\mu g/m^3$.

APPENDIX C: ESTIMATES OF ATTRIBUTABLE DEATHS

Populations and population weighted mean annual $PM_{2.5}$ ($\mu g/m^3$) by Ward and estimated attributable deaths (rounded to whole numbers) per annum, based on 2008 rates, **at COMEAP's recommended concentration-response coefficient of 6% per 10$\mu g/m^3$ of $PM_{2.5}$**, plus estimates at limits of 1% and 12% to inform sensitivity analysis.

Area Code	Area	Total Popn	$PM_{2.5}$ Conc ($\mu g/m^3$)	Attributable Deaths at coeff[t] (change for 10 $\mu g/m^3$ $PM_{2.5}$)		
				6%	1%	12%
C000R	**Greater London**	7,673,217	15.34	**4,267**	756	7,965
H00AA	**City of London**	9155	17.59	**4**	1	7
	Ward					
00ABFX	Abbey	11,558	15.39	**8**	1	15
00ABFY	Alibon	9,876	14.86	**7**	1	13
00ABFZ	Becontree	11,716	14.94	**8**	1	15
00ABGA	Chadwell Heath	9,470	14.80	**7**	1	12
00ABGB	Eastbrook	10,478	14.66	**7**	1	13
00ABGC	Eastbury	10,390	15.25	**7**	1	13
00ABGD	Gascoigne	10,721	15.62	**7**	1	14
00ABGE	Goresbrook	11,036	15.16	**8**	1	14
00ABGF	Heath	9,852	14.84	**7**	1	13
00ABGG	Longbridge	9,604	15.03	**7**	1	12
00ABGH	Mayesbrook	9,658	14.91	**7**	1	12
00ABGJ	Parsloes	9,170	14.94	**6**	1	12
00ABGK	River	10,678	15.09	**7**	1	14
00ABGL	Thames	9,493	15.31	**7**	1	12
00ABGM	Valence	8,841	14.95	**6**	1	11
00ABGN	Village	10,027	14.75	**7**	1	13
00ABGP	Whalebone	9,789	14.99	**7**	1	13
00ACFX	Brunswick Park	15,577	14.87	**10**	2	18
00ACFY	Burnt Oak	15,672	14.89	**10**	2	18
00ACFZ	Childs Hill	18,103	15.51	**11**	2	21
00ACGA	Colindale	15,804	15.06	**10**	2	18
00ACGB	Coppetts	15,036	15.31	**9**	2	17
00ACGC	East Barnet	15,805	14.67	**10**	2	18
00ACGD	East Finchley	15,019	15.34	**9**	2	17
00ACGE	Edgware	15,253	14.87	**9**	2	18
00ACGF	Finchley Church End	14,652	15.43	**9**	2	17
00ACGG	Garden Suburb	15,064	15.29	**9**	2	17
00ACGH	Golders Green	16,787	15.81	**10**	2	19
00ACGJ	Hale	16,088	15.00	**10**	2	18
00ACGK	Hendon	15,973	15.52	**10**	2	18
00ACGL	High Barnet	14,762	14.62	**9**	2	17
00ACGM	Mill Hill	17,036	14.95	**10**	2	20
00ACGN	Oakleigh	15,224	14.84	**9**	2	17
00ACGP	Totteridge	14,880	14.70	**9**	2	17
00ACGQ	Underhill	15,996	14.64	**10**	2	18
00ACGR	West Finchley	14,960	15.12	**9**	2	17
00ACGS	West Hendon	14,977	15.66	**9**	2	17

Area Code	Area	Total Popn	$PM_{2.5}$ Conc ($\mu g/m^3$)	Attributable Deaths at coeff[t] (change for 10 $\mu g/m^3$ $PM_{2.5}$) 6%	1%	12%
00ACGT	Woodhouse	16,084	15.17	**10**	2	18
00ADGA	Barnehurst	10,177	14.80	**7**	1	14
00ADGB	Belvedere	10,920	14.76	**8**	1	15
00ADGC	Blackfen and Lamorbey	10,341	14.80	**8**	1	14
00ADGD	Blendon and Penhill	10,319	15.04	**8**	1	14
00ADGE	Brampton	10,249	14.76	**7**	1	14
00ADGF	Christchurch	10,403	15.01	**8**	1	14
00ADGG	Colyers	10,525	14.74	**8**	1	14
00ADGH	Crayford	10,306	14.90	**7**	1	14
00ADGJ	Cray Meadows	10,321	14.68	**8**	1	14
00ADGK	Danson Park	10,303	14.99	**7**	1	14
00ADGL	East Wickham	10,283	14.84	**7**	1	14
00ADGM	Erith	10,596	14.86	**8**	1	14
00ADGN	Falconwood and Welling	10,503	15.09	**8**	1	14
00ADGP	Lesnes Abbey	10,882	14.81	**8**	1	15
00ADGQ	Longlands	9,705	15.01	**7**	1	13
00ADGR	North End	10,496	14.73	**8**	1	14
00ADGS	Northumberland Heath	10,548	14.74	**8**	1	14
00ADGT	St. Mary's	9,999	14.81	**7**	1	14
00ADGU	St. Michael's	10,569	14.77	**8**	1	14
00ADGW	Sidcup	10,360	14.81	**8**	1	14
00ADGX	Thamesmead East	11,140	14.76	**8**	1	15
00AEGJ	Alperton	12,643	15.29	**6**	1	11
00AEGK	Barnhill	13,204	15.11	**6**	1	12
00AEGL	Brondesbury Park	12,299	15.44	**6**	1	11
00AEGM	Dollis Hill	12,677	15.75	**6**	1	11
00AEGN	Dudden Hill	14,058	15.83	**7**	1	13
00AEGP	Fryent	12,264	15.04	**6**	1	11
00AEGQ	Harlesden	13,216	15.72	**6**	1	12
00AEGR	Kensal Green	11,340	15.89	**5**	1	10
00AEGS	Kenton	12,163	14.91	**6**	1	11
00AEGT	Kilburn	14,744	15.71	**7**	1	13
00AEGU	Mapesbury	14,242	15.44	**7**	1	13
00AEGW	Northwick Park	12,518	14.99	**6**	1	11
00AEGX	Preston	14,061	15.07	**7**	1	13
00AEGY	Queens Park	13,157	15.61	**6**	1	12
00AEGZ	Queensbury	14,272	14.93	**7**	1	13
00AEHA	Stonebridge	17,229	15.78	**8**	1	16
00AEHB	Sudbury	12,884	15.13	**6**	1	12
00AEHC	Tokyngton	12,169	15.36	**6**	1	11
00AEHD	Welsh Harp	12,726	15.59	**6**	1	11
00AEHE	Wembley Central	11,712	15.18	**6**	1	11
00AEHF	Willesden Green	14,285	15.51	**7**	1	13
00AFGD	Bickley	14,362	14.77	**10**	2	19
00AFGE	Biggin Hill	10,353	14.37	**7**	1	14
00AFGF	Bromley Common and Keston	14,375	14.62	**10**	2	19
00AFGG	Bromley Town	15,656	14.94	**11**	2	21
00AFGH	Chelsfield and Pratts Bottom	14,903	14.42	**11**	2	20
00AFGJ	Chislehurst	15,137	14.72	**11**	2	20
00AFGK	Clock House	16,107	14.96	**12**	2	22

Area Code	Area	Total Popn	$PM_{2.5}$ Conc ($\mu g/m^3$)	Attributable Deaths at coeff[t] (change for 10 $\mu g/m^3$ $PM_{2.5}$) 6%	1%	12%
00AFGL	Copers Cope	15,098	14.94	**11**	2	20
00AFGM	Cray Valley East	14,960	14.51	**11**	2	20
00AFGN	Cray Valley West	16,109	14.66	**12**	2	22
00AFGP	Crystal Palace	11,517	15.07	**8**	1	16
00AFGQ	Darwin	4,846	14.36	**3**	1	7
00AFGR	Farnborough and Crofton	14,192	14.55	**10**	2	19
00AFGS	Hayes and Coney Hall	14,888	14.61	**11**	2	20
00AFGT	Kelsey and Eden Park	15,541	14.86	**11**	2	21
00AFGU	Mottingham and Chislehurst North	10,277	14.83	**7**	1	14
00AFGW	Orpington	15,295	14.54	**11**	2	21
00AFGX	Penge and Cator	16,891	14.99	**12**	2	23
00AFGY	Petts Wood and Knoll	13,593	14.56	**10**	2	18
00AFGZ	Plaistow and Sundridge	14,622	14.80	**11**	2	20
00AFHA	Shortlands	9,419	14.82	**7**	1	13
00AFHB	West Wickham	14,323	14.75	**10**	2	19
00AGGD	Belsize	11,991	15.86	**6**	1	12
00AGGE	Bloomsbury	9,205	17.54	**5**	1	9
00AGGF	Camden Town with Primrose Hill	12,286	16.21	**6**	1	12
00AGGG	Cantelowes	11,220	16.53	**6**	1	11
00AGGH	Fortune Green	10,895	15.70	**6**	1	10
00AGGJ	Frognal and Fitzjohns	11,937	15.73	**6**	1	11
00AGGK	Gospel Oak	10,817	15.85	**6**	1	10
00AGGL	Hampstead Town	11,016	15.49	**6**	1	11
00AGGM	Haverstock	11,749	15.88	**6**	1	11
00AGGN	Highgate	10,622	15.29	**5**	1	10
00AGGP	Holborn and Covent Garden	11,438	17.18	**6**	1	11
00AGGQ	Kentish Town	12,424	15.99	**6**	1	12
00AGGR	Kilburn	11,000	15.88	**6**	1	11
00AGGS	King's Cross	11,717	17.19	**6**	1	11
00AGGT	Regent's Park	12,324	16.70	**6**	1	12
00AGGU	St. Pancras and Somers Town	13,081	16.74	**7**	1	13
00AGGW	Swiss Cottage	12,409	15.84	**6**	1	12
00AGGX	West Hampstead	11,067	15.84	**6**	1	11
00AHGE	Addiscombe	16,076	15.08	**10**	2	18
00AHGF	Ashburton	13,905	14.93	**8**	1	16
00AHGG	Bensham Manor	16,857	15.08	**10**	2	19
00AHGH	Broad Green	15,794	15.38	**9**	2	18
00AHGJ	Coulsdon East	12,092	14.49	**7**	1	14
00AHGK	Coulsdon West	13,412	14.80	**8**	1	15
00AHGL	Croham	15,043	14.99	**9**	2	17
00AHGM	Fairfield	16,149	15.16	**10**	2	18
00AHGN	Fieldway	11,019	14.55	**7**	1	12
00AHGP	Heathfield	12,984	14.66	**8**	1	15
00AHGQ	Kenley	14,240	14.62	**9**	2	16
00AHGR	New Addington	10,261	14.48	**6**	1	11
00AHGS	Norbury	14,632	15.09	**9**	2	16
00AHGT	Purley	14,111	15.00	**8**	1	16
00AHGU	Sanderstead	12,078	14.62	**7**	1	14
00AHGW	Selhurst	15,175	15.17	**9**	2	17
00AHGX	Selsdon and Ballards	11,751	14.63	**7**	1	13

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00AHGY	Shirley	13,772	14.72	**8**	1	15
00AHGZ	South Norwood	15,043	15.06	**9**	2	17
00AHHA	Thornton Heath	14,923	15.17	**9**	2	17
00AHHB	Upper Norwood	14,318	15.10	**9**	2	16
00AHHC	Waddon	14,584	15.22	**9**	2	16
00AHHD	West Thornton	16,832	15.28	**10**	2	19
00AHHE	Woodside	15,970	14.93	**10**	2	18
00AJGC	Acton Central	14,192	15.88	**7**	1	14
00AJGD	Cleveland	14,649	15.38	**8**	1	14
00AJGE	Dormers Wells	13,476	15.29	**7**	1	13
00AJGF	Ealing Broadway	13,758	15.69	**7**	1	13
00AJGG	Ealing Common	13,352	15.74	**7**	1	13
00AJGH	East Acton	18,422	16.04	**10**	2	18
00AJGJ	Elthorne	13,581	15.44	**7**	1	13
00AJGK	Greenford Broadway	14,961	15.13	**8**	1	15
00AJGL	Greenford Green	12,802	15.17	**7**	1	12
00AJGM	Hanger Hill	14,535	15.92	**8**	1	14
00AJGN	Hobbayne	13,401	15.17	**7**	1	13
00AJGP	Lady Margaret	13,014	15.04	**7**	1	13
00AJGQ	Northfield	12,970	15.35	**7**	1	13
00AJGR	North Greenford	13,374	15.05	**7**	1	13
00AJGS	Northolt Mandeville	13,286	15.02	**7**	1	13
00AJGT	Northolt West End	13,732	14.98	**7**	1	13
00AJGU	Norwood Green	12,922	15.37	**7**	1	13
00AJGW	Perivale	14,308	15.33	**7**	1	14
00AJGX	South Acton	13,843	15.52	**7**	1	13
00AJGY	Southall Broadway	13,577	15.54	**7**	1	13
00AJGZ	Southall Green	13,320	15.34	**7**	1	13
00AJHA	Southfield	13,034	15.34	**7**	1	13
00AJHB	Walpole	13,212	15.27	**7**	1	13
00AKGL	Bowes	11,847	15.52	**7**	1	14
00AKGM	Bush Hill Park	14,110	14.99	**9**	2	16
00AKGN	Chase	13,264	14.72	**8**	1	15
00AKGP	Cockfosters	13,590	14.62	**8**	1	16
00AKGQ	Edmonton Green	16,198	15.61	**10**	2	19
00AKGR	Enfield Highway	14,881	14.80	**9**	2	17
00AKGS	Enfield Lock	14,303	14.92	**9**	2	16
00AKGT	Grange	12,681	14.81	**8**	1	15
00AKGU	Haselbury	14,931	15.27	**9**	2	17
00AKGW	Highlands	13,334	14.64	**8**	1	15
00AKGX	Jubilee	12,982	14.88	**8**	1	15
00AKGY	Lower Edmonton	14,536	15.00	**9**	2	17
00AKGZ	Palmers Green	13,694	15.35	**8**	1	16
00AKHA	Ponders End	13,906	14.93	**9**	2	16
00AKHB	Southbury	13,351	14.95	**8**	1	15
00AKHC	Southgate	13,546	14.88	**8**	1	15
00AKHD	Southgate Green	13,379	15.25	**8**	1	15
00AKHE	Town	14,814	14.78	**9**	2	17
00AKHF	Turkey Street	13,211	15.13	**8**	1	15
00AKHG	Upper Edmonton	15,752	15.76	**10**	2	18

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00AKHH	Winchmore Hill	12,946	14.88	**8**	1	15
00ALGP	Abbey Wood	14,053	14.83	**9**	2	16
00ALGQ	Blackheath Westcombe	12,261	15.62	**8**	1	14
00ALGR	Charlton	12,800	15.44	**8**	1	15
00ALGS	Coldharbour and New Eltham	12,546	15.00	**8**	1	15
00ALGT	Eltham North	12,459	15.35	**8**	1	15
00ALGU	Eltham South	11,966	14.93	**8**	1	14
00ALGW	Eltham West	13,810	15.55	**9**	2	16
00ALGX	Glyndon	15,458	15.05	**10**	2	18
00ALGY	Greenwich West	13,830	15.73	**9**	2	16
00ALGZ	Kidbrooke with Hornfair	13,127	15.25	**8**	1	15
00ALHA	Middle Park and Sutcliffe	13,024	15.19	**8**	1	15
00ALHB	Peninsula	13,309	16.17	**8**	1	16
00ALHC	Plumstead	14,386	14.87	**9**	2	17
00ALHD	Shooters Hill	13,075	14.86	**8**	1	15
00ALHE	Thamesmead Moorings	17,794	14.90	**11**	2	21
00ALHF	Woolwich Common	15,310	15.09	**10**	2	18
00ALHG	Woolwich Riverside	17,242	15.44	**11**	2	20
00AMGA	Brownswood	12,178	15.65	**5**	1	10
00AMGB	Cazenove	11,482	15.39	**5**	1	9
00AMGC	Chatham	11,432	15.89	**5**	1	9
00AMGD	Clissold	11,230	15.46	**5**	1	9
00AMGE	Dalston	12,032	15.75	**5**	1	10
00AMGF	De Beauvoir	11,560	15.75	**5**	1	9
00AMGG	Hackney Central	11,014	15.83	**5**	1	9
00AMGH	Hackney Downs	11,638	15.49	**5**	1	9
00AMGJ	Haggerston	12,165	16.21	**5**	1	10
00AMGK	Hoxton	12,230	16.15	**5**	1	10
00AMGL	King's Park	11,538	15.40	**5**	1	9
00AMGM	Leabridge	11,405	15.49	**5**	1	9
00AMGN	Lordship	12,518	15.37	**5**	1	10
00AMGP	New River	12,314	15.53	**5**	1	10
00AMGQ	Queensbridge	11,410	15.63	**5**	1	9
00AMGR	Springfield	11,425	15.24	**5**	1	9
00AMGS	Stoke Newington Central	11,512	15.70	**5**	1	9
00AMGT	Victoria	13,049	15.81	**6**	1	11
00AMGU	Wick	11,225	16.59	**5**	1	9
00ANGA	Addison	11,814	15.73	**6**	1	11
00ANGB	Askew	12,651	15.61	**6**	1	11
00ANGC	Avonmore and Brook Green	12,085	16.03	**6**	1	11
00ANGD	College Park and Old Oak	9,064	15.94	**4**	1	8
00ANGE	Fulham Broadway	10,994	15.63	**5**	1	10
00ANGF	Fulham Reach	10,769	15.69	**5**	1	10
00ANGG	Hammersmith Broadway	12,204	16.42	**6**	1	11
00ANGH	Munster	10,436	15.51	**5**	1	9
00ANGJ	North End	11,509	16.03	**6**	1	10
00ANGK	Palace Riverside	7,675	15.33	**4**	1	7
00ANGL	Parsons Green and Walham	10,842	15.88	**5**	1	10
00ANGM	Ravenscourt Park	11,621	15.76	**6**	1	11
00ANGN	Sands End	11,881	15.56	**6**	1	11

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00ANGP	Shepherd's Bush Green	11,331	15.86	**5**	1	10
00ANGQ	Town	10,479	15.68	**5**	1	9
00ANGR	Wormholt and White City	13,301	15.84	**6**	1	12
00APGA	Alexandra	11,146	15.09	**5**	1	9
00APGB	Bounds Green	12,806	15.29	**5**	1	10
00APGC	Bruce Grove	12,816	15.33	**5**	1	10
00APGD	Crouch End	11,692	15.25	**5**	1	9
00APGE	Fortis Green	12,203	15.18	**5**	1	10
00APGF	Harringay	11,493	15.55	**5**	1	9
00APGG	Highgate	11,089	15.33	**5**	1	9
00APGH	Hornsey	11,345	15.24	**5**	1	9
00APGJ	Muswell Hill	10,583	15.22	**4**	1	8
00APGK	Noel Park	12,349	15.37	**5**	1	10
00APGL	Northumberland Park	13,616	15.19	**6**	1	11
00APGM	St. Ann's	13,730	15.46	**6**	1	11
00APGN	Seven Sisters	14,243	15.43	**6**	1	11
00APGP	Stroud Green	11,250	15.27	**5**	1	9
00APGQ	Tottenham Green	13,277	15.62	**6**	1	11
00APGR	Tottenham Hale	13,535	15.41	**6**	1	11
00APGS	West Green	12,832	15.27	**5**	1	10
00APGT	White Hart Lane	12,558	15.29	**5**	1	10
00APGU	Woodside	12,492	15.23	**5**	1	10
00AQFY	Belmont	9,681	14.79	**5**	1	10
00AQFZ	Canons	10,875	14.72	**6**	1	11
00AQGA	Edgware	10,294	14.89	**6**	1	10
00AQGB	Greenhill	11,118	15.08	**6**	1	11
00AQGC	Harrow on the Hill	11,659	14.97	**6**	1	12
00AQGD	Harrow Weald	10,674	14.67	**6**	1	11
00AQGE	Hatch End	10,401	14.67	**6**	1	11
00AQGF	Headstone North	9,749	14.73	**5**	1	10
00AQGG	Headstone South	9,909	14.92	**5**	1	10
00AQGH	Kenton East	10,189	14.96	**6**	1	10
00AQGJ	Kenton West	10,514	14.84	**6**	1	11
00AQGK	Marlborough	10,048	14.86	**5**	1	10
00AQGL	Pinner	9,854	14.60	**5**	1	10
00AQGM	Pinner South	10,226	14.70	**6**	1	10
00AQGN	Queensbury	10,375	14.93	**6**	1	11
00AQGP	Rayners Lane	10,446	14.74	**6**	1	11
00AQGQ	Roxbourne	11,854	14.84	**6**	1	12
00AQGR	Roxeth	10,926	14.93	**6**	1	11
00AQGS	Stanmore Park	10,642	14.65	**6**	1	11
00AQGT	Wealdstone	9,459	14.79	**5**	1	10
00AQGU	West Harrow	10,063	14.87	**5**	1	10
00ARGC	Brooklands	13,673	14.81	**11**	2	20
00ARGD	Cranham	12,260	14.67	**10**	2	18
00ARGE	Elm Park	12,261	14.58	**10**	2	18
00ARGF	Emerson Park	11,656	14.51	**9**	2	17
00ARGG	Gooshays	14,108	14.57	**11**	2	21
00ARGH	Hacton	12,585	14.48	**10**	2	18
00ARGJ	Harold Wood	12,614	14.58	**10**	2	19

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00ARGK	Havering Park	12,792	14.40	**10**	2	19
00ARGL	Heaton	11,909	14.58	**9**	2	17
00ARGM	Hylands	12,717	14.61	**10**	2	19
00ARGN	Mawneys	12,706	14.64	**10**	2	19
00ARGP	Pettits	13,019	14.66	**10**	2	19
00ARGQ	Rainham and Wennington	12,230	14.66	**10**	2	18
00ARGR	Romford Town	14,982	14.85	**12**	2	22
00ARGS	St. Andrew's	12,956	14.53	**10**	2	19
00ARGT	South Hornchurch	12,683	14.86	**10**	2	19
00ARGU	Squirrel's Heath	12,452	14.70	**10**	2	18
00ARGW	Upminster	12,876	14.44	**10**	2	19
00ASGG	Barnhill	12,280	14.85	**8**	1	14
00ASGH	Botwell	12,915	15.16	**8**	1	15
00ASGJ	Brunel	15,008	14.84	**9**	2	17
00ASGK	Cavendish	11,242	14.66	**7**	1	13
00ASGL	Charville	11,738	14.72	**7**	1	13
00ASGM	Eastcote and East Ruislip	11,454	14.63	**7**	1	13
00ASGN	Harefield	7,249	14.39	**4**	1	8
00ASGP	Heathrow Villages	10,517	15.66	**6**	1	12
00ASGQ	Hillingdon East	11,930	14.84	**7**	1	14
00ASGR	Ickenham	9,866	14.81	**6**	1	11
00ASGS	Manor	10,991	14.77	**7**	1	13
00ASGT	Northwood	10,977	14.45	**7**	1	13
00ASGU	Northwood Hills	11,154	14.59	**7**	1	13
00ASGW	Pinkwell	12,556	15.52	**8**	1	14
00ASGX	South Ruislip	11,213	14.83	**7**	1	13
00ASGY	Townfield	12,072	15.26	**7**	1	14
00ASGZ	Uxbridge North	12,074	14.94	**7**	1	14
00ASHA	Uxbridge South	11,680	14.79	**7**	1	13
00ASHB	West Drayton	12,209	15.17	**7**	1	14
00ASHC	West Ruislip	10,476	14.61	**6**	1	12
00ASHD	Yeading	12,325	14.98	**8**	1	14
00ASHE	Yiewsley	11,506	14.97	**7**	1	13
00ATFY	Bedfont	10,290	15.12	**5**	1	10
00ATFZ	Brentford	12,388	15.78	**7**	1	12
00ATGA	Chiswick Homefields	11,868	15.48	**6**	1	12
00ATGB	Chiswick Riverside	11,408	15.55	**6**	1	11
00ATGC	Cranford	11,427	15.42	**6**	1	11
00ATGD	Feltham North	9,897	15.23	**5**	1	10
00ATGE	Feltham West	14,195	14.81	**7**	1	14
00ATGF	Hanworth	13,112	15.01	**7**	1	13
00ATGG	Hanworth Park	10,776	14.91	**6**	1	11
00ATGH	Heston Central	11,418	15.39	**6**	1	11
00ATGJ	Heston East	11,180	15.34	**6**	1	11
00ATGK	Heston West	11,883	15.50	**6**	1	12
00ATGL	Hounslow Central	12,044	15.09	**6**	1	12
00ATGM	Hounslow Heath	11,953	14.98	**6**	1	12
00ATGN	Hounslow South	10,973	14.97	**6**	1	11
00ATGP	Hounslow West	10,862	15.16	**6**	1	11
00ATGQ	Isleworth	11,283	15.14	**6**	1	11

Area Code	Area	Total Popn	$PM_{2.5}$ Conc ($\mu g/m^3$)	Attributable Deaths at coeff[t] (change for 10 $\mu g/m^3$ $PM_{2.5}$) 6%	1%	12%
00ATGR	Osterley and Spring Grove	10,859	15.24	**6**	1	11
00ATGS	Syon	10,849	15.22	**6**	1	11
00ATGT	Turnham Green	11,240	15.88	**6**	1	11
00AUFX	Barnsbury	11,087	16.05	**6**	1	10
00AUFY	Bunhill	11,089	16.61	**6**	1	10
00AUFZ	Caledonian	13,161	16.14	**7**	1	12
00AUGA	Canonbury	10,653	15.75	**5**	1	10
00AUGB	Clerkenwell	10,399	16.61	**5**	1	10
00AUGC	Finsbury Park	13,522	15.87	**7**	1	13
00AUGD	Highbury East	11,529	15.69	**6**	1	11
00AUGE	Highbury West	14,096	15.78	**7**	1	13
00AUGF	Hillrise	11,936	15.42	**6**	1	11
00AUGG	Holloway	15,549	15.98	**8**	1	15
00AUGH	Junction	11,461	15.83	**6**	1	11
00AUGJ	Mildmay	12,179	15.75	**6**	1	11
00AUGK	St. George's	11,925	15.75	**6**	1	11
00AUGL	St. Mary's	11,362	16.09	**6**	1	11
00AUGM	St. Peter's	11,882	16.00	**6**	1	11
00AUGN	Tollington	13,284	15.57	**7**	1	13
00AWFY	Abingdon	9,795	16.31	**4**	1	8
00AWFZ	Brompton	9,884	16.78	**4**	1	8
00AWGA	Campden	8,919	15.97	**4**	1	7
00AWGB	Colville	8,366	15.85	**4**	1	7
00AWGC	Courtfield	10,123	16.42	**5**	1	9
00AWGD	Cremorne	9,794	16.33	**4**	1	8
00AWGE	Earl's Court	10,430	16.65	**5**	1	9
00AWGF	Golborne	9,367	16.18	**4**	1	8
00AWGG	Hans Town	9,822	16.14	**4**	1	8
00AWGH	Holland	9,903	15.92	**4**	1	8
00AWGJ	Norland	9,196	15.89	**4**	1	8
00AWGK	Notting Barns	9,400	16.27	**4**	1	8
00AWGL	Pembridge	8,672	15.87	**4**	1	7
00AWGM	Queen's Gate	10,241	16.05	**5**	1	9
00AWGN	Redcliffe	9,229	15.93	**4**	1	8
00AWGP	Royal Hospital	8,036	16.26	**4**	1	7
00AWGQ	St. Charles	9,696	15.90	**4**	1	8
00AWGR	Stanley	8,142	16.17	**4**	1	7
00AXFX	Alexandra	9,176	15.03	**5**	1	10
00AXFY	Berrylands	9,582	14.99	**6**	1	10
00AXFZ	Beverley	10,063	14.95	**6**	1	11
00AXGA	Canbury	11,308	15.02	**7**	1	12
00AXGB	Chessington North and Hook	8,825	14.89	**5**	1	10
00AXGC	Chessington South	10,023	14.69	**6**	1	11
00AXGD	Coombe Hill	10,361	15.04	**6**	1	11
00AXGE	Coombe Vale	9,453	14.92	**6**	1	10
00AXGF	Grove	9,152	15.37	**5**	1	10
00AXGG	Norbiton	9,569	15.23	**6**	1	10
00AXGH	Old Malden	9,194	14.96	**5**	1	10
00AXGJ	St. James	8,758	15.27	**5**	1	10
00AXGK	St. Mark's	9,822	14.94	**6**	1	11

Area Code	Area	Total Popn	$PM_{2.5}$ Conc ($\mu g/m^3$)	Attributable Deaths at coeff[t] (change for 10 $\mu g/m^3$ $PM_{2.5}$) 6%	1%	12%
00AXGL	Surbiton Hill	10,627	14.93	**6**	1	12
00AXGM	Tolworth and Hook Rise	9,703	15.12	**6**	1	11
00AXGN	Tudor	8,589	14.94	**5**	1	9
00AYFZ	Bishop's	10,003	16.50	**5**	1	9
00AYGA	Brixton Hill	13,734	15.58	**7**	1	12
00AYGB	Clapham Common	13,706	15.67	**6**	1	12
00AYGC	Clapham Town	14,564	15.96	**7**	1	13
00AYGD	Coldharbour	15,493	15.81	**7**	1	14
00AYGE	Ferndale	14,518	15.79	**7**	1	13
00AYGF	Gipsy Hill	14,598	15.22	**7**	1	13
00AYGG	Herne Hill	13,039	15.64	**6**	1	12
00AYGH	Knight's Hill	14,688	15.23	**7**	1	13
00AYGJ	Larkhall	15,775	15.81	**7**	1	14
00AYGK	Oval	13,873	16.56	**7**	1	12
00AYGL	Prince's	12,575	16.25	**6**	1	11
00AYGM	St. Leonard's	13,423	15.51	**6**	1	12
00AYGN	Stockwell	14,491	15.91	**7**	1	13
00AYGP	Streatham Hill	14,372	15.45	**7**	1	13
00AYGQ	Streatham South	14,335	15.22	**7**	1	13
00AYGR	Streatham Wells	14,093	15.39	**7**	1	12
00AYGS	Thornton	13,426	15.53	**6**	1	12
00AYGT	Thurlow Park	12,497	15.54	**6**	1	11
00AYGU	Tulse Hill	14,389	15.53	**7**	1	13
00AYGW	Vassall	14,191	15.79	**7**	1	13
00AZGD	Bellingham	14,360	15.05	**8**	1	15
00AZGE	Blackheath	14,048	15.50	**8**	1	15
00AZGF	Brockley	15,709	15.69	**9**	2	17
00AZGG	Catford South	14,790	15.03	**8**	1	16
00AZGH	Crofton Park	14,753	15.35	**8**	1	16
00AZGJ	Downham	15,016	14.97	**9**	2	16
00AZGK	Evelyn	16,772	15.57	**10**	2	18
00AZGL	Forest Hill	14,962	15.27	**9**	2	16
00AZGM	Grove Park	14,827	14.98	**8**	1	16
00AZGN	Ladywell	13,210	15.28	**8**	1	14
00AZGP	Lee Green	12,777	15.18	**7**	1	14
00AZGQ	Lewisham Central	15,978	15.49	**9**	2	17
00AZGR	New Cross	16,617	15.63	**9**	2	18
00AZGS	Perry Vale	15,386	15.16	**9**	2	16
00AZGT	Rushey Green	14,261	15.39	**8**	1	15
00AZGU	Sydenham	16,215	15.15	**9**	2	17
00AZGW	Telegraph Hill	15,331	15.52	**9**	2	16
00AZGX	Whitefoot	14,008	15.07	**8**	1	15
00BAFX	Abbey	10,866	15.38	**6**	1	11
00BAFY	Cannon Hill	9,347	14.96	**5**	1	9
00BAFZ	Colliers Wood	11,222	15.34	**6**	1	11
00BAGA	Cricket Green	10,633	15.30	**6**	1	11
00BAGB	Dundonald	9,412	15.30	**5**	1	10
00BAGC	Figge's Marsh	10,344	15.45	**6**	1	11
00BAGD	Graveney	9,758	15.15	**5**	1	10
00BAGE	Hillside	9,590	15.16	**5**	1	10

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00BAGF	Lavender Fields	10,165	15.21	**6**	1	10
00BAGG	Longthornton	10,086	15.10	**5**	1	10
00BAGH	Lower Morden	8,675	14.93	**5**	1	9
00BAGJ	Merton Park	9,694	15.23	**5**	1	10
00BAGK	Pollards Hill	10,260	15.17	**6**	1	10
00BAGL	Ravensbury	9,808	15.35	**5**	1	10
00BAGM	Raynes Park	9,887	15.13	**5**	1	10
00BAGN	St. Helier	9,460	15.02	**5**	1	10
00BAGP	Trinity	9,217	15.13	**5**	1	9
00BAGQ	Village	9,418	15.00	**5**	1	10
00BAGR	West Barnes	9,791	15.10	**5**	1	10
00BAGS	Wimbledon Park	10,435	15.30	**6**	1	11
00BBGB	Beckton	14,388	15.28	**7**	1	13
00BBGC	Boleyn	12,487	15.15	**6**	1	11
00BBGD	Canning Town North	12,439	15.52	**6**	1	11
00BBGE	Canning Town South	13,629	15.88	**6**	1	12
00BBGF	Custom House	12,184	15.60	**6**	1	11
00BBGG	East Ham Central	12,436	15.30	**6**	1	11
00BBGH	East Ham North	11,592	15.12	**5**	1	10
00BBGJ	East Ham South	12,848	15.79	**6**	1	11
00BBGK	Forest Gate North	13,741	15.29	**6**	1	12
00BBGL	Forest Gate South	15,786	15.42	**7**	1	14
00BBGM	Green Street East	13,696	15.28	**6**	1	12
00BBGN	Green Street West	13,110	15.27	**6**	1	11
00BBGP	Little Ilford	13,761	15.24	**6**	1	12
00BBGQ	Manor Park	12,841	15.21	**6**	1	11
00BBGR	Plaistow North	13,777	15.35	**6**	1	12
00BBGS	Plaistow South	12,081	15.59	**6**	1	11
00BBGT	Royal Docks	8,428	15.39	**4**	1	7
00BBGU	Stratford and New Town	16,367	15.76	**8**	1	14
00BBGW	Wall End	13,103	15.46	**6**	1	11
00BBGX	West Ham	12,997	15.47	**6**	1	11
00BCFY	Aldborough	12,568	14.75	**8**	1	14
00BCFZ	Barkingside	11,815	15.12	**7**	1	14
00BCGA	Bridge	11,517	14.99	**7**	1	13
00BCGB	Chadwell	12,100	15.01	**7**	1	14
00BCGC	Church End	11,159	15.48	**7**	1	13
00BCGD	Clayhall	12,134	15.22	**7**	1	14
00BCGE	Clementswood	12,248	15.22	**8**	1	14
00BCGF	Cranbrook	12,135	15.37	**7**	1	14
00BCGG	Fairlop	12,051	14.73	**7**	1	14
00BCGH	Fullwell	12,087	14.85	**7**	1	14
00BCGJ	Goodmayes	11,424	15.02	**7**	1	13
00BCGK	Hainault	11,615	14.55	**7**	1	13
00BCGL	Loxford	15,026	15.44	**9**	2	17
00BCGM	Mayfield	11,474	14.91	**7**	1	13
00BCGN	Monkhams	10,089	14.86	**6**	1	12
00BCGP	Newbury	13,839	15.18	**8**	2	16
00BCGQ	Roding	11,066	15.75	**7**	1	13
00BCGR	Seven Kings	12,692	15.06	**8**	1	15

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00BCGS	Snaresbrook	11,208	15.33	**7**	1	13
00BCGT	Valentines	12,502	15.20	**8**	1	14
00BCGU	Wanstead	11,804	15.30	**7**	1	14
00BDFW	Barnes	10,277	15.28	**5**	1	10
00BDFX	East Sheen	10,260	15.00	**5**	1	10
00BDFY	Fulwell and Hampton Hill	10,104	15.02	**5**	1	10
00BDFZ	Ham Petersham & Richmond Riversi	10,131	14.89	**5**	1	10
00BDGA	Hampton	10,060	14.81	**5**	1	10
00BDGB	Hampton North	9,673	14.83	**5**	1	10
00BDGC	Hampton Wick	10,194	14.83	**5**	1	10
00BDGD	Heathfield	9,950	15.03	**5**	1	10
00BDGE	Kew	11,179	15.19	**6**	1	11
00BDGF	Mortlake and Barnes Common	10,624	15.37	**6**	1	11
00BDGG	North Richmond	10,325	15.20	**6**	1	10
00BDGH	St. Margarets & North Twickenham	10,686	15.33	**6**	1	11
00BDGJ	South Richmond	10,906	15.13	**6**	1	11
00BDGK	South Twickenham	9,478	14.97	**5**	1	9
00BDGL	Teddington	10,487	14.81	**6**	1	10
00BDGM	Twickenham Riverside	10,211	15.05	**5**	1	10
00BDGN	West Twickenham	10,328	15.00	**6**	1	10
00BDGP	Whitton	9,646	15.07	**5**	1	10
00BEGC	Brunswick Park	12,281	15.82	**6**	1	11
00BEGD	Camberwell Green	13,928	15.97	**7**	1	13
00BEGE	Cathedrals	15,723	16.61	**8**	1	14
00BEGF	Chaucer	15,934	16.52	**8**	1	15
00BEGG	College	11,303	15.27	**6**	1	10
00BEGH	East Dulwich	11,947	15.41	**6**	1	11
00BEGJ	East Walworth	13,100	16.14	**6**	1	12
00BEGK	Faraday	13,570	15.79	**7**	1	12
00BEGL	Grange	14,559	16.06	**7**	1	13
00BEGM	Livesey	13,699	15.71	**7**	1	13
00BEGN	Newington	14,277	15.93	**7**	1	13
00BEGP	Nunhead	12,030	15.45	**6**	1	11
00BEGQ	Peckham	11,842	15.66	**6**	1	11
00BEGR	Peckham Rye	12,912	15.29	**6**	1	12
00BEGS	Riverside	13,354	16.00	**7**	1	12
00BEGT	Rotherhithe	13,022	15.72	**6**	1	12
00BEGU	South Bermondsey	12,809	15.99	**6**	1	12
00BEGW	South Camberwell	12,313	15.50	**6**	1	11
00BEGX	Surrey Docks	12,719	15.35	**6**	1	12
00BEGY	The Lane	14,420	15.67	**7**	1	13
00BEGZ	Village	11,096	15.44	**5**	1	10
00BFGC	Beddington North	9,938	15.04	**7**	1	12
00BFGD	Beddington South	10,364	14.85	**7**	1	13
00BFGE	Belmont	10,067	14.91	**7**	1	12
00BFGF	Carshalton Central	9,977	14.96	**7**	1	12
00BFGG	Carshalton South and Clockhouse	10,028	14.71	**7**	1	12
00BFGH	Cheam	9,849	14.93	**6**	1	12
00BFGJ	Nonsuch	10,312	14.84	**7**	1	13
00BFGK	St. Helier	11,450	15.07	**8**	1	14

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00BFGL	Stonecot	10,477	14.98	**7**	1	13
00BFGM	Sutton Central	10,869	14.96	**7**	1	13
00BFGN	Sutton North	9,895	14.92	**7**	1	12
00BFGP	Sutton South	9,247	14.78	**6**	1	11
00BFGQ	Sutton West	10,255	15.02	**7**	1	13
00BFGR	The Wrythe	10,436	14.90	**7**	1	13
00BFGS	Wallington North	10,074	15.06	**7**	1	12
00BFGT	Wallington South	9,807	15.02	**6**	1	12
00BFGU	Wandle Valley	10,998	15.10	**7**	1	14
00BFGW	Worcester Park	11,137	14.84	**7**	1	14
00BGFW	Bethnal Green North	12,347	15.92	**5**	1	10
00BGFX	Bethnal Green South	14,886	15.88	**7**	1	12
00BGFY	Blackwall and Cubitt Town	20,406	16.11	**9**	2	17
00BGFZ	Bow East	10,897	16.31	**5**	1	9
00BGGA	Bow West	11,101	15.70	**5**	1	9
00BGGB	Bromley-by-Bow	14,514	16.27	**6**	1	12
00BGGC	East India and Lansbury	13,202	16.28	**6**	1	11
00BGGD	Limehouse	14,328	16.25	**6**	1	12
00BGGE	Mile End and Globe Town	15,412	15.81	**7**	1	13
00BGGF	Mile End East	12,377	15.74	**5**	1	10
00BGGG	Millwall	16,705	15.56	**7**	1	14
00BGGH	St. Dunstan's and Stepney Green	15,037	15.65	**7**	1	12
00BGGJ	St. Katherine's and Wapping	12,734	16.13	**6**	1	10
00BGGK	Shadwell	12,733	16.44	**6**	1	10
00BGGL	Spitalfields and Banglatown	9,417	16.37	**4**	1	8
00BGGM	Weavers	12,420	15.90	**5**	1	10
00BGGN	Whitechapel	13,148	16.32	**6**	1	11
00BHFX	Cann Hall	11,792	15.27	**7**	1	12
00BHFY	Cathall	10,981	15.86	**6**	1	11
00BHFZ	Chapel End	11,965	15.33	**7**	1	12
00BHGA	Chingford Green	9,742	14.69	**5**	1	10
00BHGB	Endlebury	10,284	14.87	**6**	1	11
00BHGC	Forest	10,971	15.26	**6**	1	11
00BHGD	Grove Green	11,832	15.75	**7**	1	12
00BHGE	Hale End and Highams Park	10,199	15.21	**6**	1	11
00BHGF	Hatch Lane	10,072	14.82	**6**	1	10
00BHGG	High Street	11,959	15.06	**7**	1	12
00BHGH	Higham Hill	11,441	15.15	**6**	1	12
00BHGJ	Hoe Street	12,041	15.15	**7**	1	13
00BHGK	Larkswood	10,869	14.97	**6**	1	11
00BHGL	Lea Bridge	12,927	15.24	**7**	1	13
00BHGM	Leyton	13,705	15.46	**8**	1	14
00BHGN	Leytonstone	11,718	16.48	**7**	1	12
00BHGP	Markhouse	10,745	15.06	**6**	1	11
00BHGQ	Valley	10,064	15.66	**6**	1	10
00BHGR	William Morris	11,527	15.13	**6**	1	12
00BHGS	Wood Street	11,872	15.17	**7**	1	12
00BJFZ	Balham	14,268	15.57	**7**	1	14
00BJGA	Bedford	14,730	15.43	**8**	1	14
00BJGB	Earlsfield	14,116	15.46	**7**	1	14

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00BJGC	East Putney	14,764	15.56	**8**	1	14
00BJGD	Fairfield	13,956	16.12	**7**	1	13
00BJGE	Furzedown	14,374	15.27	**7**	1	14
00BJGF	Graveney	14,203	15.44	**7**	1	14
00BJGG	Latchmere	13,711	16.08	**7**	1	13
00BJGH	Nightingale	14,605	15.51	**8**	1	14
00BJGJ	Northcote	13,990	15.71	**7**	1	13
00BJGK	Queenstown	15,391	16.01	**8**	1	15
00BJGL	Roehampton	13,262	15.20	**7**	1	13
00BJGM	St. Mary's Park	15,386	15.95	**8**	1	15
00BJGN	Shaftesbury	13,510	15.87	**7**	1	13
00BJGP	Southfields	15,508	15.47	**8**	1	15
00BJGQ	Thamesfield	14,914	15.48	**8**	1	14
00BJGR	Tooting	14,266	15.32	**7**	1	14
00BJGS	Wandsworth Common	14,477	15.48	**7**	1	14
00BJGT	West Hill	16,288	15.18	**8**	1	16
00BJGU	West Putney	13,372	15.17	**7**	1	13
00BKGA	Abbey Road	10,745	15.83	**5**	1	9
00BKGB	Bayswater	9,419	16.66	**4**	1	8
00BKGC	Bryanston and Dorset Square	11,415	17.71	**5**	1	9
00BKGD	Churchill	9,105	16.34	**4**	1	7
00BKGE	Church Street	10,453	16.45	**5**	1	9
00BKGF	Harrow Road	10,045	15.97	**4**	1	8
00BKGG	Hyde Park	13,288	17.28	**6**	1	11
00BKGH	Knightsbridge and Belgravia	10,645	16.32	**5**	1	9
00BKGJ	Lancaster Gate	14,050	15.98	**6**	1	12
00BKGK	Little Venice	9,381	16.38	**4**	1	8
00BKGL	Maida Vale	11,030	15.58	**5**	1	9
00BKGM	Marylebone High Street	10,525	17.69	**5**	1	9
00BKGN	Queen's Park	10,240	15.65	**5**	1	8
00BKGP	Regent's Park	13,283	16.06	**6**	1	11
00BKGQ	St. James's	11,015	17.35	**5**	1	9
00BKGR	Tachbrook	9,533	16.47	**4**	1	8
00BKGS	Vincent Square	10,567	16.70	**5**	1	9
00BKGT	Warwick	8,888	16.77	**4**	1	7
00BKGU	Westbourne	11,562	16.69	**5**	1	9
00BKGW	West End	9,561	17.41	**4**	1	8

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