

DECISION-MAKER:	OVERVIEW AND SCRUTINY MANAGEMENT COMMITTEE
SUBJECT:	AIR POLLUTION IN SOUTHAMPTON DURING LOCKDOWN
DATE OF DECISION:	15 OCTOBER 2020
REPORT OF:	CABINET MEMBER FOR GREEN CITY AND PLACE

<u>CONTACT DETAILS</u>			
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STATEMENT OF CONFIDENTIALITY
None
BRIEF SUMMARY
At the request of the Overview and Scrutiny Management Committee (OSMC), this report is provided to offer a summary of air quality variations in Southampton during the lockdown period and to indicate whether Southampton's experiences were consistent with other cities and those assumptions that support the council's Clean Air Strategy.
The lockdown imposed to reduce the spread of coronavirus resulted in a significant reduction in traffic on our roads whilst the port in Southampton saw an upsurge in cruise ship visits as cruises were cancelled. Other cities reported significant improvements in air quality in response to reduced road traffic emissions. In Southampton concerns were raised amongst local interest groups regarding the cities air quality and whether it was indeed experiencing the same improvements reported elsewhere.
Short term trends in air quality can be difficult to determine as underlying changes in emissions can be readily masked or exaggerated by weather conditions. To determine, with confidence, if local changes were consistent with expectations and trends elsewhere, a detailed statistical assessment was commissioned (the assessment). This differentiated between the effects of weather and key emission sources before and during the lockdown period.

The assessment was able to demonstrate that;

- Weather has a greater influence on air quality concentrations than emissions;
- Southampton experienced significant reductions in nitrogen oxides (NO_x) and nitrogen dioxide in response to reduced road traffic;
- There is a correlation between pollution levels at monitoring locations and wind direction from road sources;
- As a guide to the impact that reduced traffic levels can have, average concentrations of NO₂ at the automatic monitoring stations would be around a third lower in 2020 than in 2019 if July traffic levels are maintained for the remainder of the year;
- When meteorological effects are removed, the rate of NOx reduction in Southampton and other South coast cities was found to be lower than most other monitoring locations in the UK suggesting that transboundary sources (i.e. originating from across continental Europe) may be maintaining stable background levels across the region;
- Southampton experienced a statistical increase in particulate matter (PM) during the lockdown period indicating that that concentrations are more readily affected by weather and sources other than road traffic;
- An increased in measured pollutants occurred in April that could not be explained by traffic levels or weather and;
- There was no statistical relationship between cruise ship activity and peak pollutants concentrations.

Although not definitive there is some evidence to suggest that activity in the direction of the port or other nearby industrial sources could have an impact on measured pollutant levels.

RECOMMENDATIONS:

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| (i) | That the committee considers the contents of this report. |
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REASONS FOR REPORT RECOMMENDATIONS

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| 1. | To enable the Overview and Scrutiny Management Committee to consider how the circumstances resulting from the pandemic lockdown affected air quality in Southampton and how this might relate to current and future assessments and strategies to improve local air quality. |
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ALTERNATIVE OPTIONS CONSIDERED AND REJECTED

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| 2. | None |
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DETAIL

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| 3. | Following lockdown, improvements in air quality were widely reported in the national media in response to reductions in road traffic emissions. Locally, questions were raised concerning the extent of improvements in Southampton and whether it was experiencing the same trends that other cities across England and the world were reporting. Campaigners questioned whether some peak levels were potentially a result of other local sources such as cruise ships visiting the port. SCC undertook a simple analysis in early April which suggested that concentrations of nitrogen dioxide had reduced by as much as a third during lockdown when compared with the previous year. An increase in particulates (PM) was also identified, thought to originate from transboundary sources during recognised pollution events which affected much of England in spring. Saharan dusts and |
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	seasonal application of ammonia fertilisers across Europe are often cited as an issue at this time of the year. However, it was not possible to report with confidence if these changes could be attributed to the reduction in road traffic emissions, changes in port activity or how they might compare with other cities. To achieve this, it would be necessary remove the effect of weather, which will readily mask and/or exaggerates underlying air quality trends.
4.	Consequently, Ricardo were commissioned to undertake a detailed statistical analysis of air quality data from Southampton's monitoring network and compare it with data from the national network, meteorological data, local road traffic trends and other key sources of emissions including shipping.
5.	All assessments to date have been undertaken during the annual reporting period. Therefore 2020 monitoring data would have yet to be subjected to the full ratification process and, as such, the results and conclusions presented must be considered in this context.
6.	Ricardo's assessment reports several key conclusions regarding the key pollutants measured in Southampton:
	Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO₂)
7.	Nitrogen oxides are a group of gases and compounds generally generated during combustion processes and collectively known as NOx. Nitrogen dioxide is known to be harmful to health, causing inflammation of the airways and can exacerbate the symptoms of those already suffering from lung or heart conditions. Like many cities Southampton has experienced levels that persistently exceed statutory limit levels (40 µg/m ³ annual average) and in 2019 introduced a set of transport focused measures in a Local Nitrogen Dioxide Plan (aka Non-Charging Clean Air Zone) to ensure legal levels were achieved in the shortest possible time.
8.	The assessment demonstrated a correlation between wind direction from road sources and measured levels of NO ₂ indicating that traffic was the predominant source for NO ₂ both during and prior to lockdown.
9.	The assessment used 'partial dependence plots' to see how changes to various factors correlate with concentrations. This analysis demonstrates that changes in meteorology are responsible for 57% of the variation in concentrations of NO ₂ at the A33 monitoring site whilst 27% can be explained by changes in road vehicle activity. Putting aside meteorology, road vehicle movements would then explain 63% of the variations in concentrations, with the remaining 37% being an outcome of unmeasurable or unknown factors. This supports previous assessments which have indicated that road transport is the most significant source of NO ₂ in Southampton.
10.	Substantial decreases in concentrations of both nitrogen oxides (NO _x) and nitrogen dioxide (NO ₂) were monitored by Southampton's four automatic monitoring sites during the lockdown period (April-June for this report), compared to business as usual.
11.	Concentrations of NO _x during lockdown at roadsides sites were, as an average between the sites, 34% lower than previous years (business as usual).
12.	Concentrations of NO ₂ during the lockdown at roadside sites were, as an average between the sites, 12% lower than business as usual.

13.	The lowest decrease in NO _x /NO ₂ was measured at the Brintons Road background site where road vehicles have a far lower influence on concentrations. This again supports previous assessments regarding emission sources.
14.	While concentrations of NO _x at Victoria Road were 29% lower during lockdown compared to business as usual, concentrations of NO ₂ fell by only 1% and showed little improvement across the lockdown months. It is currently difficult to determine if this might be due to local circumstances affecting pollutant concentrations or a discrepancy in monitoring data. Further assessment when the data is subject to annual ratification will be required to achieve a better understanding of this apparent anomaly.
15.	Decreases of NO ₂ and NO _x during lockdown were typically lower than those seen in other UK cities, but similar to the cohort of monitoring locations in other south coast cities. This indicates that regional meteorological and geographical factors have influenced concentrations on the centre-south coast over lockdown. Background contribution from continental Europe would be more likely to affect this region than other parts of the UK and is a potential cause of this phenomenon.
16.	Annual average concentrations are a good guide for assessing air quality trends. It would be difficult to determine what reported levels for 2020 are likely to look like as traffic levels remain unpredictable. However, as a guide, if July traffic levels are maintained for the remainder of the year, it is predicted that annual average concentrations of NO ₂ at the automatic monitoring stations will be around a third lower than in 2019.
Particulate Matter (PM)	
17.	Airborne particulate matter is made up of a collection of solid and/or liquid materials of various sizes but is most commonly reported as PM ₁₀ (particles less than 10µm in diameter) and PM _{2.5} (particles less than 2.5µm in diameter). It consists of both primary components, which are released directly from the source into the atmosphere, and secondary components, which are formed in the atmosphere by chemical reactions. Particulate matter comes from both humanmade and natural sources including windblown dusts and salts, agriculture, domestic wood burning, bonfires, shipping and road transport. It contains a range of chemical compounds and the identity of these compounds provides clues to its origin. PM ₁₀ exposure has been associated with a wide range of health impacts but impacts are most evident among those susceptible groups with pre-existing lung or heart disease and/or the elderly and children. Current statutory standards are not exceeded in Southampton but there is growing evidence that long term exposure to any elevated levels can impact on public health.
18.	As with NOx and NO ₂ , PM levels were affected by weather conditions with levels at their highest during low wind speeds when dispersion is low.
19.	There is a dominant source of PM with strong South Westerly winds which might be attributed to sea salt particles.
20.	At the two stations where PM is measured, a statistical increase was identified during the lockdown period compared to business as usual indicating that PM concentrations are derived from a wider range of sources than NO _x . Particulate matter concentrations increased by a far greater proportion at the A33 monitoring station compared to the city centre site

	suggesting that sea salt particles may be a local source. Citywide compliance with national air quality objectives has remained unthreatened.
21.	Maximum PM levels correspond with wind directions and road alignment indicating traffic remains a predominant source.
22.	During lockdown period a potential source of fine particulates (PM _{2.5}) to the South East of the city centre was potentially detected.
	Sulphur Dioxide (SO₂)
23.	Sulphur dioxide (SO ₂) is formed during the combustion of fuels containing sulphur, the most significant being fossil fuels. Sulphur dioxide is a respiratory irritant and is toxic at high concentrations. It is also damaging to ecosystems and a major precursor in the formation of acid rain. Levels in the UK have reduced significantly in recent years due to the introduction of low sulphur fuels and in Southampton levels fall well below statutory standards. But monitoring trends can help identify changes in local fossil fuel emissions.
24.	SO ₂ is measured at the Southampton Centre monitoring station and levels remain safely below statutory standards for ambient concentrations and suggest there are no significant sources influencing SO ₂ levels in the city. Levels remained low enough during the lockdown that any analysis of trends would have offered little value.
	Shipping Activity
25.	The assessment looked for any statistical correlation between cruise ship activity and changes in PM and SO ₂ concentrations. None was identified. Associated British Ports provided descriptive evidence on shipping activity during lockdown which showed that, while the number of cruise ships at berth was on average higher than business as usual, energy usage per ship was lower than business as usual as a result of very limited usage of most decks. Activity of container ships was similar to business as usual while car carriers were far less active.
	Conclusions
26.	The assessment illustrates that the reductions in road traffic resulting from the lockdown are able to demonstrate how large reductions in concentrations of NO ₂ and NO _x can be realised. Like other cities, Southampton has locations where NO ₂ levels have exceeded both European and UK standards. Previous assessments have indicated that emissions from road traffic are the primary source and compliance would most likely be achieved by actions that reduce this emission source. SCC's Clean Air Strategy and Action Plan and the Local NO ₂ Plan (aka Non-Charging Clean Air Zone) have done just this. This latest evidence supports that approach and indicates that levels between 21µg/m ³ and 27µg/m ³ could be well within reach if reductions in traffic emissions similar to those seen in July 2020 were maintained.
27.	The assessment shows that PM trends are far more difficult to explain. Whilst levels in Southampton do not exceed any current statutory levels it is widely acknowledged that elevated levels can have a corresponding impact on public health. PM is a key priority in the government's 2019 Clean Air Strategy and it is anticipated that the new Environment Bill will introduce additional duties for local authorities to manage and reduce concentrations. This assessment highlights that any strategy to achieve this will need to look beyond contributions from road transport in order to achieve tangible reductions.

	SCC is already being active in this area and is currently planning a campaign to improve emissions from domestic sources like stoves, fireplaces and bonfires by promoting good practice.
28.	The assessment highlights the value of air quality modelling which is able to identify underlying trends without the influence of weather. The assessment of the lockdown period has demonstrated that concentrations of pollutants can be significantly affected by weather conditions and short-term trends can be especially difficult to determine without the help of detailed assessment. A reliance on monitoring data without any support from statistical analysis or modelling is readily open to misinterpretation and ongoing evaluation of local actions to improve local air quality are best served by using a combination of both.
29.	Southampton's geography and circumstance suggests that it is affected by a wider spectrum of airborne pollution sources than other urban areas in the UK. Contributions from naturally occurring and transboundary sources are likely to mean that local air quality management efforts may need to be more significant than those in other areas to realise the same level of improvement.
30.	Local Authorities have a statutory duty to submit an Annual Status Report (ASR) to the Department of Food, Environment and Rural Affairs. The next submission will be due in June 2021 allowing time to both collate and assess ratified data for 2020. This will provide an opportunity to review the impacts of the lockdown and Southampton's experiences with more confidence.
31.	The 2020 Environment Bill is anticipated to present Local Authorities with new duties regarding local air quality and specifically with regard to PM. A review of SCCs' Clean Air Strategy and Air Quality Action Plan will be required in response. Further clarification on the findings of the recent lockdown assessment, as part of the ASR, will ensure this can be conducted in an informed manner with local circumstances very much at the centre of the process.

RESOURCE IMPLICATIONS

Capital/Revenue

32.	There are no direct financial implications as a result of this report.
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Property/Other

33.	None
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LEGAL IMPLICATIONS

Statutory power to undertake proposals in the report:

34.	N/A
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Other Legal Implications:

35.	Projected NO ₂ concentrations suggest that compliance with the EU Ambient Air Quality Directive limits are now more even more likely to be met in Southampton in 2020 and, if reductions in road traffic persist, more likely to be maintained for future years. SCC's ability to satisfy the expected outcomes of its Local Nitrogen Dioxide Plan (aka Non-Charging Clean Air Zone) and the associated Ministerial Direction have therefore not been compromised.
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RISK MANAGEMENT IMPLICATIONS

36.	The assessment has provided additional insight into local air quality behaviour and demonstrates that all current efforts and activities to deliver improvements are appropriate and relevant to our statutory obligations.
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POLICY FRAMEWORK IMPLICATIONS

37.	The assessment suggests SCC's adopted Green City Plan and Clean Air Strategy remains suitable and relevant but is likely to require review if additional efforts to improve PM are required or imposed on the council.
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KEY DECISION?	No
WARDS/COMMUNITIES AFFECTED:	N/A
<u>SUPPORTING DOCUMENTATION</u>	

Appendices

1.	2020 COVID-19 lockdown period - Air Quality Analysis. Report for Southampton City Council by Ricardo.
2.	2020 COVID-19 lockdown period - Air Quality Analysis: Adendum. Report for Southampton City Council by Ricardo.

Documents in Members' Rooms

1.	None
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Equality Impact Assessment

Do the implications/subject of the report require an Equality and Safety Impact Assessment (ESIA) to be carried out?

No

Data Protection Impact Assessment

Do the implications/subject of the report require a Data Protection Impact Assessment (DPIA) to be carried out?

No

Other Background Documents

Other Background documents available for inspection at:

Title of Background Paper(s)		Relevant Paragraph of the Access to Information Procedure Rules / Schedule 12A allowing document to be Exempt/Confidential (if applicable)
1.	None	