Breathing life into Portsmouth

April 2021
The economic benefits of reducing nitrogen dioxide in Portsmouth

Summary

CBI Economics analysis quantifies the potential gains to the health of Portsmouth’s workforce, and to the local economy, that could be achieved through a reduction in nitrogen dioxide (NO₂) levels via the proposed Clean Air Zone (CAZ). Just a small reduction in NO₂ of 5 µg/m³ (17%) could prevent over 10 deaths and save almost 20 days spent in Portsmouth’s hospitals due to respiratory conditions each year.¹²

Moreover, adding under 43,000 working hours each year through increased workforce participation could provide an economic boost of more than £0.5m in Gross Value Added (GVA).³

Figure 1 Economic and health benefits associated with reducing NO₂ in Portsmouth

- 5 µg/m³ reduction in Portsmouth’s NO₂
- 10 deaths prevented in Portsmouth each year
- 20 fewer days spent in Portsmouth’s hospitals each year
- 43,000 additional hours worked in Portsmouth each year
- £0.5 million economic benefit to Portsmouth’s economy each year

Source: CBI Economics analysis
**Air quality matters to the health of our citizens and ultimately to our economy**

Air pollution impacts human health and the productivity of the UK workforce, which in turn impacts the economy. Analysis conducted by CBI Economics in 2020 estimated that clean air in line with the World Health Organisation’s (WHO) guidelines could deliver a £1.6bn boost to the UK economy each year.4

Evidence shows a key link between NO2 and health outcomes. Reducing NO2 therefore has a key role to play in realising this economic potential. NO2 exposure leads to both short-term and long-term health impacts, exacerbating respiratory conditions such as asthma, possibly increasing the likelihood of lung cancer, stroke, and cardiovascular disease, and has been linked to adverse birth outcomes.5 This comes at a cost to the healthcare system. Public Health England estimates that between 2017 and 2025 the total cost to the NHS and social care system due to NO2 alone will reach £61m.6,7

**The role of Clean Air Zones**

Vehicles are the largest contributor to NO2 pollution at roadsides, contributing 80% of the total. This means higher levels of NO2 are typically focused in high traffic areas within city centres. Targeted local action, in addition to a national strategy, is therefore a key part of the government’s solution to tackling NO2 levels in the UK.8

While the government has considered a range of policy options, the evidence concludes that CAZs are the most effective measure to reduce NO2 levels within the legal limits in the shortest possible time.9 As a result, the government has mandated several cities to implement CAZs, including Portsmouth.

**Nitrogen dioxide levels in Portsmouth**

The UK has statutory limit values for the annual and 1-hour mean concentrations of NO2, set at 40 µg/m³ and 200 µg/m³ respectively.10 Analysis by Ricardo Energy and Environment (Ricardo) finds that while on average, NO2 concentrations in Portsmouth comply with the annual limit value, the maximum annual concentration across locations in Portsmouth in 2019 exceeded this by 13% (5 µg/m³). This exceedance is driven predominantly by two locations, increasing to five locations when including those just below the limit value.11 The main location of exceedance are portions of the A3 Alfred Road and A3 Mile End Road, as well as portions of the A2047 Kingston Road/ Crescent, and London Road.12
### Table 1 Statutory limit values and compliance assessment for NO₂ in Portsmouth, 2019

<table>
<thead>
<tr>
<th>Pollution measure</th>
<th>UK statutory limit value</th>
<th>Average NO₂</th>
<th>Maximum NO₂</th>
<th>Locations &gt;40.4 µg/m³</th>
<th>Locations &gt;36 µg/m³</th>
<th>Compliance assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂ annual mean</td>
<td>40 µg/m³</td>
<td>30 µg/m³</td>
<td>45 µg/m³</td>
<td>2</td>
<td>5</td>
<td>Non-compliant</td>
</tr>
<tr>
<td>NO₂ 1-hour mean</td>
<td>200 µg/m³</td>
<td>N/A</td>
<td>127 µg/m³</td>
<td>N/A</td>
<td>N/A</td>
<td>Compliant</td>
</tr>
</tbody>
</table>

**Source:** Analysis by Ricardo

### Portsmouth’s proposed Clean Air Zone

Portsmouth City Council has recommended to government a Class B charging CAZ to be implemented by Autumn 2021, based on evidence that all Classes B to D would likely achieve compliance in Portsmouth by 2022 and that a Class B would impact fewer vehicle categories. The CAZ will cover the South West of Portsmouth where the main hotspots of air pollution can be found, an area of approximately 3km.

### Figure 2 Boundary of proposed Clean Air Zone in Portsmouth

**Source:** CBI Economics analysis
Evidence from feasibility studies conducted across a range of cities suggests that introducing a CAZ D, thereby reducing the number of polluting vehicles entering the area, could reduce NO₂ concentrations by 5 µg/m³. This means Portsmouth would achieve compliance with national limits up to four years earlier than expected by implementing a CAZ D.¹⁶,¹⁷

Although the preferred model for Portsmouth is a Class B, as a feasibility study has not been published for Portsmouth at the time of writing, this analysis is based on the estimated NO₂ reduction of 5 µg/m³ from a CAZ D, which is publicly available.

**CBI Economics analysis estimates that lower NO₂ levels could prevent 5% of Portsmouth’s deaths from respiratory conditions each year**

Over two thirds (67%) of Portsmouth’s population are of working age compared to an average of 62% in England and Wales.¹⁸ Of these, 72% are currently in employment, and therefore improving the health of Portsmouth’s workers could result in a significant gain to the local economy.¹⁹

Evidence shows the impacts of poor air quality fall disproportionately on the elderly, who are more likely to be outside the working population. In Portsmouth 90% of deaths associated with respiratory diseases fall within the over-65 age bracket.²⁰ The remaining 10% of deaths are among working-age residents with long-term conditions, 52% of which are economically inactive or unemployed.²¹

In Portsmouth, 12% of all deaths and 7% of hospital admissions in 2019 were due to respiratory conditions.²² A further 27% of deaths in 2019 were due to circulatory and heart conditions, and 6% due to malignant cancers, all of which are to an extent attributable to air pollution.²³ Reducing NO₂ levels could therefore prevent premature deaths and reduce hospital admissions associated with exposure to NO₂.

CBI Economics analysis finds that a 5 µg/m³ reduction in NO₂ in Portsmouth could, at a minimum, prevent between five and 11 deaths each year, and save almost 20 days spent in hospital due solely to NO₂ exposure.²⁴ This represents around 5% of Portsmouth’s deaths associated with respiratory conditions.²⁵
The final health benefits of reducing NO₂ are likely to be far greater

As it was not possible to quantify all impact channels, the resulting health benefit is expected to go far beyond this. The reasons for additional health benefits is due to the following:

• A larger share of the UK’s population will be exposed to cleaner air than just those living inside Portsmouth’s CAZ area: While many of Portsmouth’s residents will live within the CAZ boundary, many others will travel through the CAZ for work, study or leisure, including 27,000 students across the city who live, shop, or socialise within the CAZ boundary. Around 44,000 of Portsmouth’s workers (44%) live outside of the city and commute into the CAZ area for work. In addition, Portsmouth sees an average annual inflow of 8.2m visitors, 93% of which are day visitors who are likely to visit multiple times during the year for shopping or leisure. A much larger group of the UK’s population would consequently be exposed to cleaner air than the analysis captures.

• Improving air quality will reduce a host of primary health conditions associated with air pollution: The main conditions associated with air pollution are respiratory conditions, cardiovascular disease, and lung cancer, but there is emerging evidence of associations with low birth weight and Type 2 diabetes. These conditions may be more closely linked with other pollutants, such as PM₂.₅, but NO₂ exposure is likely to play a role within a wider mix of air pollutants. As this analysis is only focused on respiratory conditions, it underestimates the overall impact of lower NO₂ on all health outcomes related to air pollution.

• Improving air quality will reduce health conditions where air pollution is a secondary factor: Exposure to air pollution can also suppress lung function growth in children, and in adulthood it can accelerate the decline in lung function with age. This increases the risk of death from other primary conditions. For example, COVID-19 patients that already suffer from long-term respiratory conditions are at greater risk of death. As a result, improvements in air quality will have knock-on impacts on other health outcomes in addition to those direct impacts captured by the analysis.

• Reducing emissions from vehicles is expected to lead to a reduction in other pollutants: Evidence suggests NO₂ is emitted with other pollutants, especially PM₂.₅, which makes it difficult to determine NO₂ as the attributable pollutant to health outcomes. In addition, road transport has been linked to other pollutants including PM₂.₅, PM₁₀, and ground level ozone, which means CAZs could lead to a reduction in other pollutants. These reductions could therefore provide further health benefits not captured by this analysis. Since PM₂.₅ is the largest determinant of health outcomes due to air pollution, this omission could be significant.
CBI Economics analysis estimates that bringing NO₂ within legal limits will add £0.5m to Portsmouth’s economy each year through increased workforce participation

Despite a disproportionate impact of air pollution on non-working residents, there is still expected to be a large impact on the working population. Analysis by CBI Economics shows that a healthier workforce in Portsmouth could result in an additional 20,000 to 43,000 hours worked.³⁹

Assuming full employment, meaning that these extra hours can be put to immediate use, this could increase the total production in the economy by an additional £0.5m in GVA from preventing these health outcomes.

The final economic benefit to Portsmouth is likely to be much larger

The resulting economic benefit is expected to go beyond £0.5m GVA not only because the resulting health impacts are expected to be larger than it is possible to quantify, but also for the following reasons:

• The resulting days lost from work in the event of a hospital admission will be higher than just the days in hospital: Prior to a hospital admission, it is likely that an individual will already have been suffering and will also likely require time to recover, increasing the days lost from work over and above the time spent in hospital. However, this analysis only quantifies the impact of a reduction in NO₂ on the time spent in hospital due to limited availability of academic evidence.⁴⁰

• The value of unpaid work not carried out as a result of conditions related to NO₂ emissions cannot be estimated: Activities taken outside of formal employment are estimated to be a significant contributor towards the UK economy: the ONS estimated unpaid work at 60% of GDP in 2016.⁴¹ For example, activities such as volunteering and unpaid social care also add value to the local economy but are not captured in this analysis. As a result, cost benefit analyses on air pollution often seek to include this as an impact pathway for quantification.⁴² However, it was not possible to quantify this as part of this analysis due to an absence of academic evidence solely for NO₂.

The analysis evidences the potential gains to Portsmouth’s local economy and to the health of the workforce by reducing NO₂ levels. With just a small 5 µg/m³ reduction in NO₂ estimated to provide, at a minimum, an additional £0.5m in GVA and prevent over 10 deaths, it is clear that lower NO₂ levels can support a healthier and more prosperous city.
1. This change is based on an estimate of the 2019 annual average NO₂ level for Portsmouth of 30 µg/m³, estimated by Ricardo.

2. The number of deaths and hospitalisations will not stay the same as the years go on because of changes in population size and age structure as the deaths prevented accumulate over time. However, given this is a static analysis, the population and employment levels are assumed constant.

3. Real Gross Value Added (GVA) - Chained Volume Measures (2016 prices), i.e. accounting for the effect of inflation by using 2016 prices as the reference case. The figures refer to 2018. GVA is the value generated by any unit engaged in the production of goods and services. This includes the compensation of employees (wages and salaries, bonuses etc.), taxes (less subsidies) on production, and gross operating profits (including self-employment earnings) associated with the production a given level of output.


6. PHE (2018) Estimation of costs to the NHS and social care due to the health impacts of air pollution

7. However, caution should be used when interpreting these figures. Estimating NHS costs is complex, and the PHE study does not include the secondary impact of health care costs that arise from people living longer due to better air quality.


10. Statutory limit values are legally binding and must not be exceeded. In the case of NO₂ this is 40 µg/m³ for the annual mean and 200 µg/m³ for the 1-hour mean. In order for the UK to comply with the limit value, all local areas across the UK must be in compliance.

11. UK best practice guidance. Local Air Quality Management Technical Guidance 2016 LAQM. TG(16) (Defra, 2018) states that the error of concentrations produced from air quality models should be within 10 % of the limit value. Therefore for NO₂ the error in modelled concentrations should be 4 µg/m³, which means setting the limit value to 36 µg/m³ takes into account error in the model.


13. The annual mean NO₂ concentrations are calculated by taking the average of the annual mean using monitoring data and the PCM roads model for roadside locations. While the hourly concentrations are measured by analysing the relationship between the annual mean and 1-hour maximum based on a regression equation.

14. Portsmouth’s Clean Air Zone 2021,

15. Portsmouth’s Clean Air Zone 2021, Portsmouth City Council.

16. This is based on CAZ feasibility studies for Bath, Birmingham, Caerphilly, Cardiff, Derby, Liverpool, Manchester and Newcastle.

17. This is based on an average of the estimated reduction in NO₂ following the introduction of a CAZ-D across eight cities (Bath, Birmingham, Caerphilly, Cardiff, Derby, Liverpool, Manchester and Newcastle), sourced from each city’s CAZ feasibility studies.

18. ONS (2021), Population Estimates, 2019
20. ONS (2021), Mortality Statistics by Underlying Cause and Age, 2019
22. ONS (2020) Mortality Statistics
23. Ibid.
24. The estimate for deaths is based on long-term exposure to NO₂ while the hospital admissions figures are due to short-term NO₂ exposure. A full explanation of the methodology can be found in the accompanying methodology document.
25. This is based on the upper end estimate of 21 deaths prevented, calculated using deaths data from the ONS.
26. Limited academic evidence on the quantification of a reduction in NO₂ on the health of a population meant that several channels of impact were not quantified. A full explanation of this can be found in the accompanying methodology document.
27. HESA (Higher Education Statistical Agency), 2021 – HE Student Data by HE Provider, 2019/20
28. Estimates based on the 2011 Census of Population (origin-destination statistics) and ONS Population Estimates for 2019. The estimates are based on the difference between the number of all usual residents and Portsmouth residents who work in Portsmouth in 2011. This difference is subsequently projected forward to 2019 based on total population growth for Portsmouth between 2011 and 2019 (from the ONS Population Estimates).
29. Visit Britain (2020), Overnight and day visitors (from elsewhere in the UK and international) – 2019
30. The analysis is based on deaths and hospital admissions by local authority and therefore only captures those individuals recorded as living in Portsmouth or visiting Portsmouth’s hospitals and not those from other local authorities.
32. Li, Y (2019) Association between air pollution and type 2 diabetes: an updated review of the literature
33. Ibid.
37. Modelling the impact of CAZs on other pollutants such as PM₂.₅ would have required a significant undertaking and a number of assumptions and therefore the decision was taken to omit this from the quantification.
39. The number of working years gained are converted into number of working days on the basis of the number of hours worked in a given week by all Bristol residents in employment (based on the ONS Annual Survey of Hours and Earnings 2019 data on average number of hours worked per week).
40. The concentration response function (CRF) used in this analysis estimates the impact of a unit change in concentration to the number of hospital admissions due to respiratory disease. It does not capture the full extent of working days lost due to respiratory illness. To do this we would need figures on sickness absence in the workforce due to respiratory illness, to capture days lost sick at home and in hospital.
42. Defra (2012), Valuing the Impacts of Air Quality on Productivity.
This report was produced by CBI Economics and commissioned by the Clean Air Fund using modelling by CBI Economics based on input data from a variety of sources.

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