The Scottish Parliament
Pàrlamaid na h-Alba

SPICe The Information Centre
An t-Ionad Fiosrachaidh

SPICe Briefing
Pàipear-ullachaidh SPICe

Transport (Scotland) Bill: Low Emission Zones

Alan Rehfisch

This briefing provides an overview of the powers set out in the Transport (Scotland) Bill to allow local authorities to establish and manage low emission zone schemes.

5 September 2018
SB 18-55

Contents

Executive Summary

Part 1 of the Transport (Scotland) Bill would create a system allowing local authorities to establish, operate, amend and revoke Low Emission Zone (LEZ) schemes. An LEZ would:

1. Restrict the driving of vehicles within an LEZ to those that meet the specified emissions standards or are exempted from the LEZ restrictions
2. Where anyone drives a car within an LEZ that is neither exempt nor meets the required emissions standard, to pay a penalty charge
3. Include an initial grace period, following the establishment of an LEZ where enforcement action will not be taken
4. Allow for enforcement of LEZ restrictions, which although not specified in the Bill this would likely be by automatic number plate recognition (ANPR) enabled CCTV cameras
5. Allow Scottish Ministers powers to make regulations specifying emissions standards, exempt vehicles, the amount of any penalty charge and other detailed aspects of LEZ scheme operation

Introduction

The Transport (Scotland) Bill ("the Bill") was introduced to the Scottish Parliament by Derek Mackay MSP, Cabinet Secretary for Finance and the Constitution, on 8 June 2018. Part 1 of the Bill deals with Low Emission Zones (LEZs).

This briefing summarises:

- Why air pollution from motorised vehicles in an issue
- Key Scottish air pollution statistics
- What LEZs are and whether they help reduce air pollution
- Current Scottish Government efforts to reduce air pollution from transport
- The proposals set out in "Part 1: Low Emission Zones" of the Bill
- Financial implications of the Bill
- Consultation on the LEZ proposals undertaken by the Scottish Government prior to the introduction of the Bill

Why is air pollution from motorised vehicles an issue?

Air pollution is a major environmental risk to human health [1] . Poor air quality is linked to a number of health problems, including lung cancer, strokes and cardiovascular disease. Air pollution is responsible for millions of premature deaths across the globe every year, predominantly in the developing world. In Scotland, over 1,500 premature deaths each year are attributable to air pollution [2] .

The groups most vulnerable to air pollution are children, the elderly and those with pre-existing medical conditions. There are also significant economic costs associated with air pollution, including health care, loss of workdays through sick leave, rehabilitation of the environment and damaged buildings, and reductions in crop yield.

Over recent years the profile of air quality has risen, with events such as the VW emissions controversy [3] and the European Commission decision [4] to refer the UK Government to the Court of Justice of the EU for failure to meet nitrogen dioxide (NO_2) limits. The UK is also accused of failing to take appropriate measures to keep periods where limits were breached as short as possible. These matters have all placed the issue air quality at the forefront of the news.

The pollutants currently of greatest concern are nitrogen oxides and particulate matter, as these are believed to be most damaging to human health. The transport sector, principally road transport, is now the single largest source of nitrogen oxide emissions and the second largest source of particulates in Scotland [5] .

A far more detailed overview of air pollution matters can be found in the SPICe briefing Air Quality in Scotland [6] .

Key Scottish transport related air pollution statistics

As mentioned in the previous section, transport related nitrogen oxide and particulate matter emissions are of most concern, as these are proven to have significant effects on human health. The following sections provide a brief overview of trends in emissions of these substances in Scotland since 1990.

Nitrogen Dioxide: Nitrogen Dioxide (NO_2) is one of a group of highly reactive gases known as oxides of nitrogen or nitrogen oxides (NO_x). Other nitrogen oxides include nitrous acid and nitric acid. NO_2 is used as the indicator for the larger group of nitrogen oxides.

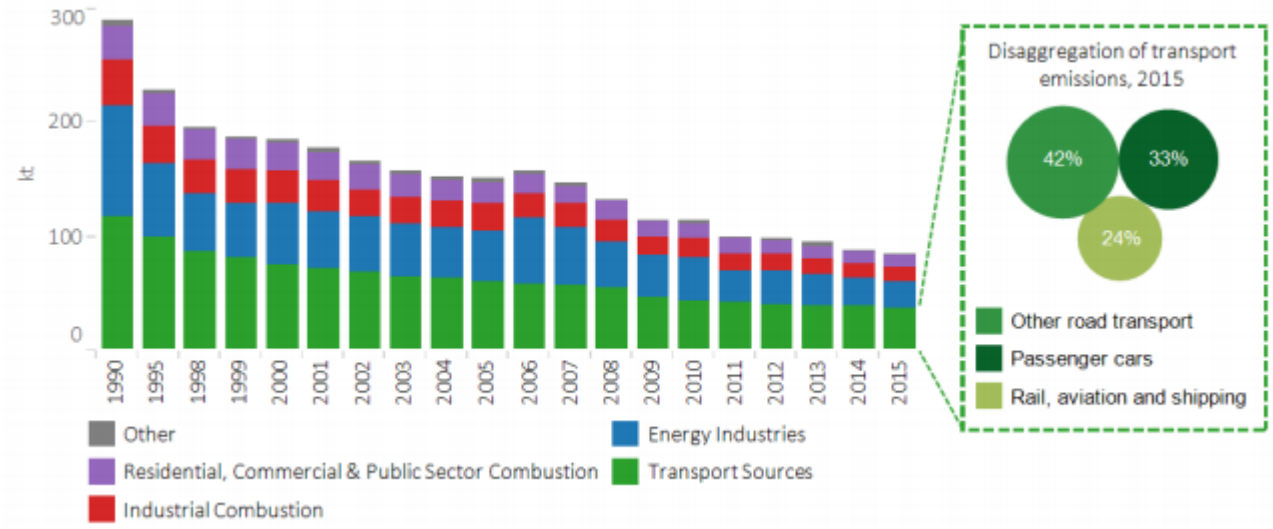
NO_2 primarily gets in the air from the burning of fuel. NO_2 forms from emissions from cars, trucks and buses, power stations and off-road equipment.

Breathing air with a high concentration of NO_2 can irritate airways in the human respiratory system. Exposure over short periods can aggravate respiratory diseases, particularly asthma, which can lead to coughing, wheezing or difficulty breathing that can require

admission to hospital in some cases. Longer exposure to elevated concentrations of NO_2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections. People with asthma, as well as children and the elderly are generally at greater risk for the health effects of NO_2.

The graph below shows total annual NO_2 emissions in Scotland, broken down by source since 1990. While there has been a 71% reduction in NO_2 emissions since 1990, with all sources seeing a decline, the significance of transport as a source of NO_2 emissions has increased - as emissions from other sources have reduced at a faster rate.

Nitrogen oxides emissions in Scotland



Air Quality Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2015, Ricardo Energy & Environment for the Scottish Government et al

Particulate Matter: Particulate matter is the term used to describe solid or liquid particles suspended in the atmosphere. Particulate matter is composed of a complex mixture of substances including: nitrates, sulphates, elemental or organic carbon, metals and biological materials. Particulate matter also includes dust, smoke and soot. Sources of particulate matter may be exclusively natural or man-made, or a combination of both. Exposure to particulate matter can have significant effects on human health including: premature death in people with heart or lung disease, non-fatal heart attacks, irregular heart beat, aggravated asthma, decreased lung function, increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing

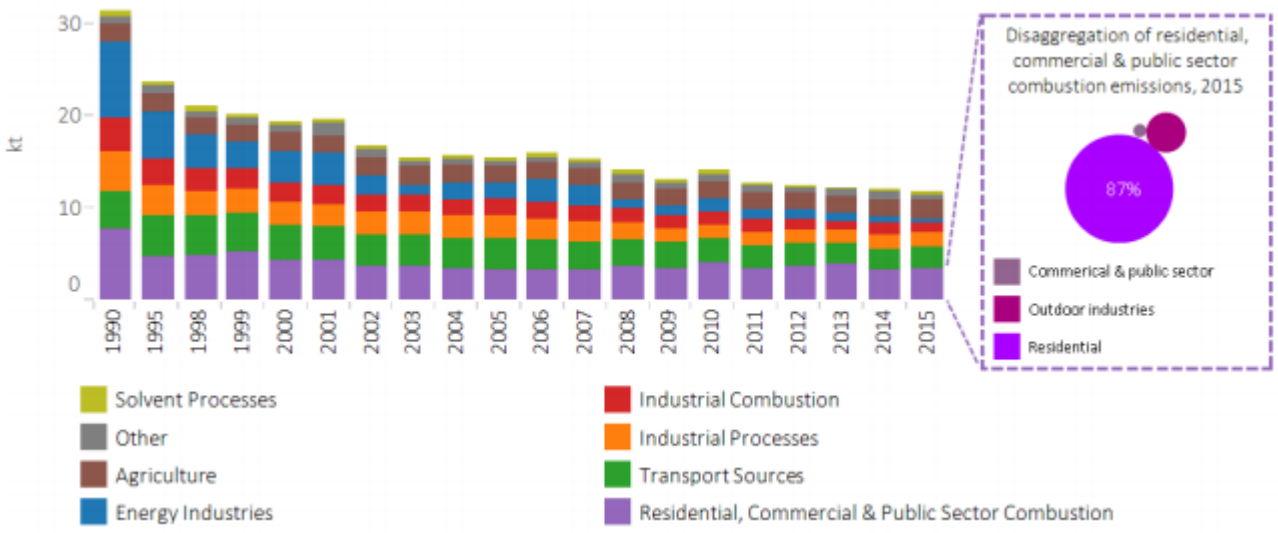
Particulate matter is measured in a number of different size-fractions based on the particle's aerodynamic diameter. Most monitoring is currently focussed on PM10 (particles with an aerodynamic diameter of less than 10 micrometres). However, the finer fractions such as PM2.5 and PM1 are of increasing interest in terms of possible associations with adverse health effects. Particle size determines how deep a particle can penetrate into the lungs. Particulates greater than 10 micrometers diameter are usually filtered out in the upper airways (nose and throat). Generally particles less than 10 micrometres can penetrate into the conducting airways (trachea and main bronchi) and particles of generally less than 2.5 micrometres can penetrate deeper into the lungs.

The graph below shows total annual man-made PM10 emissions in Scotland, broken down by source since 1990. While there has been a 63% reduction in PM10 emissions since 1990, with all sources seeing a decline, the significance of transport as a source of

PM10 emissions has increased, overtaking energy and industry to become the second biggest source of such emissions. It is worth noting that transport related PM10 emissions are not all due to exhaust emissions, research [5] indicates that:

> " PM10 exhaust emissions from diesel fuelled vehicles have been decreasing due to the successive introduction of tighter emission standards over time. Increasingly non-exhaust sources of PM10 (for example tyre wear) have become a more important to consider as exhaust PM10 has been reduced. In fact, in 2015, 69% of emissions from the road transport sector were related to non-exhaust sources. "

PM10 emissions in Scotland



Air Quality Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2015, Ricardo Energy & Environment for the Scottish Government et al

What are low emission zones and do they help reduce air pollution?

Low Emission Zones (LEZs) are areas where access to vehicles that produce emissions of certain pollutants above a specified limit is restricted. The restriction may take the form of a complete ban, usually with a penalty imposed for non-compliance, or there may be a charge to enter the LEZ if the entry criteria are not met.

Research into the effectiveness of LEZs shows that they can reduce emissions of nitrogen oxides and particulate matter - although the impact is normally fairly modest. Research into LEZs in 17 German cities [7] , generally considered to be the most effective in the EU, concluded that:

> " Our analyses indicate that there is a statistically significant, but rather small reduction of NO_2, NO, and NO_X concentrations associated with LEZs."

EU sponsored research [8] into the effectiveness of LEZs across northern and central Europe concluded that:

> " Annual mean PM10 concentrations were reduced by 0 to 7%, with no effects observed in most LEZs. In Munich the LEZ and a ban on HGVs in the city centre reduced annual mean PM10 concentrations by up to 12%. It appears that the impact is greater in summer than in winter, possibly due to traffic contribution being lower due to other sources (e.g. for heating and electricity generation) increasing PM10 emissions in winter. In many cities there is a large regional component and significant contributions from other sources resulting in only a small portion from vehicle exhaust emissions, and therefore available for the LEZ to influence. In these cases it is not surprising that it is difficult to detect an impact."

As might be expected given the above results, research has also identified that the effectiveness of LEZs is dependent on their design and implementation. Research [9] into the effectiveness of LEZs in London, Berlin and Munich concluded that:

> " Findings indicate that the impact of LEZ in the reduction of Particulate Matter (PM) concentration in London has been rather minimal, despite the high rate of compliance by vehicle users. Significantly higher reductions in PM and Nitrogen Oxides concentrations have been reported in Munich and Berlin. The paper argues that reported differences are likely as a result of differences in implementation."

Further research [10] into the operation of the first five years of the London LEZ concluded that:

> " London's air quality also appears to have improved marginally with reductions in concentrations of PM10 and NOX despite an increase in the number of heavy vehicles within the LEZ. Although reductions in the concentration of PM10 have been larger than elsewhere, the small improvement in NOX levels is comparable to that observed outside the LEZ. In addition, there are indications that improvements in air quality have been greater near areas with a large proportion of heavy vehicle traffic. Both these findings indicate that the LEZ has at least played a part in improving air quality although the overall effect has still been relatively small."

The EU sponsored research mentioned above [8] makes 12 recommendations for cities contemplating the implementation of an LEZ, which can be summarised as follows:

- **National LEZ frameworks:** these minimise the cost, time and effort required by a local authority in setting up an LEZ, make communicating the entry criteria easier and increase industry and public acceptance.
- **Aim of LEZ:** This should be clear. Is it to achieve EU limit values or to improve the health of citizens?
- **LEZ Area:** Determine the area of the potential LEZ on clear criteria.
- **Vehicles:** Determine the vehicles to be subject to the LEZ scheme, considering dominant vehicles in pollution hot spots, whether private cars should be included and impacts on the owners of older vehicles.
- **Appropriate Assessment:** An assessment of the potential impact of the proposed LEZ should be undertaken to determine if there is likely to be an improvement in air quality.
- **Retrofitting:** Decide whether retrofitting older vehicles with pollution abatement equipment to meet the emission criteria would be permitted, determine how the equipment will be certified, its minimum efficiency, and how often recertification will be required.
- **Enforcement**: Determine how the LEZ would be enforced, including political acceptability of enforcement methods.
- **Industrial and public acceptance:** Getting the freight transport industry, bus and coach operators and, if applicable motorists, to accept a LEZ requires well thought out and consistent communication campaigns. A simple LEZ is easier to understand and will gain more public acceptance than a highly complex scheme.
- **Exemptions:** In general, the fewer exemptions the more impact and credibility the LEZ would have.
- **Phased implementation:** Phased implementation with the emission criteria tightened over time allows the worst polluting vehicles to be removed in the first phase and the affected communities to get accustomed to the LEZ concept.
- **EU Requirements:** Finally, ensure compliance with the EU freedom of movement principle. The LEZ criteria should not be harder for a foreign vehicle to comply than a local one, and publicity needs to be EU-wide.

Current Scottish Government policies to reduce air pollution from transport

The Scottish Government published Cleaner Air for Scotland: The Road to a Healthier Future [11] in 2015. It establishes a vision of:

> " A Scotland that reduces transport emissions by supporting the uptake of low and zero emission fuels and technologies, promoting a modal shift away from the car, through active travel (walking and cycling) and reducing the need to travel."

In relation to emissions from transport, Cleaner Air for Scotland set out proposals for a National Low Emission Framework (NLEF). The NLEF is designed to enable local authorities to appraise, justify the business case for, and implement a range of, air quality improvement options related to transport (and associated land use), which includes LEZs, Clean Air Zones, other access regulations, traffic management measures and restrictions on public service and taxi licences.

The NLEF builds on the work already underway through the Local Air Quality Management system. The NLEF is supported by the National Modelling Framework (NMF), which provides assessment tools that can be used by local authorities, allowing a consistent approach to be taken to air pollution issues across Scotland.

The proposals set out in "Part 1: Low Emission Zones" of the Bill

Effect of a low emission zone scheme: A person cannot drive a vehicle on a road within an LEZ unless it meets the specified emissions standards or it is exempted from the LEZ restrictions. Anyone driving a non-compliant vehicle into an LEZ is liable to pay a penalty charge. LEZ enforcement will be carried out by local authorities through the use of approved devices, typically automatic number plate recognition CCTV cameras. These record the numberplate of each vehicle entering the LEZ, which allows the vehicle type and emission levels to be identified (using a database maintained by the Secretary of State for Transport). The registered keeper of any vehicle entering an LEZ which does not meet the required standards, and is not exempt, may be issued with a penalty charge notice

Scottish Ministers may make regulations:

- establishing the specified emissions standards, exempt vehicles and the amount of any penalty charge
- the form, content and method of issue of a penalty charge notice
- timing and manner of payment
- reviews and appeals against a penalty charge notice
- how penalty charge notices will be enforced
- steps to be taken following the cancellation of a penalty charge notice
- enabling local authorities to enter into arrangements with other organisations to undertake enforcement action on their behalf

Creation and modification of a low emission zone scheme: A local authority, or two or more authorities working together, may make, modify or revoke an LEZ scheme for all, or part, of their area at any time. Any new or amended LEZ scheme, or proposal to revoke a scheme, must be approved by Scottish Ministers. Scottish Ministers can modify any proposed LEZ scheme prior to approval.

Before asking Scottish Ministers to approve an LEZ scheme, a local authority must consult with SEPA, Scottish Natural Heritage, Historic Environment Scotland and representatives of local business, drivers, the road haulage, bus and coach and taxi industries, any others specified in regulations by Scottish Ministers and anyone else the authority considers appropriate. Both the local authority and Scottish Ministers will have powers to require an inquiry to be held into a proposed LEZ scheme. In addition, Scottish Ministers may make regulations covering the creation, amendment and revocation of LEZ schemes.

Content of a low emission zone scheme: An LEZ scheme must specify:

- the area to which it relates on a map
- the date on which the scheme comes into effect

- the scheme's objectives (which must include the objective of contributing towards air quality objectives set out in the Environment Act 1995)
- the dates that the grace period (described below) is in operation

An LEZ scheme cannot apply to private roads or special roads, which includes trunk roads and motorways.

Every LEZ scheme must specify a grace period, that is a period between the LEZ becoming operational and enforcement activity commencing. The Bill sets minimum and maximum time limits for grace periods, with different limits for people living within the zone and those normally resident outside its boundaries. These are set out in the table below:

Grace periods

	Minimum	Maximum
Resident	2 years	6 years
Non resident	1 year	4 years

In addition to the grace period, a local authority may also grant time-limited exemptions to particular types of vehicle or individual vehicles. These exemptions must last no more than one year.

LEZs will normally operate 24 hours a day, although an LEZ scheme may specify different hours of operation.

Operation of a low emission zone scheme: Local authorities may:

- install, maintain and remove (either itself or through third parties) approved devices, associated buildings and traffic signs required for the operation of the LEZ
- temporarily suspend an LEZ for a specified period for a special event being held in, or within the vicinity of, the zone
- incur expenditure in deciding whether to pursue, the development and operation of an LEZ
- enter into arrangements with third parties in connection with the development and operation of an LEZ

Scottish Ministers will have powers to make grants to vehicle owners to retrofit emissions reduction equipment to their vehicles. They can also make grants to local authorities to assist them in determining whether to pursue an LEZ scheme, develop and operate scheme.

Any income received by a local authority from penalty charges must be used to further the achievement of the LEZ scheme's aims (either directly or indirectly) or to repay grants made by Scottish Ministers to support the development of the scheme. Scottish Ministers may make regulations governing LEZ accounts. Local authorities will be required to submit an annual report on the operation of each LEZ scheme to Scottish Ministers.

Scottish Ministers would also be able to direct a local authority to carry out a review of the operation and effectiveness of a low emission zone scheme and direct the authority to take action following the conclusion of that review.

General: Local authorities must have regard to any guidance on LEZ schemes issued by Scottish Ministers.

Financial implications of the Bill

Transport Scotland commissioned consultants Jacobs to produce cost estimates for low emission zones in Scotland, with a final report submitted to Transport Scotland in September 2017. While the full report is not publicly available, key findings are set out in the financial memorandum which accompanies the Bill.

The main output produced by Jacobs was a table of estimated public sector costs (that includes both the Scottish Government and local authorities) for creating and operating a hypothetical small (0.5 km^2), medium (1.5km^2) and large (3.0km^2) LEZ. Three estimates for each size of LEZ were produced - based on low, medium and high grant awards to vehicle owners for the retrofitting of emissions reduction equipment or the scrappage of particularly polluting older vehicles. This table is reproduced below:

Estimates of costs associated with the establishment and operation of a small, medium and large LEZ

LEZ area and grant	Design costs (£)	Imp. costs (£)	Grant costs (£)	Year 1 operate costs (£)	Year 1 risk (£)	Total costs year 1 (£)	Total costs 10 years (£)
Small LEZ - low grant	0.325m	0.522m	1.288m	0.198m	0.233m	2.567m	4.228m
Small LEZ - medium grant	0.325m	0.522m	1.910m	0.198m	0.296m	3.252m	4.912m
Small LEZ - high grant	0.325m	0.522m	2.575m	0.198m	0.362m	3.983m	5.644m
Medium LEZ - low grant	0.424m	0.706m	3.863m	0.463m	0.546m	6.001m	9.879m
Medium LEZ- medium grant	0.424m	0.706m	5.730m	0.463m	0.732m	8.055m	11.993m
Medium LEZ - high grant	0.424m	0.706m	7.726m	0.463m	0.932m	10.250m	14.129m
Large LEZ - low grant	0.424m	0.871m	7.726m	0.805m	0.983m	10.809m	17.549m
Large LEZ - medium grant	0.424m	0.871m	11.460m	0.805m	1.356m	14.971m	21.657m
Large LEZ - high grant	0.424m	0.871m	15.452m	0.805m	1.755m	19.307m	26.048m

In summary, the public sector costs for small LEZs range between £4.228m and £5.644m, medium LEZs between £9.879m and £14.129m and large LEZs between £17.549m and £26.048m.

These figures are based on 2017 prices, with risk calculated as 10% of year 1 costs. The figures include an optimism bias of 44% (in effect 44% is added to the estimated costs to reflect the tendency of project appraisers to be overly optimistic about the likely costs of a project).

The financial memorandum also highlights cost pressures from LEZs on individuals, bus operators, taxi operators and logistics companies. Principally, these relate to decisions on whether to pay penalty charge notices, scrap older vehicles, retrofit emissions reduction equipment to existing vehicles or purchase new compliant vehicles. No solid estimates are

provided, although figures provided by individual firms during earlier consultation are highlighted.

The financial memorandum also outlines the possible monetary benefits from increased good health associated with reduced air pollution, although it does not estimate the possible scale of such benefits from LEZs.

While the financial memorandum mentions possible penalty charge income, following the expiry of any grace periods, it states that:

> “ It is particularly challenging to predict at the time of the Bill's introduction the amount of revenue which might be generated from low emission zone schemes in Scotland, as the legislation sets out the broad framework for introduction rather than defining the specifics of implementation. ”

Consultation on the LEZ proposals undertaken by the Scottish Government prior to the introduction of the Bill

The Scottish Government launched a consultation on [12] Building Scotland's Low Emission Zones on 6 September 2017, which was open for comment until 28 November 2017. The consultation posed 20 questions on the general principles of LEZs and more detailed aspects of their operation, e.g. hours of operation, grace periods and vehicle exemptions.

Transport Scotland commissioned consultants CH2M Hill to analyse the responses, with a full analysis report [13] being published in February 2018. A total of 967 responses were received, 866 from individuals and 101 from organisations. Of the 866 individual responses, 742 were based on a standard response developed by Friends of the Earth Scotland.

Generally, there was strong support for the general principle of establishing LEZs in Scotland with a view to reducing air pollution, 24 hour operation, enforcement by ANPR cameras and the principle of grace periods. There was a more mixed response to issues around the charging/penalty regime and more detailed practical aspects of scheme implementation.

Bibliography

1 World Health Organisation. (2018, May). Ambient (outdoor) air quality and health. Retrieved from http://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health [accessed 20 August 2018]

2 Committee on Medical Effects of Affects of Air Pollutants. (2010). The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/304641/COMEAP_mortality_effects_of_long_term_exposure.pdf [accessed 20 August 2018]

3 House of Commons Transport Committee. (2017, February). Volkswagen Group emissions violations. Retrieved from https://www.parliament.uk/business/committees/committees-a-z/commons-select/transport-committee/inquiries/parliament-2015/volkswagen-group-emissions-violations-15-16/ [accessed 20 August 2018]

4 European Commission. (2018, May 17). Air quality: Commission takes action to protect citizens from air pollution. Retrieved from http://europa.eu/rapid/press-release_IP-18-3450_en.htm [accessed 20 August 2018]

5 Ricardo Energy & Environment for Department for Business, Energy and Industrial Strategy; Department for Environment, Food and Rural Affairs; The Scottish Government; Welsh Government; Department of Agriculture, Environment and Rural Affairs for Northern Ireland. (2017, August 31). Air Quality Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2015. Retrieved from https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1710060932_DA_Air_Quality_Pollutant_Inventories_1990-2015_v01-01.pdf [accessed 20 August 2018]

6 O'Brien, F. (2016, May 10). Air Quality in Scotland. Retrieved from http://parliament.scot/ResearchBriefingsAndFactsheets/S5/SB_16-35_Air_Quality_in_Scotland.pdf [accessed 20 August 2018]

7 Morfeld, P., Groneberg, D., & Spallek, M. (2014, August). Effectiveness of Low Emission Zones: Large Scale Analysis of Changes in Environmental NO2, NO and NOx Concentrations in 17 German Cities. Retrieved from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0102999 [accessed 21 August 2018]

8 European Commission: Life. (2016, December). Low emissions zones in northern and central Europe. Retrieved from http://airuse.eu/wp-content/uploads/2013/11/R16_AIRUSE-Low-Emission-Zones-CNE.pdf [accessed 21 August 2018]

9 Ezeah, C., Finney, K., & Nnajide, C. (2015, July). A Critical Review Of The Effectiveness Of Low Emission Zones (LEZ) As A Strategy For The Management Of Air Quality In Major European Cities. Retrieved from http://www.jmest.org/wp-content/uploads/JMESTN42350921.pdf [accessed 21 August 2018]

10 Ellison, R.B., & al, . (2014, January). Medium term effects of London's low emission zone. Retrieved from https://www.researchgate.net/publication/287317941_Medium_term_effects_of_London's_low_emission_zone [accessed 21 August 2018]

11 Scottish Government. (2015, November). Cleaner Air for Scotland: The Road to a Healthier Future. Retrieved from https://www.gov.scot/Resource/0048/00488493.pdf [accessed 21 August 2018]

12 Transport Scotland. (2017, September). Building Scotland's Low Emission Zones: A Consultation. Retrieved from https://consult.gov.scot/transport-scotland/building-scotlands-low-emission-zones/user_uploads/low-emission-zones-consultation-2.pdf [accessed 23 August 2018]

13 Transport Scotland. (2018, February). Consultation on Building Scotland's Low Emission Zones – Analysis Report. Retrieved from https://www.transport.gov.scot/media/41828/analysis-report-february-2018-consultation-on-building-scotland-s-low-emission-zones.pdf [accessed 23 August 2018]

SPICe The Information Centre
An t-Ionad Fiosrachaidh

Scottish Parliament Information Centre (SPICe) Briefings are compiled for the benefit of the Members of the Parliament and their personal staff. Authors are available to discuss the contents of these papers with MSPs and their staff who should contact
Members of the public or external organisations may comment on this briefing by emailing us at SPICe@parliament.scot. However, researchers are unable to enter into personal discussion in relation to SPICe Briefing Papers. If you have any general questions about the work of the Parliament you can email the Parliament's Public Information Service at sp.info@parliament.scot. Every effort is made to ensure that the information contained in SPICe briefings is correct at the time of publication. Readers should be aware however that briefings are not necessarily updated or otherwise amended to reflect subsequent changes.