Cleaner Air for Scotland Strategy – An Independent Review

Final report to the Scottish Government

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1. Executive Summary

1.1 The air that we breathe is fundamental to human life and the quality of our environment. The quality of life lived is placed at short and longer term risk by pollution. In Scotland today, whilst industrial, domestic, agricultural, natural and transboundary pollution are all parts of the mix, pollution from transport is the single biggest source of concern. Tackling all sources requires concerted and systemic action.

1.2 The Scottish Government engaged an independent chair and a multi-stakeholder steering group to review the progress made since the Cleaner Air for Scotland (CAFS) Strategy was produced in 2015, and to recommend next steps, with a particular focus on the actions necessary and practical in the next three to five years. At the outset it is clear that air pollution, climate change, carbon reduction, and mobility are strongly interconnected. Whilst this was evident to some extent in the original CAFS strategy, just four years on, the inter-woven agendas are even clearer and this review should lead to a highly visible statement regarding this inter-connectivity and the co-benefits associated between mobility choices, carbon emissions and air quality.

1.3 Our conclusion is that Scotland is generally performing quite well by EU and global comparison, with ambient atmospheric pollution concentration levels and regulated pollution emissions generally continuing to fall as a result of actions taken thus far. More remains to be done, not least as we understand better the impacts of pollution in the air we breathe on human health and the natural environment[1]. Whilst human health has been and remains a strong justification for effort, the initial CAFS was focused on air quality, and particularly transport as the largest source of urban air quality issues. CAFS must now move on more clearly to include other sources and the wider issues of air pollution (such as agriculture and domestic combustion) if we are to achieve the best air quality in Europe – with a quality of air that aims to protect and enhance health, wellbeing and the environment.

1.4 Emissions of some key pollutants in Scotland are EU compliant and some are already below World Health Organisation (WHO) guideline values, but there are both some general and some localised and periodic poor air quality areas which require urgent attention and action. There are still serious and particular challenges around transport constraints, nitrogen oxides, particulate and ammonia levels (from agriculture), and aspects of public

[1] Pollution can affect the human body in many ways. Pollutants, especially fine particulate matter, appear to be able to penetrate deep into human organs via our circulatory systems. Whilst there are significant uncertainties around the mechanics of causation, application of the precautionary principle and our awareness of health effects urge us to take further action to deal with air pollution. The evidence base is developing globally and in Scotland and careful consideration is needed to shape public health policy and the messages to be deployed, including the strategy for sensitive receptors and how messages are conveyed to the public. There may ultimately be no such thing as a minimum safe level and we need to reduce pollution and protect the public from sources generally.

behaviour and our choices, given options available and perceived, which need to be tackled.

1.5 CAFS appears to have had a positive impact but as an action programme has had an overly complex structure, is not yet wholly implemented or widely understood, has had insufficient authority and now needs more focus and energetic and aligned implementation. Effort is required to tackle governance and performance management: who does what, is held responsible for delivery and collaboration, and how to assess and report progress. Existing structures are overly complex and inadequately accountable and effective.

1.6 There is largely constructive engagement between stakeholders but more simplicity and authority are needed in order to ensure effective delivery in areas of overlapping or connected operational and performance management. Integration of policy and implementation is essential, nationally and locally. Local government has a key role to play and its monitoring, transport service provision, transport management, spatial and mobility planning and public health actions all need to fit more effectively with the strategic goals, and with the responsibilities and operational activities of Transport Scotland and SEPA. Visible and politically empowered as well as simpler partnership between the key players is needed to achieve this in policy and operational areas.

1.7 Further effective reduction in pollution will require concerted action across many sectors including national and local government, the private and public sector and by the public itself. All of these stakeholders have critical roles in further reducing preventable air pollution associated with transport, domestic and industrial sources, as well as agricultural activities (a source of both primary and secondary pollutants). Increased awareness and understanding of all the relevant interlinked issues is needed. With respect to transport pollution sources, interventions need to be coupled to encouraging people to change their habitual transport choices. Achieving such public behaviour change will require facilitation by more and better coordinated government action. There needs to be more focus on inter-related interventions including: improved transport infrastructure that encourages higher levels of active travel (walking, cycling); improved access to accessible, affordable and better quality public transport offering more attractive alternatives to private vehicles; and greater encouragement to adopt less polluting private personal transport (e.g. low and zero emission vehicles).

1.8 There needs to be more effective use and enhanced robustness of data and modelling, based on a) the need for and quality of continuous traffic monitoring data, and b) improved air pollution monitoring.

1.9 It is too early to comment on the success of Low Emission Zones (LEZs) but it is clear that they are a necessary and important commitment in delivering cleaner air and they need to be effectively implemented. Early implementation in 2019 in Glasgow is providing learning opportunities for the next three cities.

1.10 There are good and strong legal drivers of change in urban Scotland's air quality as well as some emerging questions to answer on specific LEZ design and overall effectiveness and the nature of the restrictions applying, and their fit with Air Quality Management Areas (AQMAs), including the nature, sequencing, impact and consequences of interventions. AQMAs can and need to be operated more effectively and overall this, with effective LEZ implementation, will lead to necessary further improvements in air quality in the next three to five years.

1.11 There are clear challenges around the leadership and management of the transport context. There is a great deal to do around achieving modal shifts, faster uptake of cleaner engines, counteracting the continued increase in private car use, tackling congestion - reducing it as well as managing effects, greatly enhancing infrastructure and support for goods and active segment options as well as effectively supporting the differing and significant needs of rural, highland and island Scotland.

1.12 There is a clear need for more and better public information on pollution and transport options. We need to know better how to and then proceed promptly to tackle the cultural issues around modal shift and behavioural change. This has to include greatly enhancing understanding of effective, tolerable and affordable incentives and disincentives.

1.13 Further effort and effective delivery are needed on the design and increased coherence, amenity and utility of the public realm. Spatial planning and better place design can guide our way to a cleaner and healthier environment. Steps have to be taken to maximise safety and amenity, urging or requiring less polluting modes and increasing ease of movement and coherence and integration of mobility systems. The steps taken must minimise exposures, especially for sensitive receptors and vulnerable users. Existing and new developments must reflect what we know is necessary to tackle air pollution and enable more sustainable mobility.

1.14 Finally, actions are recommended on pollution and transport data and monitoring, on regulatory and planning activity generally and practical actions for our cities and towns, on the approach taken to public health as a continuing and serious driver for change, on transport provision and its fit with planning, on further controls and guidance on mobility and domestic heating and agricultural activities, on engagement issues, on research needs and on improvements to governance. These are introduced and summarised in each relevant section and in an overview in Section 2.

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Professor Campbell Gemmell,
Chair of the independent Steering Group

List of Abbreviations

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
APR	Annual Progress Report
BAT	Best Available Techniques
BEAR	Bus Emissions Abatement and Retrofit
BHF	British Heart Foundation
CAFS	Cleaner Air for Scotland
CAFS GG	Cleaner Air for Scotland Governance Group
CAZ	Clean Air Zone
CCS	Carbon Capture and Storage
CI	Confidence Interval
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COMEAP	Committee on the Medical Effects of Air Pollution
CoP	Code of Practice
CoSLA	Convention of Scottish Local Authorities
CJEU	Court of Justice of the European Union
CV	Cardiovascular
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EC	European Commission
ECCLR	Environment, Climate Change and Land Reform
ED	Ecodesign
EEA	European Environment Agency
ELV	Emission Limit Value
EU	European Union
EV	Electric Vehicle
FTA	Freight Trade Association
GBRs	General Binding Rules
GHG	Greenhouse Gas
H2020	Horizon 2020
HGV	Heavy Goods Vehicle
HIA	Health Impacts Assessment
HOPS	Heads of Planning Scotland
HPS	Health Protection Scotland
HRAPIE	Health Risks of Air Pollution in Europe
HSE	Health and Safety Executive
IED	Industrial Emissions Directive
KPI	Key Performance Indicator
Kt	Kilotonnes
LAQM	Local Air Quality Management
LCVP	Low Carbon Vehicle Partnership
LEZ	Low Emission Zone
LGV	Light Goods Vehicle
MCPD	Medium Combustion Plant Directive
NAEI	National Atmospheric Emissions Inventory
NECD	National Emissions Ceilings Directive
NH_3	Ammonia
NHS	National Health Service

NICE	National Institute for Health and Care Excellence
NMF	National Modelling Framework
NMVOCs	Non-methane Volatile Organic Compounds
NO_2	Nitrogen Dioxide
NO_x	Oxide of Nitrogen
NPF	National Planning Framework
NPPF	National Planning Policy Framework
NTS	National Transport Strategy
O3	Ozone
PAS	Planning Advisory Service
Pb	Lead
PEPFAA	Prevention of Environmental Pollution from Agricultural Activities
PfG	Programme for Government
PM	Particulate Matter
PPC	Pollution Prevention and Control
REHIS	Royal Environmental Health Institute of Scotland
SEA	Strategic Environmental Assessment
SEARS	Scotland Environmental and Rural Services
SEPA	Scottish Environment Protection Agency
SG	Scottish Government
SIMD	Scottish Index of Multiple Deprivation
SME	Small to Medium Enterprise
SO_2	Sulphur Dioxide
SOLACE	Society of Local Authority Chief Executives
SPRI	Scottish Pollutant Release Inventory
STPR	Strategic Transport Projects Review
TIC	Transport, Infrastructure and Climate Change
TS	Transport Scotland
UNECE	United Nations Economic Commission for Europe
USEPA	United States Environmental Protection Agency
UK	United Kingdom
WHO	World Health Organisation
WPL	Work Place Levy
WPP	Work Place Parking

2. Summary of Recommendations

General Recommendations

A number of general recommendations arose from the Review:

1. **A Precautionary Approach.** The health evidence reviewed justifies adopting a precautionary public health approach to air pollution reduction. As a minimum, compliance is required with international air quality limits, including the WHO guideline standard for $PM_{2.5,}$ and practical efforts to reduce preventable air pollution further should continue.

2. **Integrated Thematic and Organisational Strategies.** Where strategies, policies and plans are being devised at national and local levels for climate change mitigation and adaptation and related purposes such as noise reduction, they should be closely co-ordinated and aligned with air quality action plans and with each other in order to maximise co-benefits. It is also clear that local government, which has major Local Air Quality Management ($LAQM^2$), transport delivery as well as planning, public health and regulatory roles must act in a more coherent manner to ensure strategies and plans fit together and cross-professional and functional effort is strongly aligned. Similar integration is needed within central government too.

3. **Impacts of New Developments.** To protect against future health and environmental impacts generally, consideration should be given to a presumption that any major new development (e.g. a new road or housing development) must not lead to a net increase in carbon emissions, must not worsen air quality, and must not exacerbate existing health inequalities.

4. **Better Data.** The quality and coverage of data available on transport, environmental emissions and conditions, as well as on health all require consideration. Continuous and detailed traffic data would allow better modelling and management arrangements and appropriate interventions. Similarly high quality, reliable, well distributed, located and managed monitoring data on emissions and air quality across Scotland, available to all and in close to real time would allow not just good public information but good modelling, reporting and interventions on important issues. Health data also require careful consideration so that Scotland-specific interpretations, plans and interventions are strengthened.

5. **Behavioural Research.** Research is needed to provide clear contemporary Scottish evidence drawn from population representative information on levels of knowledge, attitudes, and levels of concern related to air pollution, as well as on willingness to change air pollution related

[2] The LAQM system has the potential to drive further significant improvement. The report sets out LAQM recommendations in the Governance section and practical responses for local government in particular to deliver better performance in the Placemaking and Local Government section.

behaviours. Behavioural insights around car use in particular continue to be vital if significant reduction is to be achieved.

6. **Environmental Regulation.** In relation to current and future environmental regulation, the requirements of European Union (EU) legislation on industrial and other relevant emissions control which have been transposed and implemented into domestic legislation should be retained and new EU requirements should continue to be implemented to provide as high a level of protection of Scotland's environment as possible. High levels of compliance are to be expected and should be consistently achieved. It may also be beneficial to review whether all relevant sectors are subject to regulation and at the right level and in the right way to address air pollution pressures.

7. **Tackling Under-regulated Areas**: Domestic Burning and Agriculture are two sectors not considered in the 2015 CAFS strategy, but which this review has found, based on the evidence, to be significant contributors to air pollution in Scotland. Further developments of CAFS should include an appropriate Scotland-wide set of plans to improve the arrangements for regulating and managing domestic and agriculture sector emissions. Performance of domestic fires and stoves, appropriate fuel attributes and local authority powers to permit and control these issues as well as the management of farm fertilisers and manures, etc. have the potential to deliver significant improvements in air pollution beyond current regulatory and management approaches. Practical proposals are presented for these two areas in the recent DEFRA Clean Air strategy, which this review has concluded could provide a sound basis on which to build in Scotland.

8 **Shifting to More Sustainable Transport Modes.** It appears key to progress on transport emissions that modal shift to sustainable means is achieved. Efforts need therefore to be focussed generally on demand management, reducing personal private vehicle use as a priority. This will require strong leadership and clear understanding of demand management and behaviour change issues and the most effective interventions. It should also mean that, although not solely relying on technological solutions, we embrace new technologies, better public provision and constraints upon private use, especially in urban centres where pollution and congestion are most acute. Managing down aspects of traditional supply is necessary, as it is strongly suspected that new road building signals the acceptability of, and provides the opportunities for expanded use. Managing demand will therefore have to run alongside investment connected with safety, maintenance and modal accommodations, especially in rural areas. It is important too that existing complementary transport strategies, on cycling, walking, "Switched On Scotland", etc. as well as plans for the freight sector are meaningfully integrated with proposals and plans for the bus and other sectors. Scottish Government and Transport Scotland should ensure appropriate leadership and an integrated approach to strategy are provided through the completion and delivery of a genuinely broad and transformative second National Transport Strategy, aligned with this review, and a set of Delivery Plans and Investment Programmes that reflect its spirit and detail into implementation.

9. **Governance, Accountability and Delivery**. Simple and effective governance arrangements and a real focus on practical joined-up delivery is imperative. The mission of further improving air quality is complex, involves many delivery and stakeholder bodies and affects all of us. With relatively scarce resources and separate delivery bodies it is essential that the final agreed implementation strategy for the next stage of CAFS makes it clear who is doing what, who is leading, who is supporting and who is ultimately responsible. Specific encouragement as well as supportive arrangements will be essential if a coherent integrated and successful strategy is to be delivered and seen to be delivered.

10. **Further Progress Review.** A review of progress on air pollution should be conducted no more than 5 years hence. This should occur prior to the end of 2024/25, in order to track and consolidate LEZ progress and general compliance in Scotland as well as allowing Scotland to keep abreast of changes in both societal attitudes, sector performance and technology. Remaining challenges and actions should be identified.

Specific Recommendations

The summary of specific recommendations which follows sets out how the general recommendations can be delivered.

Health (H)

1/H1. Further **consideration of evidence on health impacts of low level pollution** in countries with levels of ambient air pollution comparable to Scotland is needed.

2/H2. Commission **population research** on the long term effects of air pollution using cohort methods to aid further understanding of health impacts and explain the apparently different epidemiology in Scotland.

3/H3. An **Air Pollution Action Plan** aligned with CAFS should be developed and implemented with actions and investment, focussed on joint actions across all relevant government departments, agencies and local government functions to increase levels of active and sustainable travel. This should include integrated and complementary approaches to improve air quality, to reduce carbon emissions and to reduce related health inequalities.

4/H4. It is strongly recommended that, at all levels of governance, when actions are being taken to address air quality then they be screened to **maximise the potential for co-benefits with climate change mitigation and adaptation.** The reverse should also be the case. The screening should, at minimum, be against the 50 recommendations in the CAFS Governance Group (CAFS GG) Report on the likely co-benefits between climate change and air quality improvement actions.

5/H5. It is strongly recommended that a task group be convened to identify what, if any, actions might best be undertaken at Scottish level to address the issues associated with **indoor air pollution.**

6/H6. Consideration should be given to research on **in-vehicle exposures** and potential health impacts to provide a factual baseline

7/H7. Consideration should be given to a "habit survey" type **assessment of actual exposures experienced** by a representative sample of the population, assessing pollution exposures over a realistic "normal activity range over a normal period".

Emissions

Domestic Emissions (D)

8/D1. Implement a package of recommendations on **domestic burning emissions** in Scotland, similar to that recommended in the DEFRA Clean Air Strategy, including: the implementation of Ecodesign (ED); voluntary codes for stoves; appropriate standards for fuels (including regulation of wood for use in woodburners, house coals and arrangements for own-resource wood burning), and education to inform consumers.

9/D2. Consider with local government and SEPA how best to address the current **permitted development status of flues for woodburning stoves and biomass boilers** and incorporate permissions into development control and monitoring.

10/D3. Commission further work to **clarify the level of PM** (and other relevant) **emissions in Scotland** and the percentage attributable to domestic burning. This will require re-evaluating the volume of wood burnt.

Industrial Emissions (I)

11/I1. Build on SEPA's sector plan approach to further reduce emissions where **"beyond compliance" measures** may be required to achieve these (e.g. NMVOCs and NH_3) and seek to include any further air pollution sources or hazards identified.

12/I2. Consider inclusion in **regulation of mobile and non-road plant emissions** (road cutting, surfacing, digging, traffic management machinery and diesel and other generators etc.), especially given potential local impacts.

Agricultural Emissions (A)

13/A1. As a minimum, Scottish Government should urgently work together with SEPA and the agricultural industry to **develop a voluntary code of practice** (CoP) for Scotland. This should incorporate recent data from the UK agricultural ammonia emissions inventory, use relevant Scottish data,

address management practices[3] and seek to engage the agriculture sector to achieve best delivery. The CoP should be subjected to an early review process to assess its effectiveness and compliance. If the review highlights through appropriate monitoring an inadequate impact, direct regulatory intervention should be considered.

14/A2. Scottish Government should **undertake work on habitats and emissions to set appropriate targets** in the current context of the UK reporting on the National Emissions Ceilings Directive (NECD). Consider related improvements to the current site condition monitoring of designated conservation sites, to improve on current method, which doesn't detect air pollution effects and assess current terrestrial ecosystems monitoring to ensure it is fit for purpose.

15/A3 A specific **assessment is needed of visible smokes and their health and amenity impacts**. This should include both muirburn and stubble–burning. A specific assessment of pollution characteristics and downwind impacts into populated areas should be considered, along with appropriate management responses and interventions.

Transport (T)

16/T1. A robust commitment is needed on data and research support for transport planning. Consideration should be given to specific investment in transport supply and demand research. Additionally, both current pollutant and impact data capture should be reviewed and a commitment is required for **continuous transport data provision** from the range of relevant locations across Scotland, building on the findings identified in SEPA and partners' National Modelling Framework (NMF) work.

17/T2 The implementation of a second National Transport Strategy should lead to a **permanent preference for more sustainable transport modes and infrastructure investments**. Serious consideration needs to be given to reductions in trunk and motorway route expansion and priority given to electric and low emissions infrastructure and services for rail, bus and goods segments. A focus on reducing vehicle numbers, supporting electric and low emission vehicles and tackling congestion issues caused my private vehicles is necessary. There should also be further and coherent, expanded support for cycle and pedestrian/active modes.

18/T3. Encourage the introduction of a **workplace parking levy in LEZ areas.** Consider use of funds generated for improvements in sustainable transport provision.

19/T4. Develop and communicate a **Transport and Mobility Hierarchy** applied to public policy and individual behaviour.

[3] Targeting ammonia abatement, in relation to emissions from fertiliser, digestate and animal husbandry types.

20/T5. Economic stimulus for **scrappage of the most polluting vehicles with behaviour change focus** including options for e-bikes, public transport season ticket contributions and other incentives which reduce car ownership.

21/T6. Consider appropriate **incentives for cycle, electric cargo and other "last mile" vehicle delivery approaches and appropriate supportive infrastructure**.

22/T7. Greatly increase bus-based **Park and Ride provision alongside LEZs** with chargers for electric/plug-in hybrid vehicles and appropriate fiscal charging for more polluting vehicles.

23/T8. Spatial planning and transport planning need to work together to be effective in ensuring local decision-making does not undermine national objectives for air quality.

24/T9. Make **Supplementary Planning Guidance on Air Quality mandatory**.

25/T10. The revised CAFS should have a commitment to a nationally funded and coordinated **programme of citizen science and community engagement** developed to improve the understanding of air pollution and how citizens can make informed decisions to reduce their impacts on the environment and improve their health.

Placemaking (P) and Local Government (LG)

26/P1. Urgent consideration should be given, by Scottish Government and Local Government, involving all relevant functions, to how to achieve a pragmatic and **integrated strategy for placemaking in policy-making and implementation** generally.

27/P2. Local government should examine its functions and consider how to ensure better **recognition and integration of the different disciplines and inter-connected policy and delivery areas related to air pollution.** Stronger alignment of functions and better engagement between them would more effectively and efficiently deliver air pollution reduction actions and benefits.

28/P3. A **review and report on current air quality policy effort** in local government should be undertaken. This would provide a clear map of who is doing what, how it is working and how linkages are being applied across local authorities.

29/P4. A forward plan for how local government engages, delivers, measures progress, resources and communicates in relation to placemaking and delivering change on air pollution issues is needed. This would address Delivery, Governance, Performance and Communications issues.

30/LG1 Realising effective Placemaking in practice – much of which relates to a higher degree of **coherence in the land use planning system in strategic and development planning** terms combined with aligned development management/control processes. Commitments to, and processes to achieve, integration will be needed.

31/LG2 LEZs. The four first round LEZs need to follow legal and policy timetables and be **in place and delivering within four years**. Visible commitments to this and evidenced delivery will be required.

32/LG3 Local Air Quality Management. Where AQMAs have been declared, these need to have **active plans that deliver** the intended outcomes **within a reasonable timetable**. When done they need to be revoked. **If not delivered, powers of intervention by SEPA/Scottish Government can and should be applied**. Also issues of **permitted development** and domestic combustion, and public health, etc., as well as identified increasing pressure from wood burning stoves, for example, or **previously approved developments** that have not yet been implemented but where no public transport or active travel provision was made, highlight specific policies that may require to be addressed for local air quality.

33/LG4 Robust monitoring and reporting. A review of air quality monitoring may be needed to ensure that we are consistently gathering meaningful data in a uniform and appropriate way to meet current EU and Scottish/UK requirements as well as being future-proof in both a Brexit context and in relation to such future Scottish Government environment and climate strategy as may apply.

Behaviour (B)

34/B1. Specific **demand assessment and behavioural research** should be commissioned. This should then be integrated into strategic mobility planning and delivery effort as well as with work to establish how the public would wish to engage in future developments. This could be integrated too with efforts at developing an engaged approach to placemaking.

Governance (G)

35/G1. Implement the suite of improvements suggested on **LAQM** arrangements.

36/G2. Establish a **broad(er) ministerial group,** meeting regularly **to oversee the delivery of the new air quality strategy**. This group would ideally be led by the Cabinet Secretaries for Environment, Climate Change and Land Reform (ECCLR) and Transport, Infrastructure and Connectivity (TIC) (and periodically Health and other relevant portfolios) as well as appropriately senior local government representatives and would be attended by senior officials from relevant areas (e.g. health, planning, etc., as appropriate) and SEPA, and external advisors. This oversight model would be

supported by an appropriately resourced officer body to bring and take advice and action reports as well as escalate action delivery and performance issues to the ministerial group.

37/G3. If the current CAFS Governance Group is to continue it should be called an **Advisory or Working Group** and adopt a clear remit, including a description of how its advice is conveyed to Scottish Ministers and/or serve as described at G2. The group will need a clear remit, clear performance targets and key performance indicators (KPIs) and appropriate authoritative membership, reflecting the stakeholders needed, not least representation from across the powers and responsibilities of local government.

38/G4. Given the multi-departmental and multi-organisational dimensions of policy and implementation responsibility, there may be merit in considering independent chairing and **appropriate overall accountability** for progress of these groups.

3. Introduction

Mission and Scope

3.1 Late last year the Scottish Government decided to undertake a review of its air quality strategy 'Cleaner Air for Scotland – The Road to a Healthier Future' (CAFS) which was published in November 2015. The review was a commitment in the 2018/19 Programme for Government and was launched by the Cabinet Secretary for the Environment, Climate Change and Land Reform on 6 November 2018. A Steering Group and an independent chair were appointed and tasked with reviewing the progress of the CAFS Strategy to date, assessing the current state of Scotland's air quality and possible future trajectories, identifying evidence and activity gaps and finally, providing advice and recommendations on priorities for further action.

3.2 The Steering Group has shaped the content of the review and agreed to the establishment of four specialist working groups to examine specific areas of interest. The review sought to cover transport, industrial, domestic and agricultural emissions as well as health, planning and relevant business issues. Membership reflected expertise from a range of disciplines and perspectives in these fields, drawing on deeper technical support and detailed input from the working group members and one off inputs from specific individuals and sources. The composition of the groups and process followed as well as the launch and other scoping materials are presented in **Annexes 1 and 2.**

Background

3.3 The policy and legal framework for managing air quality is complex and responsibilities lie with a number of bodies. A useful background paper was prepared by the Scottish Government to summarise the position[4]. This paper describes the main aspects of air quality protection and improvement, and where strengths and weaknesses may exist. An overview of the key statutory measures, policies and programmes framing air quality in Scotland is also provided in **Annex 3.**

CAFS

3.4 CAFS was published in November 2015[5]. The strategy sought, for the first time, to bring together the major policy areas relevant to air quality - climate change, transport, planning, health and energy - within one overarching framework. CAFS sets out around 40 actions relating to these policy areas, with the primary focus being on urban air quality. The strategy also covers the LAQM system. Progress in delivering the CAFS actions is summarised in a series of annual reports[6].

[4] *Air Quality Policy, Legislation and Governance in Scotland*, Scottish Government, 2019,
[5] *Cleaner Air for Scotland: the road to a healthier future*, Scottish Government, 2015.
[6] *CAFS progress reports 2016/17 and 2017/18*, Scottish Government

CAFS Implementation

3.5 CAFS was described as a national cross-government strategy setting out "how the Scottish Government, working together with partner organisations across the public and private sectors, will deliver cleaner air across Scotland, in order to help create and maintain a strong, healthy and fair society that is capable of living within environmental limits." Its ambition was to achieve integration and coherence across government. It stated "Scotland's air quality will be the best in Europe".

3.6 In the last three years, regular meetings have taken place of the CAFS Governance Group established to oversee delivery and several subgroups focusing on specific issues. Progress has been made by the various actors identified in the strategy on the 40 or so actions set out. Progress has been presented in annual reports and various quarterly and periodic reports and updates within the governance structure. This is set out in Scottish Government reports and overview documents.[7]

3.7 In summary, 14 actions out of 40 are complete, 12 are ongoing with revised timetables, two are partially complete, three are on hold, eight are ongoing and on schedule, etc. All identified actions were and are expected to be completed by the end of 2020.

3.8 It should be recognised that many actions listed within CAFS were contributed to or by other Government strategies (e.g. National Transport Strategy, Cycling Action Plan etc.) and so CAFS should not be viewed in isolation. This also demonstrates the cross-disciplinary nature of CAFS and acknowledges that many of the solutions to improve air pollution cut across a number of policy areas. Measures have also been developed outwith the CAFS process, primarily the Programme for Government commitment in 2017 to the development of Low Emission Zones (LEZs) for Glasgow, Edinburgh, Aberdeen and Dundee by 2020 and other locations by 2023 (where evidence demonstrates the need).

3.9 An assessment of the measures involved and their impact is given in a Scottish Government overview document.[8]

Relevant major events since 2015

3.10 Although CAFS is less than four years old, there have been significant policy developments during this period which have implications for the future direction of the strategy.

3.11 Whilst not intending to be a comprehensive research report on the issues framing this review, a number of significant developments over the last four years are relevant:

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[7] *Progress on the existing targets/objectives contained within the current CAFS strategy and an assessment of their status*, 2019, Scottish Government;
[8] *Measures implemented as a result of the current CAFS strategy and their outcomes and impacts towards improving air quality*, 2019, Scottish Government;

- EU Court of Auditors Report, “Air Pollution: Our health still insufficiently protected”, September 2018[9].

- Client Earth cases - Supreme Court case against UK Government April 2015 for the lack of an overall compliance delivery plan and failure to achieve minimum standards, and High Court case February 2018 - against the inadequacy of “illegal air pollution plans” by local government.

- UK Clean Air Strategy[10], published by DEFRA in January 2019 (which, labeled a UK Strategy, principally proposed a range of new arrangements and initiatives, new England-wide and local powers and controls and Clean Air Zones in England.) Much of what is proposed in Chapter 7 aligns with Scotland for transport and industrial issues. Proposed actions for agriculture and domestic combustion are of particular interest to the Scottish context, including permitting the dairy and beef sectors, controls on manure application, further codes of practice for “low emission farming”, ammonia management and guidance on fertiliser use. For domestic burning, new enforcement powers for local government as well as actions on Ecodesign of stoves and fuel quality controls were proposed.

- Initial stages of implementation of Glasgow LEZ in December 2018, principally seeking to transform the bus fleet and enhance streetscapes.

- Modelling pilot report for Aberdeen, modelling development projects for LEZs proposed for the four cities and CAFS National Modelling Framework Report[11].

- Fleet changes (new Euro VI vehicles) for Scotland’s private bus fleet.

- Progressive electrification of central Scotland’s rail network during 2018 and 2019.

- The Scottish Parliament’s Environment, Climate Change and Land Reform Committee Inquiry on Air Quality during 2017/2018[12].

- VW/”DieselGate” – the reforms and profile given to the issue of false emissions data initiated by the US EPA’s notice of violation of the US Clean Air Act against VW in September 2015 has been considerable. A range of consequential changes in engine management and design, data availability and actual emissions performance measurement and reporting etc. as well as a shift for passenger vehicles away from diesel engines has continued to flow from this origin.

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[9] *Air pollution: Our health still insufficiently protected*, European Court of Auditors, 2018. See also **Annex 4.**
[10] *Clean Air Strategy 2019*, DEFRA, 2019.
[11] NMF modelling pilot report for Aberdeen; *CAFS – National Modelling Framework Air Quality Evidence Report – Edinburgh*, SEPA, 2019,
[12] Air Quality in Scotland Inquiry, ECCLR Committee, 2017/18.

- Completion of some major road network developments, including Queensferry Crossing, Clackmannanshire Bridge, Aberdeen Western Peripheral Route (City Bypass/AWPR) and parts of the A9, M8/M73/M74, etc.

- Reorganisation of public health bodies in Scotland towards the creation of Public Health Scotland.

- The next EU Environment Action Programme, due to run from 2020, is likely to consider progress on air pollution across Europe, including taking account of the findings of the EU Court of Auditors report[13]. A more recent report by the European Environment Agency (EEA) on urban air quality implementation challenges[14], provides further context.

- Recent progress and announcements on climate change – notably the declaration of a "climate emergency" by the Scottish Government - are also relevant.

- Uncertainties around the UK's exit from the EU remain at the time of writing. The Scottish Government has committed to remaining aligned with EU environmental regulation in any circumstances. However if there are changes to EU membership and compliance standards etc. over the implementation period for the CAFS review there will be implications for the recommendations in this report.

This Review and Report

3.12 In the report that follows, the aim is to set out the status of CAFS now; consider why it is important that we continue to act; present and analyse the current air pollution drivers, state and apparent trajectories; consider the causative components and issues identified and then set out actions we would recommend to address these. The scope of CAFS moving forward has also been broadened to consider the wider impacts of air pollution on the environment as a whole, rather than the previous focus on urban air quality (although improving urban air quality is still a key area for action).

Assessment of Progress and Lessons Learned since late 2015

3.13 The actions already taken and underway, through CAFS and local government action plans, have resulted in welcome progress towards lower pollution levels in most areas.

3.14 Within the constraints of available data (whereby 2016 EU compliance data have just been published in May 2019), in the last four years, using LAQM data, we have seen broadly continuing trends of modest reductions in

[13] *Air pollution: Our health still insufficiently protected*, European Court of Auditors, 2018. See also **Annex 4**.
[14] *Europe's urban air quality – re-assessing implementation challenges in cities*, EEA, 2019. See also **Annex 4**.

pollutants, with local and temporary elevations, apart from in ammonia where there have been modest rises.

3.15 Arguably, albeit new policies and measures have been constructed which complement air pollution effort in transport planning and land use planning (such as the revision of the National Transport Strategy and the Transport and Planning Bills), there are still steps to be taken to achieve a more fully cohesive system. Actions taken to tackle climate change should also contribute favourably to reducing air pollution[15,16].

3.16 Some of the causative drivers of change - the closure of large combustion plants and continued regulatory management of other emissions, continuing rail electrification, bus fleet renewal and new Euro IV/V/VI uptake across all vehicles, increases in active travel etc. - will continue to deliver improvements over coming years subject to actual rates of change and other factors such as car numbers and goods and bus fleet replacement, engine mix and numbers, etc.

3.17 However, in spite of recent progress, a number of questions still need to be raised, for example:

- Is this progress far or fast enough?
- Will congestion and vehicle numbers overall, contributing to pollution loads, rise or fall?
- What impact will the Glasgow LEZ have and how will the four cities' LEZs work together to influence the general transport picture and impact pollution overall?
- Will other sources of pollutants, especially particulates, result in further reductions being slower or harder to achieve?
- Why is ammonia such a notable exception to the general downward trend?

[15] *Net zero: The UK's contribution to stopping global warming*, Committee on Climate Change, 2019; including reference to the advantage of net-zero approach to improving air quality.

[16] *Final assessment: The first Scottish Climate Change Adaptation Programme*, Committee on Climate Change, 2019; Table 1 includes reference to air pollution, somewhat minimally and indicates in the Society Adaptation priority, "mixed progress".

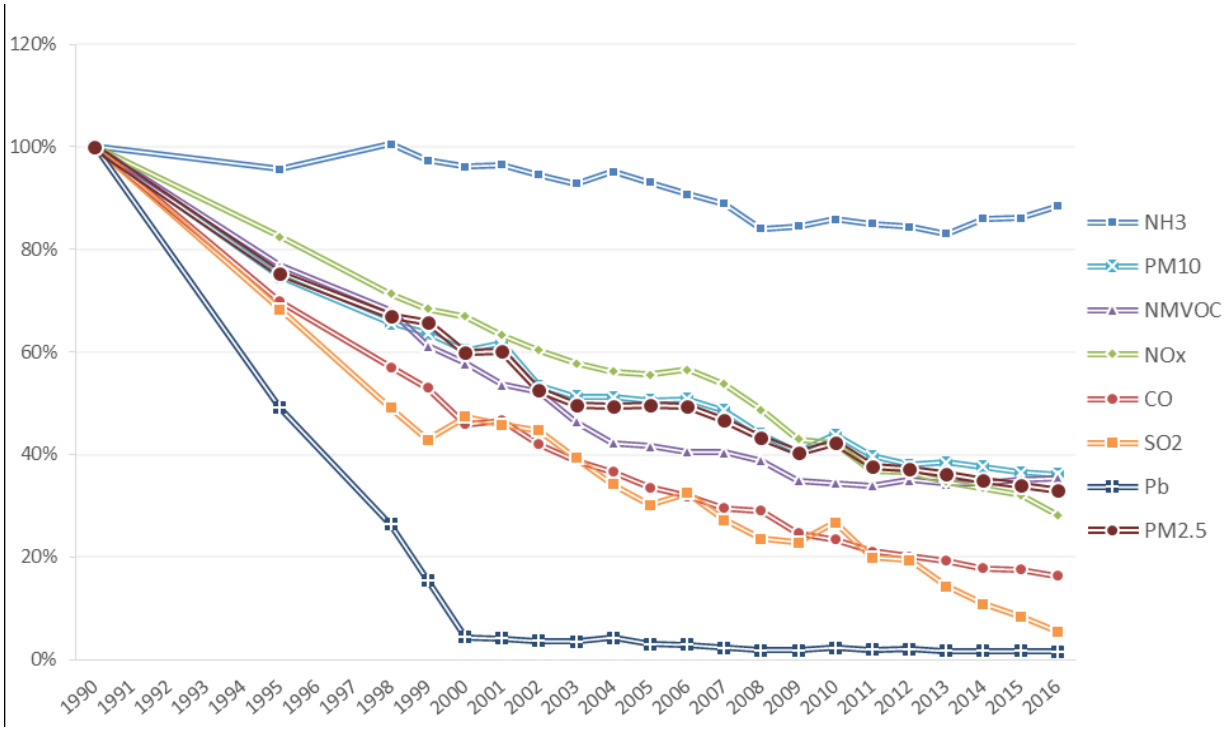
4. Findings of the Review

4.1 The findings presented in the following sections are those of the Steering Group tasked by the Scottish Government with undertaking this review. They are based upon our own structured discussions and analyses, inputs from various interested parties, and are substantially informed by the reports of the four working groups established to support the overall review[17].

Emission trends in Scotland to 2016

4.2 Emissions of the eight main air pollutants show that levels are lower in 2016 than they were in 1990. This rate of decline is relatively similar for particulate matter (PM_{10} and $_{2.5}$), oxides of nitrogen (NO_x), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO_2) and carbon monoxide (CO). Lead (Pb) shows a much higher rate of reduction from 1990 to 2000 coinciding with the phase-out of leaded petrol from 2000 while ammonia (NH_3) emissions have declined at a slower rate than other pollutants.

Figure 1 – Pollutant trends in Scotland from 1990 onwards



[17] *CAFS Review Working Group reports*

Individual pollutant trends to 2016 (since 1990)

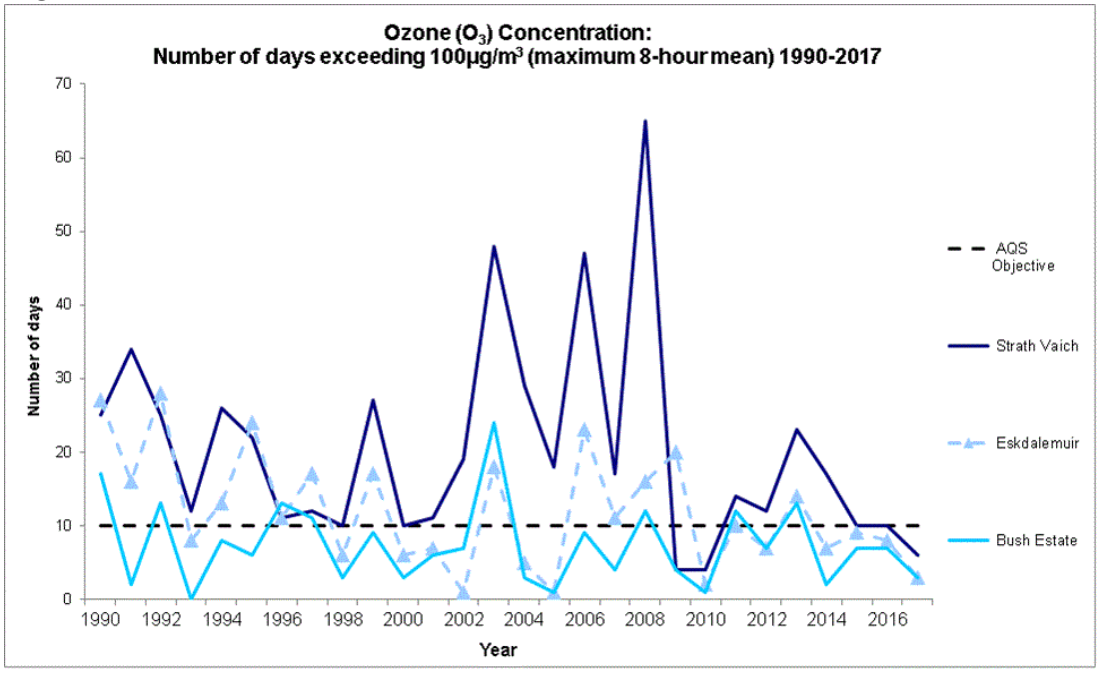
4.3 The following show the reductions in emissions of air pollutants in Scotland individually since 1990[18]. CAFS has been one, of many policy measures, which has helped contribute to these reductions.

- Emissions of NO_x were estimated to be 90 kilotonnes (kt) in 2016 (10% of the UK total) declining by 72%.
- Emissions of SO_2 were estimated to be 18kt in 2016 (10% of the UK total) declining by 94%.
- Emissions of PM_{10} were estimated to be 14kt in 2016 (8% of the UK total) declining by 64%.
- Emissions of $PM_{2.5}$ were estimated to be 9kt in 2016 (8% of the UK total) declining by 67%.
- Emissions of NH_3 were estimated to be 34kt in 2016 (12% of the UK total) declining by 12% since 1990.
- Emissions of NMVOCs were estimated to be 146kt in 2016 (18% of the UK total) declining by 65%.
- Emissions of Pb were estimated to be 3.3 tonnes in 2016 (5% of the UK total) declining by 98% since 1990.

4.4 As ground-level ozone (O_3) is a secondary pollutant formed from reactions in the atmosphere (primarily from NMVOCs and NO_x) source apportionment is not possible in the same way as for other pollutants and instead, trend data is produced. Due to the complexity of ground-level ozone formation and contributing factors (e.g. sunlight intensity, meteorology) O_3 concentrations can fluctuate from year-to-year. The following graph shows the trends of O_3 since 1990 and number of days exceeding the objective are lower for the last 10 years, likely to be due to reductions in the pre-cursor pollutants.

[18] National Atmospheric Emissions Inventory, 2018.

Figure 2 – O_3 trends in Scotland from 1990 onwards[19]



4.5 Air pollution is also closely linked with other environmental factors such as climate change, noise and indoor air quality and significant multiple benefits can be achieved if policy measures are integrated to ensure that maximum environmental improvement is secured while avoiding potential policy conflicts.

4.6 Reductions in emissions of air pollution have been the result of concerted action through policy measures such as CAFS, International agreements and European and domestic legislation. However, despite these improvements and generally improving trends in air quality further action continues to be required to meet existing and future legal targets on air pollution, to reduce background levels of air pollution impacting the environment and to address hotspots of poor air quality in urban centres.

4.7 Further breakdown of these data is available in a SEPA background paper[20]. Further detail on Scotland's situation in the EU/EAA context for the main pollutants can also be found in **Annex 4.**

[19] Scottish Government, 2018, www2.gov.scot/Topics/Statistics/Browse/Environment/TrendOzone

[20] *State of air quality, environment and pollutant trends in Scotland*, SEPA, 2019;

5. Health and Environment

Overview

5.1 The Health and Environment Working Group[21] produced initial analysis and recommendations for consideration by the Steering Group for this section of the report[22]. The report reflects discussions on evidence relating to the health impacts of air pollution in Scotland by members of the 2019 CAFS Review, Health and Environment Working Group and issues identified by the Steering Group. Some differences, of evidence, interpretation and opinion emerged on some topics, including around the philosophy of precaution versus compelling evidence on causation and on how to address scientific uncertainty associated with variation in local and international evidence on some health impacts. The report reflects a balanced perspective on the views expressed.

5.2 There is scientific consensus that exposure to air pollution is harmful to people's health, in relation particularly to premature mortality and morbidity, mainly related to respiratory and cardiovascular disease[23] [24]. It is also harmful to the environment generally. Since 2015 the profile of anthropogenic air pollution has changed in Scotland, mainly for the better. An updated analysis of trends shows that many of the most important pollutants including fine particulates are now mostly below accepted existing health based limits. However, areas of concern remain, especially excess levels of nitrogen oxides in city centres and pollutants, specifically ammonia, generated by the agricultural sector which have not reduced.

5.3 Evidence continues to accumulate on the range and scale of pressures and impacts linked to airborne pollution, expanding our understanding of how air pollution is harmful to public health and the environment. Findings from outside the UK suggest that harmful impacts can occur at levels below currently used health based limits[24]. More evidence is also available on effective interventions for reducing people's exposure, especially to road traffic sourced pollution. Consequently, despite recent encouraging trends and reductions in manmade air pollution in Scotland to date, there remains scope for further beneficial reduction.

5.4 A detailed review of the evidence on human health impacts of exposure to air pollution was undertaken by the working group, together with a comparison of the international and Scottish evidence. This can be found in **Annex 5a**, and in the full report of the working group, which also provides a list of references supporting the group's conclusions and recommendations[22].

5.5 Factors that correlate closely with air pollution in terms of impacts on people and the environment have also been considered including noise (especially transport generated noise) and airborne greenhouse gas

[21] Health and Environment Working Group Membership can be found in **Annex 2**
[22] *Health and Environment Working Group Report*;
[23] *Air Quality in Europe*, EEA, 2018
[24] *Review of evidence on health aspects of air pollution* – *REVIHAAP Project*, WHO, 2013

emissions that contribute to global warming and climate change. Increased awareness of these inter-relationships is needed, as is the potential to link co-beneficial mitigating actions. Given the close linkage between outdoor and indoor air pollution and the high proportion of time spent indoors especially by urban dwellers, indoor air quality has been identified as an important related topic.

5.6 Broader related issues that link to improving health and environmental quality generally have also been considered. These include the public health improvement agenda focused on encouraging less sedentary and more active lifestyles and reducing health inequalities; climate change adaptation policy; the planning system and the role of placemaking; environment, agriculture and land use policies; and transport policy. Improving linkages across these topics, to enable better integration of policy development and implementation, is identified as critical to the success of efforts to improve public health and environmental quality.

5.7 As a minimum, there is a continued need to reduce levels of air pollution to meet existing human and ecosystem health based limits. The international evidence suggests that further reductions in air pollutants would be likely to bring additional public health and environmental benefits, with the biggest gains coming from reducing long-term exposure. Due to the relatively lower exposure levels in Scotland already and the different epidemiology of health impacts here, it is difficult to quantify accurately the scale of any such additional potential benefits.

Conclusions on the evidence on air pollution and health

5.8 The international epidemiological evidence convincingly shows that ambient air pollution causes serious damage to both respiratory and cardiovascular health worldwide, with wide-ranging effects including earlier death. There is no agreed level of the key pollutants (fine particulates ($PM_{2.5}$), O_3 and NO_2) at which adverse effects can be said with confidence, not to occur. As noted by WHO in 2013, the evidence of effects of both short-term and long-term exposure continues to grow, with the greatest public health effects being associated with long-term exposures. These findings have for many years formed the basis of air pollution control internationally, as endorsed for example by WHO, The UK Committee on Medical Effects of Air Pollutants (COMEAP) in the UK, the EU, US EPA and many other expert groups.

5.9 The evidence relating to long-term impacts associated with particulate pollution is notably strong, especially for $PM_{2.5}$, for which there is no agreed threshold level at which adverse effects stop occurring for the population as a whole. Reducing ambient PM levels below international health based standards must therefore remain a high priority, alongside efforts to reduce nitrogen oxides and other preventable pollutants.

5.10 There is some uncertainty from international studies about the scale of health effects associated with low pollutant concentrations typical of the

average seen in Scotland now. The specifically Scottish literature, while small, has repeatedly demonstrated impacts of pollutants on respiratory illness that are consistent with international evidence. Studies in Scotland differ from the international evidence however, in not showing effects of pollution on cardiovascular (CV) disease outcomes for reasons that are unknown. The extent to which future policy making in Scotland is based on the international evidence and takes account of the specifically Scottish studies, has implications on the advice that can be given on what additional proportionate action is needed to further reduce the harm due to air pollution at current levels (and where trends in key pollutant concentrations may continue downwards in any case).

5.11 There is growing evidence from other countries showing associations of air pollution with other important health conditions including dementia, diabetes, and adverse pregnancy outcomes (low birth weight and prematurity). Collectively this constitutes good evidence that air pollution, even at the low concentrations found in much of Scotland, is linked to excess ill health that should be preventable by reducing pollution further.

5.12 The fundamental message, based on available evidence, is that air pollution is harmful to human health and the wider environment. Although difficult to predict or measure, further reductions in ambient manmade air pollution will be likely to bring additional public health gains, especially in terms of reduced long-term health impacts across a range of preventable adverse health outcomes.

5.13 Reduction in air pollution over recent decades in Scotland will have reduced the health burden associated with exposure. International evidence suggests that further reductions in human sourced air pollution would be likely to benefit public health in Scotland. However, given that key ambient pollutant levels in Scotland are now relatively low in global terms, it is difficult to predict, and may be hard to demonstrate accurately the level of additional health gain that might result from further reductions in air pollution.

5.14 Effective strategies to reduce air pollution include infrastructure support to encourage increased levels of physical activity via more active travel (walking and cycling); encouraging less reliance on private vehicles by improving access to affordable, available public transport; and improving public transport quality and choice to encourage more switching to zero and low emission vehicles. To achieve significant change in aspects of everyday business and domestic life, as well as modal shift in transport use, a better understanding is needed of current public perceptions of air pollution, as well as of motivations and barriers that impede needed changes.

5.15 Achieving these aims in a more coordinated way will also require concerted action to make health focused policy development more of a joint priority across all relevant central and local government departments (e.g. health, environment, transport, agriculture and especially planning, placemaking and development). To achieve meaningful change, all stakeholders (e.g. government, business and industry, employers (private and public) as well as the public themselves) acting as generators of pollutant

emissions generally and especially as users of transport, will need to be encouraged to play their part in helping to prevent the future health burden associated with avoidable air pollution.

5.16 Finally, there are both human rights aspects to the effects and impacts of air pollution on health as well as issues around the distribution of costs and benefits here and these require further and fuller recognition and response. Future work should interrogate the existing Scottish Index of Multiple Deprivation (SIMD) data to explore evidence of links between socially deprived communities and air quality. For example, if the main form of transport in these communities is bus then as the move to newer buses within city centres progresses then older buses may be used within peripheral areas, exacerbating disadvantage. Anecdotal evidence in Glasgow and Edinburgh supports this recent trend. Research in 2018[25] from Glasgow University looked at how economic development and urban planning decisions can both increase the links between social deprivation and poor air quality, but can also lead to improvement. Implementation measures to tackle air pollution must avoid embedding environmental injustice into proposed solutions. It is clear from even initial consideration of transport poverty as well as socio-economic conditions generally that we should better understand and address the health inequalities aspects of air pollution. Evidently those who generate the least air pollution may be those who suffer its effects most and vice versa.

5.17 In summary therefore, air pollution causes harm to human health and, while there have been valuable identifiable improvements in some areas, the impacts are serious and require to be addressed, both in order to achieve comprehensive legal compliance with EU and WHO standards and to provide appropriate precautionary protection to the population, not least those sensitive receptors upon whom pollution can have the most acute impacts.

5.18 There is a clear need to ensure all relevant sectors, including all Scottish Government and local government departments and agencies work coherently and effectively together to adopt a joint approach to achieving integrated positive health-focused policies which deliver lower air pollution, better health outcomes and the suite of possible co-benefits for and with the population.

Recommendations – evidence for health impacts

H1. Further consideration of evidence on health impacts of low level pollution in countries with levels of ambient air pollution comparable to Scotland is needed.

H2. Commission population research on the long term effects of air pollution using cohort methods to aid further understanding of health impacts and explain the apparently different epidemiology in Scotland.

[25] *Reconsidering the Relationship between Air Pollution and Deprivation*, Bailey *et al,* 2018, Int. J. Environ. Res. Public Health **2018**, 15, 629

Potential co-benefits to public health of reducing air pollution

5.19 Policies that improve air quality can potentially have multiple co-benefits for population health, for addressing inequality and for mitigating and adapting to climate change. A prime example is policy to promote active travel. Walking and cycling increase physical activity and significantly reduce cardiovascular incidence and mortality, and have been shown to reduce all-cause mortality even after controlling for other physical activity[26,27,28]. Commuters who transitioned from using a car to active travel or public transport showed reductions in body mass[29]. Substantial potential savings in health care costs have been estimated for increased levels of active travel in urban areas[30]. Evidence shows that the physical activity benefits of active travel outweigh the harm caused by potentially more exposure to air pollution in all but the most extreme situations[31]. However, walking and cycling in places with noticeable poor air quality is a disincentive. Measures to reduce traffic sourced air pollution and to increase levels of active travel can therefore amplify benefits to public health and help to meet sustainability goals. Further detail on the health and cost impacts of interventions reducing traffic sourced air pollution can be found in **Annex 5b.**

Recommendation – co-benefits

H3. An Air Pollution Action Plan should be developed and implemented with actions and investment, focussed on joint actions across all relevant government departments, agencies and local government functions to increase levels of active and sustainable travel. This should include integrated and complementary approaches to improve air quality, to reduce carbon emissions and to reduce related health inequalities.

Public Perceptions of Air Pollution

5.20 Creating a policy and physical environment that encourages less polluting, more active and healthier lifestyles is an essential but not sufficient requirement to achieve change. The perceptions and attitudes of key stakeholder groups, especially the public, to both the importance of the issues and the case for change are key factors to be addressed. There is limited research on public attitudes to air pollution as a topic.

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[26] *Association between active commuting and incident cardiovascular disease, cancer, and mortality: prospective cohort study,* 2017, Celis-Morales *et al*., BMJ 2017; 357: j1456.
[27] *Active commuting and cardiovascular risk: a meta-analytic review,* 2008, Hamer and Chida, BMJ 2017;357:j1456.
[28] *Systematic review and meta-analysis of reduction in all-cause mortality from walking and cycling and shape of dose response relationship,* Kelly *et al*., 2014, International Journal of Behavioural Nutrition and Physical Activity. 2014 11:132.
[29] *Change in commute mode and body-mass index: prospective longitudinal evidence from the UK Biobank*, Flint *et al*., 2016, The Lancet. 2016; 1:e46-55.
[30] *Effect of increasing active travel in urban England and Wales on costs to the National Health Service*, Jarrett *et al*., 2012, Lancet. 2012; 379(9832): 2198-205
[31] *Can air pollution negate the health benefits of cycling and walking?* Tainio *et al*., 2016, Preventive Medicine. 2016 87:233.

5.21 DEFRA published qualitative research involving car users, public transport users and other identified groups, gauging levels of knowledge, public understanding and attitudes to the issues[32], the results of which are summarised in **Annex 5c**. This survey was restricted to England and Wales and may not be representative of the position in Scotland. Similar research to understand levels of concern and attitudes to air pollution among the general public and key stakeholder groups in Scotland, would therefore be helpful, along with research on barriers and willingness to change pollution generating behaviours (see General Recommendation 4 above).

Co-related aspects of air pollution and health

5.22 The public health effects of indoor air quality, noise pollution and climate change correlate strongly with those of outdoor air pollution; effort to address these issues in a more coordinated way offers additional potential co-benefits. Evidence based action to reduce air pollution has clear potential co-benefits in terms of supporting the aims of a range of government policies aimed at: improving public health and reducing health inequalities; environmental quality improvement, climate change mitigation and adaptation; reducing noise pollution and creating a more sustainable transport system.

Air pollution and noise

5.23 As yet there are no fixed noise level targets in the UK. The EU adopted a Directive on environmental noise in 2002, which stipulates that measurements must be taken of ambient noise; the results must be made publicly available and action plans for noise reduction must be agreed. WHO published guidance in 2018 on environmental noise levels taking account of existing health effects evidence[33].

5.24 In Scotland's four major cities alone, it has been estimated that over 1 million people are exposed to noise levels in excess of the WHO guidelines during the daytime and over 0.8 million during the night, with evidence indicating that deprived communities suffer more[34]. The costs of increased health impacts have not been estimated in Scotland directly but based on WHO estimates elsewhere are potentially considerable. Further detail on the impacts of noise exposure for wildlife and humans can be found in **Annex 5d.**

5.25 The major source of ambient noise is from road traffic, the same source as much ambient air pollution. Studies have identified links between road traffic noise and cardiovascular impacts[35] . The adverse impacts of air pollution are closely correlated with those of noise, making it difficult to assess the impact of traffic noise on health separately. However, this also means that some interventions aimed at reducing traffic sourced air pollution

[32] *Public Attitudes to Air Quality*, DEFRA, 2018
[33] *Environmental Noise Guidelines for the European Region*, WHO, 2018
[34] *Noise statistics*, Scottish Government, 2012
[35] *Road traffic noise is associated with increased cardiovascular morbidity and mortality and all-cause mortality in London*, Halonen J *et al*, 2015

are also likely to help reduce excess traffic sourced noise. These interventions range from traffic reduction in urban areas to physical responsive solutions such as green (living plant) barriers along roads, where evidence suggests these can reduce both traffic-related air pollution and noise[36]. General Recommendation 2 above covers the need for any plan aiming to reduce noise to be aligned with other plans such as air quality action plans and those coving climate change adaptation and mitigation.

Air pollution and climate change

5.26 Scottish carbon emissions have reduced in the last 15 years. However, transport related carbon emissions have increased as a proportion of the Scottish total rising from 32.7% of greenhouse gases in 2015 to 37.3% in 2016 and in real terms, with transport mass emissions increasing by 2.3% between 2015 and 2016. As 68% of total transport emissions in Scotland are related to traffic, greenhouse gas emissions are therefore closely linked to road traffic sourced air pollution[37].

5.27 The CAFS GG commissioned a report from a Climate Change Sub-group to assess the likely co-benefits between climate change and air quality improvement actions[38].

5.28 Of the 50 recommendations made in the report, 38 presented strong evidence of synergies between tackling climate change and improving air quality simultaneously. Only three recommendations revealed some potential for tension.

Recommendation

H4. It is strongly recommended that, at all levels of governance, when actions are being taken to address air quality then they be screened to maximise the potential for co-benefits with climate change mitigation and adaptation. The reverse should also be the case. The screening should, at minimum, be against the 50 recommendations in the CAFS GG Climate Change sub-group Report.

Indoor air quality

5.29 Indoor air quality is determined by multiple factors including ambient outdoor air pollution[39]. Unlike outdoor air quality, there are no regulated limits for indoor pollutants in domestic settings in the UK. The WHO published guidelines in 2010 on safe concentrations of indoor air pollutants for general use and the Health and Safety Health Executive (HSE) publish occupational limits for a range of workplace air pollutants[40].

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[36] *Air pollution: outdoor air quality and health*, NICE, 2017
[37] Scottish Transport Statistics No. 37, Transport Scotland, 2018
[38] CAFS Climate Change Sub-group 2016,
[39] *Gasping for Air*, Curran J., The Ecologist, 2019
[40] *Workplace exposure limits*, HSE, 2018

5.30 Urban populations in the UK spend around 90% of their time indoors; the quality of the indoor air is therefore at least as important as that of outdoor air. Around 50% to 75% of the variability of indoor concentrations of common pollutants (NO_x, SO_2, O_3, and PM) is estimated to be explained by variation in outdoor pollution[41]. This makes estimating the health impacts of indoor air quality alone very challenging.

5.31 New reviews of indoor air pollution and health impacts are currently under way in the UK, including by National Institute for Health and Care Excellence (NICE), but will not report for some time. Further detail on the sources and health effects of indoor air pollution can be found in **Annex 5e**.

5.32 Although multiple government departments have a role to play, no single Government department (in UK or Scottish Governments) has sole responsibility for indoor air quality. There is therefore a need for policy integration and coherence being pursued to avoid the risks of unintended consequences. This applies generally as shown by the increase in NO_2 emissions associated with the switch to diesel engines encouraged by Government to help reduce CO_2 emissions and specifically in relation to indoor air quality. Changes determined by non-health related policy drivers (e.g. floor surfaces, cleaning policy, sealed windows and air conditioning or the drive for energy efficiency to reduce global warming gas emissions) could have unexpected adverse health consequences, if these are not viewed in the round, anticipated and mitigation measures identified.

5.33 As well as links to outdoor air pollution, indoor air pollution is therefore a complex issue in its own right with unique determinants. As a topic, it therefore merits more collective attention to assess its significance in relation to public health. A coordinated approach across government departments and other stakeholders is therefore needed to create a focus for a future cross-government indoor air quality strategy.

Recommendation

H5. It is strongly recommended that a task group be convened to identify what, if any, actions might best be undertaken at Scottish level to address the issues associated with indoor air pollution.

In-vehicle air quality

5.34 Throughout this review, from time to time the issue of air pollution inside vehicles has arisen. It has sometimes been seen as a minor issue or one too complex or anecdotal to consider and we have not been able to prioritise it in this report. However, both inside cars and vans as well as onboard buses, especially during warmer weather where windows may be open, for example, and where traffic is static with engines running for extended periods, pollution from other vehicles and sources may enter the

[41] *Modelling Relationships between Indoor and Outdoor Air Quality,* Friejer and Bloemen, 2000, J. Air & Waste Management Assocn. 50:292-300.

cabin and be breathed in by driver and passengers alike. Where public transport is used by already disadvantaged groups and by the elderly, the ill, or pregnant women or parents with young babies and children for example, this could have compounding ill-health effects. Stop-start engines and efficient and effective filtration systems will have fuel consumption and pollution impacts of their own. We also note that general improvements in future to air quality will contribute to reducing pollution inside vehicles. Nonetheless at this point there is little factual basis to conclude whether the problem is serious or not.

5.35 This highlights too the issue of actual individual exposures versus generalised data based upon place of residence, work place or other point data used to look at samples and populations that may not reflect the experience of the individual's day, life and cumulative exposure generally. We have received anecdotal evidence of some modern cars "cleaning" ambient air as it passes through the filters of the vehicle and comparisons with those smoking in a vehicle and direct and passive impacts on passengers. At this point, we are able therefore simply to make two recommendations.

Recommendations

H6. Consideration should be given to research on in-vehicle exposures and potential health impacts to provide a factual baseline.[42]

H7. Consideration should be given to a "habit survey" type assessment of actual exposures experienced by a representative sample of the population, assessing pollution exposures over a realistic "normal activity range over a normal period"[43].

These recommendations would allow stronger and more meaningful inference around the significance of real exposures to the average person and thus where further policy developments and potential interventions may need to be made.

[42] There is potentially an all-users dimension to this issue as well as heightened risk for vulnerable passengers or drivers as well as Health and Safety and employment law dimensions for bus, haulage and other business employers if drivers are potentially exposed to dangerous pollution. This may be an issue likely to benefit from a collaborative research approach.

[43] This would assess the home environment where someone might experience relatively clean air for 9-18 hours per day, through a commute by bike, car, bus, train or on foot, to a relatively clean or air conditioned work environment or school through a return commute and an evening in a public or private environment or in a street café with passing traffic and so on. Real exposures could be highly diverse and both peak pollution impacts and longer-term cumulative exposures could be relevant to health impacts, subject to prior health state and risk factors. Whilst highlighting the complexity of the situation, such work would offer assessment of boundary conditions for future policy effort. This could also offer ideal opportunities for collaborative, multi-disciplinary international research.

6. Agricultural, Industrial and Domestic Emissions

Overview

6.1 Much of the emissions and pollution information in CAFS 2015 remains valid. The main pollutants and their sources remain generally the same and are in most cases continuing to show modest reductions. In terms of the emissions dynamics and the drivers, pressures and inputs of pollution, the major changes relate to:

- The closure of the Large Combustion Plant at Longannet (24 March 2016).
- Progress with reductions in other regulated emissions.
- Continued warming temperatures and increasingly unpredictable weather conditions including systems bringing dusts, especially from the Sahara, and pollutants from elsewhere.
- Increases in ammonia emissions from agricultural sources.
- Renewables developments reducing the reliance upon and use of dirtier sources of energy for light and heat.
- Increase in the number of domestic and industrial wood-burners, biomass and medium combustion plant.
- Changing vehicle engine type (more hybrids and electric vehicles, including expanding e-charging infrastructure, and fewer diesel cars generally as well as fewer dirtier petrol and diesel engine private vehicles, despite increasing vehicle numbers overall).
- Changes toward cleaner bus fleets.
- Progressive rail electrification on the busiest routes.
- The development of cleaner freight vehicles, both heavy and light good vehicles (H and LGVs).[44]

6.2 As part of this review, an Agricultural, Industrial and Domestic Emissions (AIDE) Working Group[45] was established and it produced an extensive report[46], the substantive analysis, observational and recommendations elements of which have been incorporated into this section and **Annex 6**. There is strong connectivity across the sections of the report in terms of the impacts and sources of the emissions.

Domestic combustion emissions

6.3 The main emissions from the domestic sector are PM (PM_{10} and $PM_{2.5}$), NO_2 and SO_2. A summary of domestic combustion emission sources, pollutants and trends in Scotland can be found in **Annex 6a.**

6.4 The review has concluded, based on the working group's assessment that Scotland could and should largely follow the strategy proposed by the

[44] Transport emissions and issues are addressed in Section 7.
[45] AIDE Working Group membership is listed in Annex 2
[46] *AIDE Working Group report*,

DEFRA Clean Air Strategy for these emissions, that a package of interventions is appropriate. A summary of the DEFRA strategy's recommendations for domestic combustion, and how these relate in the Scottish context can be found in **Annex 6b.**

Conclusions – Domestic combustion emissions

6.5 The DEFRA Clean Air Strategy provides a good basis on which to build in Scotland. The stricter standards for $PM_{2.5}$ in Scotland, compared to the UK/England position, mean that Scotland may need to consider further actions. The DEFRA strategy focuses on fuels, stoves and consumer education. It relies on Ecodesign (ED) to achieve reductions in appliance emissions but ED is a base standard and also only applies to new stoves. Effectively addressing the existing stock of open fires and older stoves is an important consideration. Supporting industry initiatives will lead to the installation of appliances that have significantly lower emissions than ED. We have also identified the need to take action in four areas: (1) right appliance burning the (2) right fuel, (3) consumer education and (4) proper installation and maintenance.

6.6 The uncertainty over the level of emissions from domestic burning means that setting definite reduction targets is difficult. Further research into the proportion of emissions attributable to domestic burning, as well as assessment of type and source of emissions, is required. Further monitoring of $PM_{2.5}$ levels particularly in urban areas is desirable, subject to finding an agreed method of measurement. As up to 50% of locally observed ambient concentrations of $PM_{2.5}$ can relate to long-range transboundary transport of emissions from outside of Scotland (or the UK) a consistent approach at local, national and international scales is required.

6.7 Actions to tackle air pollution should be co-ordinated with other relevant policies and actions, including those emanating from climate change management responses and those targeted at improving house building and household energy efficiency. Moving away from gas sources, better home insulation, more electric, passive and ground source heating, low input heat-recovery systems and minimising heat loss or inefficient heating and cooking ultimately reduce energy use and/or the need for supplementary domestic heating, fires, stoves etc. These actions will all feed through to reduced air pollution.

Recommendations - Domestic combustion emissions

D1. Implement a package of suitably tailored recommendations on domestic burning emissions in Scotland, including: the implementation of Ecodesign (ED); voluntary codes for stoves; appropriate standards for fuels (including regulation of wood for use in woodburners, house coals and arrangements for own-resource wood burning), and education to inform consumers.

D2. Consider with local government and SEPA how best to address the current permitted development status of flues for woodburning stoves and

biomass boilers and incorporate permissions into development control and monitoring.

D3. Commission further work to clarify the level of PM (and other relevant) emissions in Scotland and the percentage attributable to domestic burning. This will require re-evaluating the volume of wood burnt.[47]

Industrial emissions

6.8 Emissions from industrial activities in Scotland have been subject to increasingly strict regulation since the mid-1990s as a result of EU, UK and Scottish legislation. SEPA has been recording the mass emissions from the largest regulated sites since 2002 using its Scottish Pollutant Release Inventory (SPRI)[48] system, which collects data for the main pollutants of concern. Emissions from industry can be variable as controls are typically set based on emission limit values (ELVs) from point sources (rather than mass emissions from the installation as a whole). As a result, emissions can fluctuate due to production needs, but still be in full compliance with permit conditions. A summary of the emission trends from SEPA-regulated sites since 2002 is included in the full working group report[49], with a summary of key points of interest provided in **Annex 6c.**

6.9 Industrial emissions are subject to strict control under a well-defined legal framework using the principle of Best Available Techniques (BAT). The EU Industrial Emissions Directive[50] (IED) (which covers the most polluting industrial activities) along with domestic provisions which comprise the requirements of the PPC regime in Scotland are wide-ranging, comprehensive and provide for a good level of protection of the environment as a whole. In general terms, this is demonstrated by the annual reduction in emissions observed in the data contained within SPRI. Therefore any scope for requiring further reductions of emissions to air without imposing excessive burden on business or the perception of "gold-plating" of existing legislation must be considered very carefully. Further discussion of flexibilities in IED/PPC that could be used to further reduce levels and impacts on air quality from industrial activities can be found in **Annex 6d.**

Carbon Capture and Storage (CCS)

6.10 It is unclear at this point whether CCS may be more fully resurrected once more and implemented at scale as part of an interim carbon management strategy or not. Were it to be the case that a major development occurred, it would need to be factored into industrial emissions regulation. This would be of particular interest especially if the technologies incorporated included more input energy, use of amine scrubbers etc. and thereby liability to release further gas and particulate pollution. We understand that Project

[47] User surveys being completed in 2019 should deliver new information to produce a more accurate current figure than the 2015 BEIS survey.
[48] *Scottish Pollutant Release Inventory*, SEPA
[49] *AIDE Working Group report*
[50] http://ec.europa.eu/environment/industry/stationary/ied/legislation.htm

Acorn may be operational by the mid-2020s. Both the Scottish Energy Strategy and the latest Committee on Climate Change report highlight an important potential role for CCS and it is apparently a major area of interest to the National Infrastructure Commission for Scotland. Given CCS seems to have positive and negative implications for air quality, in greenhouse gas (GHG) and air pollution terms it could be significant. It is important that climate and air pollution interventions do not work against each other.

Possible interventions – Industrial emissions

6.11 There are a few areas which could be investigated for developing future interventions to further reduce emissions to air from industry; however, recognising the comprehensive legal framework which already exists, any environmental benefits must be balanced against costs of regulation (to industry and regulator) and a robust justification provided for the need for inclusion for control. Areas for possible further investigation include:

- Whether there is environmental benefit in bringing currently unregulated sectors (which have not been prescribed by EU legislation) such as non-waste anaerobic digestion under the remit of existing legal frameworks for emissions to air;

- Whether amendments to the existing legal framework are necessary to remove omissions, ambiguities, loopholes and gaps (e.g. BAT and stack heights not applying to activities falling within the provision of the Medium Combustion Plant Directive (MCPD), clarifying legal definitions and their intent), appropriateness of capacity thresholds, which could help increase control of emissions;

- Whether additional reductions in industrial sources of emissions can be achieved where certain pollutants are not showing a downward trend (e.g. NH_3 and NMVOCs). SEPA is currently conducting work through its sector planning approach which could help further reduce emissions of these substances from specific sectors (e.g. whisky, crop and dairy production) through “beyond compliance” measures. However, opportunities may be limited, as previously discussed, due to a number of installation/sectors already operating in accordance with BAT and their permit conditions and further emissions reductions being limited by production levels and site-specific factors. Emissions of NH_3 from intensive agriculture sector are discussed in the agricultural emissions section of this report;

- Mobile and non-road machinery emissions which have no abatement and use polluting fuels (e.g. construction equipment, road cutting, surfacing, digging, traffic management machinery and diesel and other generators, etc.) could be considered for regulation, given potential local impacts.

6.12 Finally, there may be merit in quantifying/estimating the types and levels of air pollutants being released by other currently unregulated sectors to identify where opportunities exist to bring them into regulation. In many

cases currently unregulated sectors already operate under well-defined, regulator-approved, environmental guidance (such as NetRegs); however, to avoid the need to bring these sectors into formal regulation, consideration could be given to making the current guidance into formal Codes of Practice (CoPs) and enforceable through General Binding Rules (GBRs).

Conclusions – Industrial emissions

6.13 Industrial emissions in Scotland have been subject to increasingly strict regulation since the mid-1990s as a result of EU and domestic legislation. As a result, releases of the most significant pollutants have showed generally downward trends, although some are now increasing meaning further, concerted, action is required.

6.14 Due to the prescriptive nature of the legal regimes controlling industrial emissions, further reductions may be difficult unless measures which go beyond compliance are implemented. SEPA is currently taking this approach with 15 sectors which cover sources of industrial and commercial emissions. With the current uncertainty over the UK exit from the EU it is difficult to assess the future implications for emissions control; however, implementing EU requirements into domestic legislation has demonstrated that controls placed on industry are proportionate and effective in reducing emissions. This being the case, provided we maintain the current EU requirements on a domestic basis (as a minimum) further emissions reductions should be achievable, providing further environmental benefit.

Recommendations – Industrial emissions

I1. Build on SEPA's sector plan approach to further reduce emissions where "beyond compliance" measures may be required to achieve these (e.g. NMVOCs and NH_3) and seek to include any further air pollution sources or hazards identified.

I2. Consider inclusion in regulation of mobile and non-road plant emissions (road cutting, surfacing, digging, traffic management machinery and diesel and other generators, etc.), especially given potential local impacts.

Agricultural emissions

6.15 Agricultural emissions related to air quality are dominated by NH_3. NH_3 is a reactive nitrogen compound which is released when slurries, manures and nitrogen fertilisers come into contact with the air. It produces odours and is mobile, combining with acids and particulates, resulting in identifiable polluting and nuisance effects. NH_3, and therefore fertiliser value, can be lost whenever slurry or manure is exposed in this way and so practices that reduce exposure in housing, storage or during application to crops can cut losses and result in the more efficient use of nitrogen in organic and inorganic fertilisers, thus saving businesses money in the long-run. Recovering as much nitrogen as possible will maximise returns from farm inputs and good

practice in managing soil, manure, fertiliser and feed will help reduce ammonia emissions (and nitrogen losses).

6.16 Despite long-standing guidance availability, in Scotland, until recently, there has been little coverage of NH_3 in the agricultural press. Consequently there is generally poor awareness of this issue across the sector. Therefore, engagement with the sector is needed focusing on farmers and the changes they can make which will deliver both environmental and economic benefits. For the later, the concept of retaining the nutrient value of manures and fertilisers will be important.

6.17 In addition to the financial savings that farmers achieve through reduced NH_3 emissions, there are also public good benefits and minimised operational risk. Work is required to analyse the costs and benefits of mitigation options. This is important because in some instances changing farm management to reduce emissions – covering tanks and lagoons etc. - will require significant up-front investment, which may be difficult for many farmers in the short term. As such, a more detailed analysis of the costs and benefits of possible mitigations set within the Scottish context is required.

Background and emissions

6.18 Scotland emitted 34 kt of NH_3 in 2016, which was 12% of UK emissions. NH_3 emissions have decreased by 12% in Scotland since 1990; a much smaller reduction than for other pollutants. The agriculture sector dominated the ammonia emissions inventory, producing around 90% of Scotland's ammonia emissions in 2016[51] [52].

6.19 Since 1990, decreasing animal numbers and a decline in fertiliser use reduced emissions. An increase in the use of urea-based fertilisers recently has however led to higher emissions. Further detail on the policy context for agriculture emissions, trends and impacts of NH_3 and other air quality emissions from agriculture in Scotland can be found in **Annexes 6e and 6f**, and in the Working Group's full report[53]**.**

Ammonia abatement options[53]

6.20 The Gothenburg Protocol requires a national advisory code of good agricultural practice to control NH_3 emissions. Guidance was provided in the United National Economic Commission for Europe (UNECE) Framework *Code for Good Agricultural Practice for Reducing Ammonia Emissions*[54], and in *Options for Ammonia Mitigation*[55] from the Task Force on Reactive Nitrogen. DEFRA published a voluntary code of good agricultural practice for

[51] *Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2016*, National Atmospheric Emissions Inventory, 2018
[52] All data are from 2016 unless otherwise stated.
[53] See *AIDE Working Group Full Report* for a detailed overview on international and national policies addressing agricultural ammonia emissions
[54] *Code for Good Agricultural Practice for Reducing Ammonia Emissions*, UNECE, 2015
[55] *Options for Ammonia Mitigation*, UNECE, 2014

ammonia reduction[56] for England in 2018; equivalents are in development in Wales and Northern Ireland.

6.21 Consideration should be given to a similar code with parallel abatement options for Scotland. Options need to be reviewed in a Scottish context (e.g. climate, soils, agricultural practice), whether for an equivalent voluntary code of practice or formal regulation. Recent work has been done on the health and environment impacts, and on the costs and benefits of NH_3 reduction measures[57] [58] [59]. These can be taken as a starting point to investigate the costs and benefits of application in Scotland. Recent analyses suggest the potential to increase nitrogen use efficiency by matching livestock producers with excess nitrogen to arable farms with demand[60].

Interventions – Agricultural emissions

6.22 Given that NH_3 and the effects on human health and ecosystems/biodiversity of agricultural emissions have not been overtly included within air quality policy to date, and that the issues have not been communicated to the agricultural sector beyond former Scotland's Environmental and Rural Services (SEARS) initiatives, SEPA/SG *Prevention of Environmental Pollution from Agricultural Activity* (PEPFAA)[61] advice and guidance, especially connected to ammonia, nitrogen and the water environment as well as farm waste initiatives previously and other periodic cross-compliance initiatives hitherto, the emissions working group concluded that the emphasis of future action should be on education: engaging with and helping prepare the agricultural sector to reduce ammonia emissions. The Steering Group agrees with this but notes that this ought not to be seen or presented as a wholly new subject.

6.23 Through advice already available via *Farming for a Better Climate*[62] and *Farming and Water Scotland*[63], there is good awareness on many farms of measures to improve nutrient efficiency on-farm through good soil, fertiliser, manure and slurry management. Improving awareness and implementation of these measures will help reduce ammonia emissions. Again, it would be appropriate to ensure that air pollution management strategies were integrated with necessary climate management actions and indeed other water, flood, habitat and waste management actions underway to ensure unintended consequences do not occur (e.g. pollution swapping).

6.24 The emissions working group suggested that the Scottish Government work with industry to develop a voluntary code of practice. This appears a minimum approach. This code should identify the measures necessary. A

[56] *Code of Good Agricultural Practice (COGAP)*, DEFRA, 2018
[57] *Air Pollution from Agriculture,* DEFRA Air Quality Expert Group, 2018
[58] *The impact of ammonia emissions from agriculture on biodiversity,* Guthrie *et al,* 2018
[59] *Costs of Ammonia Abatement and the Climate Co-Benefits,* Reis *et al*, 2015
[60] *Applying a process-based livestock model to predict spatial variation in agricultural nutrient flows in Scotland,* Leinonen *et al,* 2019, Journal of Cleaner Production, 209:180-189
[61] *PEPFAA*, Scottish Government, 2005 2.9/2.32 – ammonia; 2.19 nitrogen use
[62] www.farmingforabetterclimate.org/
[63] www.farmingandwaterscotland.org/

voluntary code supported by the industry would set appropriate expectations and help businesses develop an appropriate timed action plan.

6.25 While there are opportunities to deliver both emission reductions and improved business performance and sustainability, mitigation practices may require investment in infrastructure and new equipment. Consequently, the development of a voluntary code may need to be accompanied by an assessment of investment and support requirements. Where action is needed as a priority and subject to the early success of engagement efforts, consideration of environmental and health pressures as well as the benefits involved, a regulatory approach may ultimately be necessary.

Conclusions – Agricultural emissions

6.26 There is a large body of relevant evidence and the review supports much of the approach taken in the DEFRA/UK Clean Air Strategy relating to Agriculture, building on guidance used in Scotland over the last 15 years. Further work to incorporate relevant elements into a tailored Scottish context would be helpful and this should be done urgently given the issues identified with ammonia and NMVOCs for example, as well as the elements relating to climate impact mitigation. There is a good understanding of the practices that can reduce and mitigate emissions and many of these could and should be adopted voluntarily and have long-term positive business benefits if taken up quickly. If uptake is slow and the problems identified continue, more direct regulatory intervention would be necessary.

Recommendations – Agricultural emissions

A1. As a minimum, Scottish Government should urgently work together with SEPA and the agricultural industry to develop a voluntary code of practice (CoP) for Scotland. This should incorporate recent data from the UK agricultural ammonia emissions inventory, use relevant Scottish data, address management practices[64] and seek to engage the agriculture sector to achieve best delivery. The CoP should be subjected to an early review process to assess its effectiveness and compliance. If the review highlights through appropriate monitoring an inadequate impact, direct regulatory intervention should be considered.

A2. SG should undertake work on habitats and emissions to set appropriate targets in the current context of the UK reporting on the NECD. Consider related improvements to the current site condition monitoring of designated conservation sites, to improve on current method, which doesn't detect air pollution effects and assess current terrestrial ecosystems monitoring to ensure it is fit for purpose.

[64] Targeting ammonia abatement, in relation to emissions from fertiliser, digestate and animal husbandry types.

A3 A specific assessment is needed of visible smokes and their health and amenity impacts. This should include both muirburn and stubble–burning, as evidently significant contributors not previously assessed. A specific assessment of pollution characteristics and downwind impacts into populated areas should be considered, along with appropriate management responses and interventions.

Conclusions

6.27 It is clear from the analysis of agricultural, industrial and domestic sector issues above that a series of actions can be taken to reduce further the emissions from non-transport human activities in general.

6.28 It is also clear from all of the elements addressed above that it is essential to ensure the facts are available. To enable assessment of and reporting on any and all emissions, in addition to more local data systems, there is a marked need to ensure high level compliance[65] monitoring is possible from the timely availability of robust data on all major pollutants of relevance to human health and the environment. Regulatory data require careful management as it may be used for legal purposes but appropriate monitoring is technically available in near-real time. This should be carefully considered for widespread availability. It could also be helpful for refreshed guidance and suitably updated information on appropriate and available equipment, methods and training etc. for data gathering on air pollution, for fixed and mobile facilities and for appropriate chemical species.

6.29 We also note the potential for remote sensing technologies to be deployed, including as part of the learning from the EU LIFE GySTRA programme[66] which "seeks to create a new sustainable mobility policy based on empirical information on road traffic emissions".[67]

6.30 Finally, General Recommendation 4 (Better Data) above addresses the need set out here for a more integrated and highly populated data gathering and monitoring regime for all emissions.

[65] Whether with current or future EU Directives or in relation to UK or Scottish air quality standards and limits drawn from international, general or local provisions.
[66] www.lifegystra.eu/en/
[67] Ricardo and Emission Analytics are using remote sensing equipment and compiling databases of vehicles and real-world emissions based on roadside monitoring. See e.g. https://ee.ricardo.com/air-quality/case-studies/remote-sensing-blog-2

7. Transport

Overview

7.1 The Transport Working Group[68] identified and ranked key areas and this priority is largely followed here but is represented fully in their report[69]. Context and evidence which supports the recommendations can also be found in **Annex 7**. Several issues identified are interlinked not only in this transport section but with the environment, health, placemaking and governance issues identified. Given the position which is set out here, there was consensus that nothing less than transformational change is necessary.

7.2 As was set out in CAFS, transport contributes just over one-sixth of Scotland's total PM_{10} and over one third of the total emissions of NO_x. The majority of these emissions are caused by road transport[70] and road transport emissions are the largest source of kerbside concentrations and poor urban air quality. Road transport sector emissions have risen slightly in recent years and the sector's emissions overall continue to grow.

7.3 With respect to air quality – behaviour change is "not a nice to have" or just an aspect that should be "encouraged", and we cannot just wait for the 'technology fix'. Energy consumption and emissions from transport are influenced not only by technical efficiency, mode choice and the carbon/pollutant content of energy but also by lifestyle choices and socio-cultural factors. The most likely pathway to success will involve both changes to our travel demand patterns and appropriate technological improvement. Policies to change travel demand patterns can be implemented sooner, and will impact more significantly, to achieve emissions reductions. The most significant impact of lifestyle change on the transport-energy system is due to reductions in the overall demand for transport energy, particularly for fossil fuels.[71]

7.4 The science on air quality is developing. Health and general emissions aspects have already been addressed earlier in this report. This highlights the cross-cutting nature of air pollution as not only an environmental and transport concern, but also as an issue which directly impacts upon public health. The next steps for the CAFS approach in relation to transport should consider and prioritise measures which stimulate and support public health improvements, particularly in relation to behaviour change and increasing the uptake of public and active travel.

Data

7.5 A review of transport data capture, relevance and gaps is needed now. It is important that interventions are based on the best possible transport data

[68] Transport Working Group Membership can be found in Annex 2
[69] *Transport Working Group report*
[70] *Cleaner Air for Scotland: the road to a healthier future*, Scottish Government, 2015
[71] *Lifestyle, efficiency and limits: modelling transport energy and emissions using a socio-technical approach,* Brand, C. *et al,* 2019, Energy Efficiency, 12: 187-207.

on current movement and mode choice. In particular, data derived from phone company records – as used by Google and Apple to give information on road congestion – can be acquired. This may be addressed by Transport Scotland in the National Transport Strategy (NTS) and would be one component of having a stronger, more up to date and deployable resource for monitoring and assessing current and future needs. It also allows a better fit with police and SEPA systems that will enhance environmental data and safety issues. Bus companies would also be able to review these data in partnership and match it with their knowledge of their own networks.

7.6 CAFS introduced the National Modelling Framework (NMF). The NMF provides the basis for a national approach to both local and regional air quality modelling. This modelling requires robust transport and environmental data. The delivery of the local NMF for the four proposed LEZs was only made possible by undertaking detailed traffic data collections. Good quality data is essential for making key decisions. Annual traffic data should be collected nationally for use at national, regional and local levels and coordinated with environmental data.

7.7 Data sharing with the National Health Service (NHS) should also be improved, including through the nascent Public Health Scotland.

Recommendation – Data

T1. A robust commitment is needed on data and research support for transport planning. Consideration should be given to specific investment in transport supply and demand research. Additionally, both current pollutant and impact data capture should be reviewed and a commitment is required for continuous transport data provision from the range of relevant locations across Scotland, building on the findings identified in SEPA and partners' NMF work.[72].

Modal/Hierarchy Shift

National Transport Strategy

7.8 In the course of the next few months we understand that there will be a revised NTS, in turn followed by the Strategic Transport Projects Review (STPR). It is to be hoped these will reflect the revised priority ascribed to tackling the climate crisis as well as the challenges identified here of reducing transport sector air pollutants in addition to enhancing public service provision generally and encouraging necessary modal shifts.

Walking and cycling

7.9 The current funding level for active travel is insufficient to meet the need for transformative change, especially for related infrastructure

[72] *CAFS – National Modelling Framework Air Quality Evidence Report* – *Edinburgh*, SEPA, 2019,

programmes and the associated behaviour change support work given the paucity of funding over many decades. Doubling the funding level again (since the 2017 doubling announcement from £40 million to £80 million) would signal the seriousness of the task and the need to upskill and expand the human resources also needed. Short-term, stop-start sustainable transport programmes must be replaced with permanent programmes. In addition, the 50% local authority match funding requirement for the bulk of the active travel budget must be reconsidered. It is important to give incentives to local authorities to invest their own resources in active travel but in a situation where their transport capital budgets are often sufficient to pay for only one or two new pedestrian crossings a year, they may be genuinely unable to 50% match the central government resources available for active travel.

7.10 There are a number of areas which are highlighted where funding shortfall means that local authorities currently do not pursue interventions which could contribute to improving local air quality and broader health co-benefits (e.g. loss of car parking funds). The promotion and modal shift towards active travel provides wider economic benefits too. In Denmark, for example, for every km travelled by bicycle instead of by car society gains c.1€ in terms of health benefits, with 1.1 million fewer sick days. As an example of health savings, the Odense National Cycling City project resulted in 248 million € in saved health cost.[73]

7.11 More broadly in terms of promoting every day cycling and walking, there needs to be a hierarchy in providing funding for promoting modal shift through development of appropriate infrastructure. An example is councils applying for Scottish Government funding to build long-distance segregated cycle paths. These long distance paths do not necessarily change travel behaviour for everyday trips, but are more focused to leisure rides. The latter are not unimportant but we must first encourage routine active travel.

7.12 Additionally, the notion of hierarchy should be applied to transport and mobility at a policy as well as a personal level. Connected with the issues arising around engagement and behaviour change, it is something we need to encourage: to ensure the dominant “car first” choice selection is rejected. Disadvantaged individuals with no or less choice and those already with satisfactory active or public options are already eased into that cleaner point in the hierarchy, but a more prominent policy stance and communication strategy around cleaner, healthier mode selection should become the norm.

Buses as a core service and a demand management tool

7.13 There will be air quality improvement and concurrent benefits for users and non-users if buses can run cleanly, quickly and reliably. The case for relatively inexpensive measures, such as bus lanes, signal priority and preferential access to city centre streets, is likely to be strong where there is an air quality problem. Consistent and strong enforcement is essential. Controls on older, more polluting cars and taxis should be more acceptable if there is a good bus service along the required axis. Scotland operated a Bus

[73] www.cycling-embassy.dk/facts-about-cycling-in-denmark/statistics/

Route Development Grant scheme over a number of years in the early 2000s, distributing several £Ms. A similar scheme that operated in England increased bus use on marginal bus services by more than 30% over two years, on average. There was a consensus, therefore, that there is not only a need to promote cleaner vehicles, but also to reduce the number of private cars on the roads in general. However, we note that buses need to be cleaner (Euro VI Diesel), and, as of now, it is more cost effective to provide cleaner buses than the longer term task of changing current private car fleets along many urban transport corridors.

Current bus replacement actions

7.14 Discussions with both public and private providers led to a clear picture of significant investment and improvement underway, albeit that progress is constrained by limited investment funds and capacity[74]. The industry is also already acutely aware of criticism of its pace of renewal but stresses the progress being made and planned. Technology and cost options have been considered carefully, including the work of the Low Carbon Vehicle Partnership (LCVP) and UK Government Department for Transport (DfT) projects, such as for Southampton. Specific Clean Air Zones (CAZs) such as Leeds, which appear to be working well, have been studied as exemplars and aids to learning for Scotland. For retrofit, the challenges and lessons from the Bus Emissions Abatement and Retrofit Programme (BEAR) 1 and 2 should be learned and reflected in a more effective BEAR 3. There are also short to medium term risks of displacement (as with taxis, etc.) of older, dirtier vehicles moving to already disadvantaged areas and users as fleets are upgraded, potentially worsening air quality in these areas. Nonetheless, the fleet changes already seen are bringing new and retrofitted, cleaner buses (as with taxis) onto a number of routes in our major cities and the consequent benefits can also be expected in the future. EURO VI engines in the bus fleet represent a reduction of c 80% in unit NO_x and a halving of PM output over EURO V engines, continuing the step down in emissions per unit by buses over the last decade since EURO V was introduced.

LEZ workplace parking charges

7.15 Workplace Parking Levies are being considered at Stage 2 of the Transport (Scotland) Bill. In its first three years of operation Nottingham's Workplace Parking Levy (WPL) has raised £25.3m which is being invested back into transport improvements in the city – namely the expansion of Nottingham's tram network, the redevelopment of Nottingham Station and funding the city's Link Bus Network which serves key employment site, hospitals, and Park and Ride services. Following the successful approach applied in Nottingham, results indicate that the introduction of the WPL as measured by the number of levies on Work Place Parking (WPP) has a

[74] Data provided by the main 9 bus operators in Scotland, at 17 April 2019, covering c 85% of all commercial mileage showed 1064 units now EURO VI, representing 26.8% of the fleet. Of the total of 3959 units, a further 121 were hybrids (98), hydrogen (10) or full electric, and 34.9% EURO V.

statistically significant impact on traffic congestion in Nottingham[75] and thus likely lowering air pollution levels. Whilst potentially politically sensitive, with an appropriate narrative, these approaches can clearly deliver benefits. A coherent strategic package would be required.

Park and Ride provision

7.16 Increasing Park and Ride provision alongside LEZs with charges for all (or for more polluting) cars is almost certainly the most cost-effective way to support people who have no viable alternative to car travel for the main part of their journey but cannot afford to upgrade their car in order to drive without charge into a charged zone. Park and Ride provision is more effective if it is complemented by relentless attention to minimising the effect of congestion on the bus routes that serve it. This means making sure that bus lanes and bus stops are not blocked by cars and vans, for example. Such provision should also provide appropriate charging for electric/hybrid vehicles of appropriate type and scale.

Freight

7.17 The international evidence base suggests a size reduction of the vehicles (and likewise capacity) used for last mile deliveries in urban areas as a more sustainable and efficient alternative for freight operations.[76] However, given the potential for knock on effects of increased congestion resulting from greater numbers of smaller vehicles, if a larger vehicle can be used without adverse impact, this should not be prevented in the right setting. Consolidation in this fashion reduces costs, lowers energy use and minimises use of the transport system. Electric vehicles (EVs) are likely to become the main alternative for lighter commercial vehicles, however the cost of procuring these vehicles is prohibitively more expensive than their diesel counterparts currently (though this should change in time). As well as investment in supportive infrastructure for an electric fleet, the capacity of the grid needs to be assessed in each area and upgraded where required.

7.18 There is a lack of information available on LGVs. This is important as freight transfer into urban areas is a major issue and LGV use has been increasing so fast. The Transport Working Group, whilst recognising the importance of the issue, was unable to diagnose specific solutions and hence we make no specific recommendations. Further research, and discussions with the freight and retail industries are required. Discussions with the Freight Transport Association (FTA) and some freight and distribution experts led to a view that the LGV segment, partly as much of this sector is dominated by small to medium enterprises (SMEs) in Scotland, would be slow to take up electric or hybrid vehicles – the view that the battery would be a large part of the load and appropriate vehicles were not yet on the market at affordable

[75] *Evaluating the impact of a workplace parking levy on local traffic congestion: The case of Nottingham UK,* Dale, S. *et al*, 2017, *Transport Policy*, 59: 153-164.
[76] *Sustainable Vehicles-Based Alternatives in Last Mile Distribution of Urban Freight Transport: A Systematic Literature Review,* De Oliveira, C. *et al*, 2017., *Sustainability*, 9, 1324; doi:10.3390/su9081324

prices, unless legislatively driven or strong incentives were offered. Nonetheless for distribution, urban and motorway/city edge-located consolidation centres are becoming a normal part of logistics thinking. If large or more polluting vehicles are excluded from city LEZs, how goods move into and around cities will be an issue of increasing importance.

Scrappage and mode shift support

7.19 Scrappage of older and more polluting vehicles does not have to mean replacement with new motor vehicles. The Transport Working Group noted the particularly important role that e-bikes could have in attracting people to active travel and international evidence for the increasing take-up of e-bikes.[77] Behaviour change programmes would be helped by significant incentives including season commuter season tickets and funding for other aspects of sustainable travel.

Trunk Roads

7.20 Additions to the existing Trunk Road and Motorway network should be significantly de-prioritised and ideally end within the next five or so years – other than for safety, maintenance and flow improvement reasons, and taking appropriate account of rural and remote needs. This is so that there is no further demand incentive offered, especially in urban areas, through the supply and expansion of these networks. Arguably, expansion at best does nothing to encourage behaviour change in supporting reduced emissions, and at worst increases emissions through actual and perceived continued infrastructure support, based on current travel behaviour.[78] [79] Given that analysis of the National Travel Survey shows that daily time spent travelling has remained constant over time, and vehicle km travelled have increased eight fold since 1952, it is safe to conclude that investments in new road infrastructure encourage people to travel further, and faster, by car, rather than cutting the amount of time that they spend travelling[80]. This response to new road capacity is unhelpful from an air quality point of view.

[77] *E-bikes in the Mainstream: Reviewing a decade of research*, Fishman, E., Cherry, C., 2016. *Transport Reviews*, 36(1): 72-91.
[78] We highlight that the Freight Transport Association did not support this recommendation.
[79] Dec 2024 is a critical environmental compliance date including concerning LEZ full implementation. The National Infrastructure Commission for Scotland will be making recommendations for the period from 2024 and we would expect the National Transport Strategy in its next form as well as the Investment Plans that follow will shape road network developments. In terms of the current Infrastructure Investment Plan, it would seem that the A9 and A82 project should be (largely) complete. Consideration would have to be given to dualling the A96 and potentially other intercity routes previously identified as strategic commitments. Examination of regional benefits and projects already in the Infrastucture Investment pipeline will be needed.
[80] *Does Reducing Journey Times Improve the Economy – and, if not, what are the Implications for Transport Assessment?* Rye T. and Scotney D., 2011, Paper to Scottish Transport Applications and Research Conference, Glasgow.

Recommendations – Modal/hierarchy shift

T2. The implementation of a second NTS should lead to a permanent preference for more sustainable transport modes and infrastructure investments. Serious consideration needs to be given to reductions in trunk and motorway route expansion and priority given to electric and low emissions infrastructure and services for rail, bus and goods segments. A focus on reducing vehicle numbers, supporting electric and low emission vehicles and tackling congestion issues caused by private vehicles is necessary. There should also be further and coherent, expanded support for cycle and pedestrian/active modes.

T3. Encourage the introduction of a workplace parking levy in LEZ areas. Consider use of funds generated for improvements in sustainable transport provision.

T4. Develop and communicate a Transport and Mobility Hierarchy applied to public policy and individual behaviour.

T5. Economic stimulus for scrappage of the most polluting vehicles with behaviour change focus including options for e-bikes, public transport season ticket contributions and other incentives which reduce car ownership.

T6. Consider appropriate incentives for cycle, electric cargo and other "last mile" vehicle delivery approaches and appropriate supportive infrastructure.

T7. Greatly increase bus-based Park and Ride provision alongside LEZs with chargers for electric/plug-in hybrid vehicles and appropriate fiscal charging for more polluting vehicles.

Placemaking and Planning

7.21 The Local NMF model, implemented and delivered by SEPA has proven to be beneficial in developing the evidence for the four cities (Aberdeen, Dundee, Edinburgh and Glasgow) required to implement LEZs. This level of support has had a positive impact on the development of LEZs and on the delivery of Glasgow's LEZ, although it is rather early to make outcome rather than intent and process observations at this point. This approach should be expanded to include the Regional NMF – based on the Dutch Air Quality Cooperation Programme [81]. This appears to be a very sound regime.

[81] The NSL (Nationaal Samenwerkingsprogramma Luchtkwaliteit) is a statutory programme that coordinates the Dutch government's work on air quality. It requires all levels of Dutch government to work together to carry out air quality improvement duties. The objective of the NSL is to deliver compliance with air quality standards and to ensure that development does not adversely affect current and future compliance. The NSL has created a national model of air quality, similar to the planned regional NMF set out in CAFS, however the NSL approach also coordinates the collation of traffic data, which is the big limitation to the development of the regional NMF. In addition the NSL identifies early in the planning process any spatial developments that could potential make a significant contribution to air pollution through scale and increased traffic-related effects. This

7.22 There needs to be a spatial and general land use planning framework which is robust, clear and which ensures that, among other things that "local actions" would not be allowed where they go against nationally sought-after outcomes such as improving local air quality and achieving decarbonisation.

7.23 As there is a major programme of housing development and redevelopment of derelict sites, etc., there should be a major focus on ensuring that new developments are designed to reduce emissions through good design which includes connecting up with existing bus and rail services and other sustainable options as the first choice for local travel, as a *de minimis*. "Planning by design" is critical from the start in terms of delivering a new development. Car ownership and use needs to become seen as not the best first choice and car use trends must be countered, with polluting and inefficient car journeys made less attractive (including through social marketing). This could include "filtered permeability" to ensure the most direct and pleasant routes are afforded to those travelling actively or walking to public transport stops.

7.24 Supplementary Guidance on air quality is currently simply guidance. In view of the need to improve air quality it was the view of the Transport Working Group that it should be made mandatory. This can help the Scottish Government to impose changes where local authorities lack ambition in relation to air pollution mitigation.

Recommendations – Placemaking and Planning

T8. Spatial planning and transport planning need to work together to be effective in ensuring local decision-making does not undermine national objectives for air quality.

T9. Make Supplementary Planning Guidance on Air Quality mandatory.

Public Engagement and Citizen Science

7.25 With heightened attention already during the first half of 2019 at least to climate change and LEZs there is an opportunity to engage further in 2019/20 with the public on issues that have direct impacts at the household and community level. Scottish Government, Transport Scotland and local authorities, with SEPA and HPS *et al*. could be seen to act in concert to lead clean air initiatives. For example, the issue of actual exposures and what they mean could be communicated. This could relate to bus and car in-vehicle air quality and old versus new vehicles. It could address experience at pavement level and healthier modes, segregated route options and the benefits of cleaner vehicles etc. A sustained engagement with the public over years is

results in direct requirement to include mitigation measures to maintain or improve air quality before approval can be granted. The model used within the NSL is developed and maintained centrally, built using robust traffic data, emission and air quality monitoring data. The model is updated annually to take account of new monitoring (air and traffic) data and developments/mitigation measures.

likely to be needed to explain and discuss the reasons for, and the urgency of real change in travel behaviour.

7.26 Whilst some might find it challenging, a plain speaking, direct and factual TV/web video campaign highlighting the impact of vehicle emissions on children, cyclists, bus passengers, pedestrians and outdoor space users at street level pre-LEZ etc. could be impactful in encouraging behaviour change. Urging walking to school would also have multiple benefits, for those readily able to do so. Economic and other pro-environmental choice stimuli could go alongside improved travel (e.g. lower bus fares, employer benefits for non-car users within defined areas where there are travel choices) which are economically advantageous and socially normative, as well as visible positive changes such as priority bus routes, and segregated cycle routes on roads with speed limits above 20mph.

7.27 Citizen science could become an element of CAFS 2. Citizen science and public engagement campaigns are potentially very valuable in fostering understanding and allowing citizens to make informed choices and change behaviours in relation to transport and improving air quality and health. Many campaigns are currently underway which seek to achieve behaviour change at a variety of levels and also achieve multiple benefits across different policy areas. Individual local authorities, SEPA, Living Streets and Cycling Scotland as well as Health charities are all involved in education and awareness-raising campaigns around improving air quality, carbon emissions, active travel and health, travel choices and planning, anti-idling, and pedestrianisation outside schools which seek to educate pupils and their families on the wider environmental and societal benefits of making better transport-use decisions. These campaigns should be continued and broadened to ensure the maximum coverage of Scotland's population can be achieved and also extended into new policy areas where additional benefits can be gained.

7.28 Local authorities, with a few exceptions, largely don't appear to have the resources to prioritise air pollution and communication actions. There is a need for Scottish Government support, co-ordination and funding to assist local authorities with actions, including city/town centre street closures to raise awareness of the benefits for air quality, pedestrian space and business. Edinburgh's 'Open Streets' initiative, which began on May 5th 2019 and similar events in Glasgow should provide a template for this kind of activity. Smaller local authorities do not have the funding available to establish regular Sunday street closures. Overall, there is a need to directly engage with the public on car ownership but leadership from Scottish Government is needed (see below).

Recommendation – Public engagement and citizen science

T10. The revised CAFS should have a commitment to a nationally funded and coordinated programme of citizen science and community engagement developed to improve the understanding of air pollution and how citizens can

make informed decisions to reduce their impacts on the environment and improve their health.

Leadership

7.29 Overall, managing demand is seen to be politically difficult and it is demand which largely is increasing emissions through both motorised traffic volumes and congestion. It is not however, enough to ask local politicians to act. There needs to be an informed and engaged public and clear national leadership. Then funding needs to follow logically on for increased and sustained growth in sustainable transport in order to address part of the root cause of road traffic-generated air pollution. The review therefore urges Scottish Government to give clear messages and practical advantages to the sustainable travel modes and balance effort visibly accordingly in order to deliver agreed air policy (and climate) objectives. The co-ordination of departmental effort in Scottish as well as local government needs to flow from this. Recommendations regarding integration of strategies and governance can be found in the General Recommendations section above.

Equity and Social Inequalities

7.30 There were concerns among the Transport Working Group to ensure that measures implemented do not have unintended consequences which exacerbate inequalities. Yet it remains that the poorest income groups, often with no or limited access to cars, are over-represented such as through residential location and/or occupational exposure (e.g. taxi drivers) to air pollution, yet the smallest proportional contributors to it. This may be an issue for scrutiny by the Just Transition Commission.

7.31 The proposal that not only should spending be increased on active travel and buses, but spending should be reduced on new trunk road infrastructure, which also has relevance to the placemaking work in this review highlights further challenges. It is clear from cities that have effected modal shift away from the car that they have not only improved alternatives but also made it more difficult to drive. This is also suggested later in Rachel Howell's observations in the Engagement section (See **Annex 9).**

Densification

7.32 It is also clear that creating cities of short distances and medium densities is key to significantly reducing car use. New (trunk) road investment, by reducing the time cost of driving, does exactly the opposite, and encourages people to travel further, by car – so while the areas they live in may not be polluted, they will be more car reliant for trips into the polluted areas of cities and add to overall local and global pollutant emissions. It also changes patterns of accessibility and encourages more dispersed low density development patterns at longer distances from town and city centres, thus creating a built environment that is less conducive to active travel and bus use. Emerging policy and particularly the new NTS needs to reflect this analysis.

Best Practice

7.33 A range of learning examples was identified by the Transport Working Group and are represented also in EU/EEA[82] research reports and these deserve consideration and replication where appropriate. Several inform the group's recommendations. They are presented at **Annex 7.**

Conclusions

7.34 The Transport Working Group and this review have made a number of recommendations to address the growing transport challenges, opportunities and significant emissions from transport we face. It is clear that LEZ implementation, combined with appropriate strategies for AQMAs (those already included and new ones) are a vital part of the necessary strategy for delivering cleaner air. As transport emissions are the largest component of pollution loadings in urban areas, reducing the number of vehicles is central to progress, as is both the promotion of active and sustainable options and the ultimate inclusion of all polluting vehicles in LEZs. It will also therefore be essential over the next four years that we understand what a successful LEZ[83] needs to look like and implement accordingly. This will be a matter not just of implementing best practice, but of ensuring LEZs with formats appropriate to their local issues and priorities are framed in a coherent overall Scottish framework and that appropriate interventions are applied to tackle the challenges involved.

7.35 It is also clear that the needs of urban and rural Scotland differ and the provision of infrastructure and services in highland, island and more remote communities must be tackled alongside the needs of urban areas. Signals of actual investment will be interpreted and new roads and services in some areas may be the best cost-effective way of providing appropriate mobility but in others may simply facilitate further car traffic and congestion and thereby exacerbate air pollution issues in the short-medium term. Greatly increasing public awareness and understanding as well as tackling a range of constraints will be central to achieving adequate progress. In the context of the declared climate emergency, the role of the new National Transport Strategy will be critical to leading radical improvements in mobility, in air quality and in influencing the balances of benefits, costs and hazards discussed.

[82] *Europe's urban air quality – re-assessing implementation challenges in cities*, EEA, 2019. See also **Annex 4**.
[83] https://urbanaccessregulations.eu

8. Placemaking, Planning and Local Government

Overview

8.1 The Placemaking Working Group[84] prepared headline observations for this review. The group advocated the view presented in CAFS and endorsed by the Steering Group that good quality Placemaking can and will help to deliver improvements in air quality. It was also acknowledged that these were not quick fixes and that collaborative working was required between all communities of interest.

8.2 The locus of local authority planners, the structure and multiple functions of local government and the challenges faced in engaging in this review both shaped and constrained aspects of our findings. Early limited access to senior decision makers led to useful dialogue with local authority colleagues in individual authorities and in the Convention of Scottish Local Authorities (CoSLA) and the Society of Local Authority Chief Executives (SOLACE). Our experience of engagement in this review suggests that air pollution is not currently a high priority for local government and it must move up the agenda and become more of a priority for the future. The working group made it clear, and the Steering Group agreed, that land-use planning, careful and integrated development implementation and public engagement issues lie at the heart of delivering a progressive framework for tackling air pollution. Planning affects how we live, work, shop, play and move now and will do so in the future. It must shape and support the delivery of a clean, healthy and safe environment for all. A number of related and complementary recommendations are also presented in the transport, emissions and health sections above.

8.3 There is a long history of spatial planning and design in Scotland and early leadership, from those such as Sir Patrick Geddes, the Edinburgh based founding father of modern Urban Planning, has been recognised for a century. In modern terminology we would probably refer to this as placemaking, behavioural change and nature-based solutions. It means working collaboratively across professions and communities to identify the best place-based solution for the issues that we face.

8.4 Taking a long-view, it is evident that many of the challenges we face in delivering air pollution improvements, especially in our towns and cities, result from the inertia and frictions of past economic geography, providing us with an inheritance of built environments and road and pavement layouts, dynamics, infrastructure and substructures and adjacencies. Much of that also shows the dominance over the last 120 years of the car, lorry and bus and the internal combustion engine driving them. There is even evidence of the role of draught horse and first generation tram in some locations. The cumulative impacts of these modes and telecoms, electricity, gas, water and other infrastructure interventions is also frequently a constraint and a disruptor as well as a service deliverer. These various inheritances can to a

[84] Membership of the Placemaking working group can be found in Annex 2; also see the full *Placemaking Working Group report*.

degree be adapted and improved but, especially if we wish to address our heritage as well as costs, and the impacts of disruption, constraints abound. Only with wholly new build do we have the opportunity more comprehensively to address improvements by designing them in. Unless effectively future-proofed, even these may prove short-lived successes.

8.5 Section 7 in CAFS set out some of the significance and dimensions of placemaking, essentially the way we plan, design and manage our towns and cities. The role of greenspaces was clearly identified in and around new developments as resources, as buffers and spaces for recreation, active mobility and nature. It was seen as imperative that new developments be designed to better manage vehicles in our towns and cities, generating less traffic, linking to bus, walking and cycling routes and wherever possible prioritising active travel over vehicles. Clearly we have opportunities to get this more right in all new developments but large challenges remain when it comes to adapting existing places to contemporary and future needs and priorities. If we get placemaking right, we can tackle air pollution, create better, more sustainable places and contribute to better, healthier lives and higher amenity and improved conditions for work, life and play. This in turn makes locations more attractive for business too.

8.6 In CAFS, arguably, the main deliverables connecting environment, transport emissions and place were the modelling of air quality for the four main cities, and (although not itself a deliverable of CAFS) the Programme for Government (PfG) commitment to LEZs. This review has concluded that a further focus on placemaking is still, and urgently, necessary. The national and international policy context to the recommendations that follow can be found in **Annex 8**, with further detail in the placemaking Working Group's report[85]**.**

Creating Places, the Place Standard and the Place Principle

8.7 Creating Places[86] is the Scottish Government's policy statement on architecture and place, published in 2013. It contains a commitment to develop the Place Standard assessment tool, which will be the hallmark of well-designed places. The purpose of the Place Standard is to maximise the potential of the physical and social environment to support health, wellbeing and a high quality of life. In order to achieve this, it provides a framework[87] for:

- Evaluation and improvement of new and existing places;
- Structured conversations through which communities, the public sector, private sector and third sector work together to deliver high quality places;
- Consistency across Scotland in the delivery of high quality, sustainable places that promote community wellbeing, and more positive environmental impacts;

[85] *Placemaking Working Group* report
[86] *Creating Places – A policy statement on architecture and place for Scotland*, Scottish Government, 2013
[87] www.placestandard.scot

- Maximization of the contribution of place to reducing health inequalities; and
- Consideration of social aspects of place alongside physical.

8.8 As part of the original Placemaking workstream for CAFS, the use of the Place Standard tool to initiate conversations around air quality was piloted in Glasgow, Edinburgh and Crieff. The pilot was led by Planning Aid Scotland (PAS) and a full report of the findings is available[88]. An air quality technical version of the Place Standard tool was created by shifting the main focus to "improving air quality". The prompt questions that sit under each of the tool's headline questions were adjusted to bring air quality and health to the fore. The intention was to enable better conversations between communities of interest that would lead to the identification of solutions that went beyond the normal environmental health or transport solutions. The pilot recommended that the Place Standard was a good tool for starting conversations about air quality and it showed how thinking about the issue in terms of 'place' can result in a more holistic conversation. The review of the Place Standard, which is currently ongoing, will take on board the recommendation in the report.

8.9 In April 2019 the Scottish Government and CoSLA agreed to adopt the Place Principle[89] to help overcome organisational and sectoral boundaries, to encourage better collaboration and community involvement, and improve the impact of combined energy, resources and investment in Scotland's regions, cities, towns, and neighbourhoods. This provides a good basis around which to frame the placemaking aspirations of the revised air quality strategy for Scotland.

8.10 Some of the recommendations and suggested deliverables emanating from the Glasgow Connectivity Commission[90] and the Horizon 2020 (H2020) Connecting Nature project[91] provide inspiration for the way forward to identify actions that are place based; that can improve air quality and shift the focus from traditional transport solutions. There may be merit in all of Scotland's cities and larger towns looking at a similar connectivity and integrated place based planning approach, factoring air pollution management into their approaches.

Evidence Gaps and Priorities for action

8.11 Placemaking actions as well as others described above are fundamental to delivery of LEZs in the four big cities by the end of 2020. We appear to know enough, subject to delivery commitments to take these forward urgently and effectively. Focusing on these LEZs is therefore a clear and achievable priority. Given the intended benefits and the legal and policy dimensions, they must come at the top of the recommendation list. The

[88] *CAFS Project, Place Standard Air Quality pilot*, PAS, 2018
[89] *Place Principle, introduction*, Scottish Government, 2019. See also **Annex 8**
[90] www.glasgow.gov.uk/connectivitycommission. See also **Annex 9**/ the full working group report
[91] https://connectingnature.eu/ See also **Annex 9**/ the full working group report

second NTS is also clearly a framework for identification of priority deliverables.

8.12 From a placemaking perspective, other supporting dimensions also come into play. Areas of multiple deprivation, where transport poverty adds to existing disadvantage, identifiable in SIMD data; community engagement generally; mobility planning for all city and wider Scotland, including rural, island and remote users; refinements to development planning to support placemaking that address air pollution and mobility objectives – active and sustainable option "design-in" as well as actions to address emerging pollution sources such as woodburning stoves, etc. These all require policy and practice guidance refinement or development and narratives for leaders, staff and the community. Some of this will require establishment of baseline knowledge in order to target effective interventions and it is in some ways surprising how poor the knowledge appears to be of the air pollution issues in some areas.

8.13 There are also increasing examples of good and less effective placemaking effort, with calls (and responses) for design standards and guidance to improve placemaking approaches. For example, the Improvement Service produced *Place-based Approaches to Joint Planning, Resourcing and Delivery: An overview of current practice in Scotland*[92]. Whilst not a systematic digest of good and bad examples, which would be very useful to have, it is an identifiable part of what we should in future assemble to guide better practice.

8.14 Future policy and practice guidance for projects in planning processes and facing assessment could also consider the current discussion on revisions to Health Impact Assessment (HIA) guidelines. For example, Worcestershire Council developed a toolkit[93] taking on aspects of equalities assessment and the advocacy of its use in pre-master-planning work. Paralleling Strategic Environmental Assessment (SEA) in some respects, this could ensure or at least encourage the consideration of health and environment quality for infrastructure, transport and use planning and design work, especially in cities.

8.15 There is also continuing creation of guidance at the national and local level relevant to planning for better air quality, such as in Perth[94]. Whilst place and economy are well flagged in some recent policy, and a link between public health and public place is also sometimes cited, there are also examples where air quality and planning are not yet seen as fundamentally and causally connected in policy making[95].

[92] *Place-based Approaches to Joint Planning, Resourcing and Delivery: An overview of current practice in Scotland*, The Improvement Service, 2016
[93] *Health Impact Assessments in Planning Toolkit*, Worcestershire County Council, 2016
[94] *Supplementary Guidance: Air Quality and planning (consultation draft)*, Perth and Kinross Council, 2019
[95] *Planning, economy, place: literature review*, Scottish Government, 2019; *Public Health Priorities for Scotland*, COSLA, 2018

8.16 During this review, members have considered a range of anecdotal examples of developments. A systematic assessment would clearly strengthen our impressions but we have seen new developments emerge, since the CAFS strategy was published, that do not have bus routes or improved traffic management or any street or path provision for active travel and connection to existing – or proposals for new - public transport options. There are also examples of new developments with clear priority for more car parking, not even including significant bike, shelter, solar covers or e-power (charging) facilities. To have gained planning consent, it is assumed that these developments are consistent with development plans and policies. This suggests that these plans and policies need to be the urgent target of change to help deliver pollution and health objectives as well as development ones.

8.17 Where developments were approved some time ago and are only now being built, there should be a need and trigger to revise these plans to take account of national policy as well as local air quality/LEZ status and other contemporary strategic priorities as well as some consideration of future-proofing design standards. Some additional placemaking perspectives can be found in **Appendix 8.**

Conclusions

8.18 The achievement of clean air will be much easier if planning policy and approaches to placemaking are more holistic and integrated, both nationally and within local authorities. Policies also need to be reflected in actual planning decisions. They need to reflect better how we live, what we value and how we approach mobility, health and environmental quality as well as the utility and quality of our living, work and recreational spaces in future. This requires the active integration of planning, transport, environment, health and economic policies at policy making and implementation stages. This appears, despite some good examples, to be some way off.

Recommendations

8.19 The Placemaking Working Group's recommendations focused on further research and developmental effort to increase awareness of the pressures and impacts of air pollution amongst planners, local authorities and other stakeholders, and how these could be mitigated and reframed in future by placemaking approaches. These recommendations are somewhat less mature than others in this report and a core observation is that a deeper, multi-disciplinary and delivery-focused approach is urgently needed. It is also noteworthy that local government colleagues, in a response to the Infrastructure Commission for Scotland[96], made a number of connected observations, with which this review would agree, amongst which were:

- the need for infrastructure skills and experience to be engaged in the work;
- a longer term planning time horizon, beyond 30 years;

[96] Submission from a meeting of SOLACE and others responding to the Infrastructure Commission for Scotland's Call for Evidence. https://infrastructurecommission.scot/page/call-for-evidence

- digital and smart technology focus;
- priority for maintenance and renewal of key existing rather than new infrastructure (transport, buildings and utilities);
- an appropriate and sustainable funding model;
- the need for a zero carbon focus and steps to adapt to new energy models;
- plans for removal of redundant infrastructure;
- proper fit with development planning;
- better use of planning tools;
- integration across transport modes;
- a constructive approach to rurality and connectedness;
- a strategy for international connectedness;
- enhanced focus on and investment in resilience;
- fit with health strategies and integration of these and active strategies across LA boundaries;
- tackling skills and demography issues in the sector;
- public safety priorities better addressed; and
- a more robust governance approach.

P1. Overarching emphasis on Placemaking

Urgent consideration by the Scottish Government and local government, involving all relevant functions, of how to achieve a pragmatic and integrated strategy for placemaking in policy-making and implementation generally. This must address the question of how placemaking works in practice, identify and acknowledge its role and drive Scotland-wide implementation. Tackling rural and urban needs, population growth targets, active and improved mobility generally and improved public health as well as environmental outcomes requires a more visibly interconnected and effective strategy. How therefore in this case does the Place Principle align with CAFS and deliver future improvements? This should also engage different professions and promote increased partnership working, identify actions on air quality that are placemaking based and embrace the outcomes from the test of the pilot Place Standard for air quality.

P2. Integration across Local Government

We urge local government to look at its own functions and consider how to ensure better recognition and integration of the different disciplines and inter-connected policy and delivery areas where stronger alignment and better engagement would more effectively and efficiently deliver air pollution reduction actions and benefits. This would include assessing legal drivers and policies, national, regional and neighbour “fit”, design capability, strategic and development planning and building control functions as well as environmental and public health, economic development, transport planning and service operation, environmental monitoring, function skills and training, etc. The existing linkages between policy areas and the role of National Planning Framework (NPF), NTS, Place Principle and the individual authorities’ priorities need to be seen in the round.

P3. Local Authority Air Quality Performance Specifics and Knowledge Exchange

A report on current air quality policy effort in local government should be prepared. This should address how many councils have air quality policies within their Development Plans or other statutory documents, how many City Deals have air quality objectives and initiatives and what are they, do they align with and impact on regional policies and Scottish outcomes and what has been the impact of pilot air quality training for planners and should this be rolled out to other partners and the community. It would also be very useful to have case study examples of successful approaches and actions and where interventions have and haven't worked.

Additionally, it would be useful to have and share successful initiatives tackling air pollution issues across Scotland, from AQMAs, for example, and in relation to nature based solutions. Approaches to mobility behaviour motivations as well as any cost-benefit assessments of interventions would be very useful for future policy development and learning. This latter might benefit from Scottish Government and SEPA inputs.

P4. Local Government Delivery, Governance, Performance and Communications

An overarching plan for how local government engages, delivers, measures progress and gains credit for delivering change on air pollution issues is needed. It is clear that local government has several key delivery roles in relation to both placemaking and tackling air pollution. Successful delivery will be easier with a clearer understanding and statement of the services involved and the services we need as well as the behaviours we wish to influence and change. It is also clear that local government faces a range of pressures around competing demands and limited resources. A delivery plan would help manage delivery and expectations. A communications strategy, setting out what will be delivered, how and where would engage the public and increase outcome ownership.

Placemaking and air pollution in the broad Local Government context.

8.20 Looking specifically at local government, there are emerging observations relating to placemaking that are required to ensure air pollution strategies can be effectively developed and delivered. These relate to functional connection, alignment and integration, and specifically to how planning actually works, the various policies to be implemented, delivering LEZs, tackling existing and continuing AQMA challenges and ensuring data collection, monitoring, reporting and regulatory functions are discharged and coherent in deployment, operation and impact. Aspects of achieving this relate to leadership, systems, skills, resources and governance and this will be pursued later in this report, but some overarching recommendations are made below:

Recommendations

LG1. Realising effective Placemaking in practice

Much of which relates to a higher degree of coherence in the land use planning system in strategic and development planning terms combined with aligned development management/control processes that deliver national, strategic and development plan policies effectively on the ground. Policy needs to be better and regulatory roles need to fit with those. Commitments to, and processes to achieve, integration will be needed.

LG2. LEZs

The four first round LEZs need to follow legal and policy timetables and be in place and delivering within 4 years. Visible commitments to this and evidenced delivery will be required. Where planning and bus management effort is required, this needs to move as quickly as possible. And for business as well as the citizen, Scotland-wide coherence in the systems implemented will be needed. Some of this connects directly to LG3.

LG3. Local Air Quality Management

Some sectoral, organisational and environmental media issues come together under the umbrella of local government LAQM powers and roles. Where AQMAs have been declared, these need to have active plans that deliver the intended outcomes within a reasonable timetable. Some have existed for a considerable time without improvement. When done they need to be revoked. If not delivered, powers of intervention by SEPA/SG can and should be applied. Also issues of permitted development and domestic combustion and public health, etc., as well as identified increasing pressure from wood burning stoves, for example, or previously approved developments that have not yet been implemented but where no public transport or active travel provision was made, highlight specific policies that may require to be addressed for local air quality. This of course then relates back to LG1.

LG4. Robust monitoring and reporting

A review of air quality monitoring may be needed to ensure that we are consistently gathering meaningful data in a uniform and appropriate way to meet current EU and Scottish/UK requirements as well as being future-proof in both a Brexit context and in relation to such future Scottish Government environment and climate strategy as may apply. All monitoring of the pollutants we consider important needs to be done at the right places in the right way at the right time. We then need both to use these data for reporting and modelling work for LEZ and AQMA planning and delivery as well as for compliance and public information purposes.

9. Engagement, Behaviour Change and Public Information

Overview

9.1 This review did not have the opportunity to conduct research or discussions on engagement. Some relevant materials are being gathered by Transport Scotland. Further structured work on this subject seems highly desirable and the urgent need for it is included in the General Recommendations at the head of the report.

9.2 It is widely accepted and identified in the CAFS strategy and in EU policy and public surveys that public information, awareness and behaviour change are inter-linked and essential for the delivery of long-term change in the environment generally and air pollution specifically. The delivery of better information is one matter, the achievement of behaviour change potentially quite another. Input received from Transport Scotland on levels of public awareness of LEZs, and academic insight into factors influencing behavioural change can be found in **Annex 9.**

9.3 Some behaviour change is already taking place. And some market signals are very effective in triggering responses. Some bus routes and bus pass systems are very popular, active travel is growing, electric and hybrid vehicles are increasing. Suitably nurtured these can develop further. But tackling the use of the car, generally and especially for urban journeys, will be necessary. Despite their cleaner image, electric vehicles still produce particulates from brakes and tyres etc., use rare earth inputs, have energy and life cycle requirements, contribute to road wear and congestion and compete with public options.

9.4 Engagement strategies will require to be carefully constructed around assessing aspects of demand from potentially very diverse users as well as shaping supply and influencing what shape future demand could take. Direct regulation and demand management tools - banning certain vehicles from certain urban routes and locations, route and space use charging, as well as parking limits and removing vehicle provisions altogether from streets and new or existing housing and offices, combined with active and public transport provision will likely be part of a successful model. Clear and strong leadership is needed for the necessary transformational change and this must aim to prepare the public for this and engage them in how it is to be achieved. This work will be vital.

Recommendation

B1. Specific demand assessment and behavioural research should be commissioned. This should then be integrated into strategic mobility planning and delivery effort as well as with work to establish how the public would wish to engage in future developments. This could be integrated too with efforts at developing an engaged approach to placemaking.

10. Governance

Overview

10.1 A paper for this review highlighted the complex nature of EU, UK and Scottish legislation and policy which provides the framework for managing air quality in Scotland.[97] It also looked in detail at the Local Air Quality Management (LAQM) system which is the framework under which local authorities manage air quality. This review concluded that some important elements of this system have been *"less than successful and conducted in an incoherent and uncommitted fashion across local authorities."*

10.2 There was, nonetheless, clear evidence from outwith and within the local government sector, that there has been, especially in more recent time, recognition of the importance of tackling air pollution and that many important elements of doing so, lie within the policy scope, powers, functions, capabilities and resources of local government. It is also worth noting that some issues impacting on air quality lie outwith local authority control: Pollution Prevention and Control (PPC) activities, trunk roads and transboundary pollution for example.

10.3 Helpful discussions have been had with representatives of CoSLA and SOLACE and their support in considering and framing implementation actions is acknowledged and appreciated. It is clear that better engagement within as well as between authorities and with fellow bodies involved in tackling air pollution will be necessary and how this is achieved and governed matters.

10.4 Scottish Ministers, in the current devolved UK context and irrespective of Brexit, given Scottish Government's commitments, are responsible for EU Directive requirements' compliance and a case still exists for the creation of a clearer and more integrative framework for all air pollution issues to ensure both effective implementation, the delivery of clean air and the avoidance of governance gaps.

LAQM governance gaps

10.5 As observed earlier, it became apparent during the review that air pollution is not currently treated as a priority. Whilst some officers and elected members clearly do appreciate the issues, there is a clear need to give a much higher priority to air pollution and to the nexus of policy and delivery areas in which local government is involved which relate to air pollution. We welcome such engagement as we have managed to garner but this does identify and amplify a major governance gap at this stage.

10.6 Local authorities are legally obliged to characterise air quality in their area, designate problem areas where pollution breaches air quality objectives (AQMAs), develop Air Quality Action Plans (AQAPs) for dealing with air quality problems in the AQMAs and report periodically on progress. However

[97] *Air Quality Policy, Legislation and Governance in Scotland*, Scottish Government, 2019;

local authorities have no legal duty to meet air quality objectives, only to demonstrate that they are doing all that is reasonably possible to work towards them. This is because some pollution sources are not within direct local authority control (e.g. Transport Scotland-controlled trunk roads and SEPA-regulated installations) and because not all AQMAs are declared due to local issues (e.g. Grangemouth). As a result, in legal terms, continuing failure to meet air quality objectives, whilst arguably a systemic failure, is a failing of Scottish Ministers not of the local authorities. In hard financial times a busy local authority Chief Executive is understandably likely to prioritise those things which s/he is legally obliged to do and mostly ignore the things which are 'nice to do'.

10.7 SEPA has, as indicated previously, significant but somewhat contingent reserve powers under the Environment Act 1995 to compel local authorities to act (with the agreement of Scottish Ministers). SEPA certainly appears to engage in encouragement and persuasion, but the powers to compel action have never been used. In part this results from the framing of the legislation at present. Currently, SEPA should ensure that LA duties are fulfilled. As those duties are to "work towards" objectives, this is vague and readily contestable. Were this expressed as LA's *having to meet* air quality objectives as set and agreed in specific and regularly updated plans, this could readily be progressed more effectively.

10.8 Our review of this system and specifically the LAQM elements, suggested a number of specific improvements. These are aimed at improving the overall effectiveness of the system through streamlining and to reduce where possible the burden on local authorities, maximise available funding and its impact and enable high quality data to be used to provide stronger evidence for necessary interventions. Some improvements will require additional directions from Scottish Ministers and some may require improved or additional guidance:

- Making the LAQM system's air quality objectives apply in all places with public access (as opposed to places where the public are "regularly present") would increase the level of health protection delivered by the system and simplify communication of air quality issues. This could add a significant burden and may require an amendment to the Air Quality (Scotland) Regulations in order to be enforceable.
- The annual progress reports (APRs) should be revised to include much more systematic reporting of progress against AQAP measures, with agreed, specified timelines
- Reporting on combustion sources, through APRs, should be expanded to include all sources, which would provide significant benefits, especially given the distribution of Medium Combustion Plant and increasing domestic sector pressures for example.
- A standardised format and defined timescales for delivery of actions for AQAPs would be a big improvement, with a two year deadline to revise current plans into the standard form.
- This standard format would require inclusion of specific measures on transport where it is a significant contributor to non-compliance, and a

requirement for a justification of their uptake or exclusion. This needs to be informed by knowledge of which types of vehicles are causing which problems, which in turn requires high quality traffic data.

- These plans should include a target date for compliance with air quality objectives, to be agreed with the Scottish Government and SEPA.
- These plans to be updated if a local authority has committed to a LEZ.
- Local authorities should expect to be held to account for delivery of the actions in their plans.
- To complement this, Scottish Ministers should target existing dedicated LAQM funding to measures which are agreed in AQAPs, and which demonstrably contribute to meeting the objectives of the AQAP, as well as to continue monitoring for an appropriate period once air quality objectives have been met.
- Scottish Government should direct SEPA to use its reserve powers under a broad remit[98], allowing for clarity on what is sanctioned and swifter action when it is necessary.
- Ideally, future legislation should place a statutory duty on local authorities to deliver the actions in their Air Quality Action Plans and this should be complemented by specific commitment to state and adhere to delivery timetables.

Governance of the new Air Quality[99] strategy

10.9 There is a major governance gap for future air quality strategy delivery at the Ministerial level. The responsibility for delivering on air quality strategy rests with the Cabinet Secretary for Environment Climate Change and Land Reform (ECCLR) but almost all the actions required sit with the Cabinet Secretary for Transport, Infrastructure and Connectivity (TIC) and Transport Scotland and the Minister for Local Government, Housing and Planning. And many of the benefits of success as well as key aspects of advice on the pressures and impacts of air pollution rest with the Cabinet Secretary for Health and the Public Health Agencies. On LEZs there are regular meetings where the Cabinet Secretaries for ECCLR and TIC co-chair discussions with the local authorities. More generally, the ECCLR Cabinet Secretary has held a number of meetings with a range of Ministers on air pollution.

10.10 As this review has made clear, Health, Planning and Local Government, including environmental and public health portfolios are strongly relevant as well as transport and environment. But there is no formal structure, below the level of Cabinet, where Scottish Ministers could regularly discuss progress on CAFS. In addition, it is not clear what reports Ministers receive on progress with the current strategy and there is no commitment to any kind of integrated, programmatic reporting to Parliament addressing the scope of this review.

[98] Current powers emanate from EA95 and require Ministerial permission. Delegation of this power would streamline procedure and hasten improvement.

[99] Some have already dubbed what needs to happen next as CAFS2. This is possible of course but a simpler or new brand might arguably be better.

10.11 The CAFS GG was misnamed. It certainly did not 'govern' the delivery of the strategy, since it had no governance or decision making powers nor powers to compel action. Nor was representation always sufficiently senior or authoritative. It might better have been called an 'Advisory Group' as it allowed a range of CAFS stakeholders to discuss issues at length, to share information at officer level and seek inputs from a wider partnership. Actual decisions regarding delivery of actions, however, were mostly made elsewhere, within individual CAFS deliver organisations with virtually no feedback loop; something members of the Governance Group complained of, at least, as an issue of lack of transparency.

10.12 Some progress reporting was attempted at the CAFS GG but the Group had no power to do anything if progress was insufficient, which led to the resignation of two of the Group's external members. Given the potential disconnects in authority and the need for different parts of government and local authorities to work together under a voluntary framework it is perhaps surprising that so many of CAFS' commitments have been delivered.

Recommendations

G1. Implement the suite of improvements suggested above on LAQM arrangements

G2. The useful experience of the ministerial group on LEZs is built on with the establishment of a broader ministerial group meeting regularly to oversee the delivery of the new air quality strategy. This group would ideally be led by the Cabinet Secretaries for ECCLR and TIC (and periodically Health and other relevant portfolios) as well as appropriately senior local government representatives[100] and would be attended by senior officials from relevant areas (e.g. health, planning, etc., as appropriate) and SEPA, and external advisors, similar to the model of the apparently-defunct Climate Change Delivery Board. Other Ministers would be invited to attend as appropriate and the existence of the group should not discourage the kind of ministerial bi-lateral meetings that have taken place from time to time. Crucially, this oversight model would be intimately connected to and served by an appropriately resourced officer body to bring and take advice and action reports as well as escalate action delivery and performance issues to the ministerial group.

G3. If a group similar to the current CAFS GG is to continue it should be correctly called an Advisory or Working Group and adopt a clear remit, including a description of how its advice is conveyed to Scottish Ministers and/or serve as described at G2. The group will need a clear remit, clear performance targets and KPIs and appropriate authoritative membership, reflecting the stakeholders needed, not least representation from across the powers and responsibilities of local government.

[100] Given recent developments as well as legitimate locus, SOLACE and CoSLA engagement would be vital. This could be supplemented too by periodic input from REHIS, SCOTS, HOPS, etc. as well as those best placed in the reformed Public Health Scotland arrangements.

G4. Given the multi-departmental and multi-organisational dimensions of policy and implementation responsibility, there may be merit in considering independent chairing or appropriate overall accountability for progress of these groups. This would help to address the question embedded in the recent and current governance discussions on the environment and other policy roles post-Brexit. Ensuring effective cabinet level leadership, authority and energy is critical. So is transparency, independence and public accountability. The matter of who guards the guards is always important but, even with parliamentary accountability, without EU Commission or the Court of Justice of the European Union (CJEU) as ultimate overseers and arbiters of performance and remedy, the question becomes yet more serious. Independent oversight would appear desirable, however it is accomplished.

Performance Reporting, Management and Accountability

10.13 The quality of performance reporting achieved during the CAFS 2015-2018 period has been high, with relatively accessible and well-presented documents. The main issue is what was done with the content. The annual performance reports have been visible and useful but they have not led to particular interrogation or detailed policy or strategic organisational responses in all the affected bodies, shared and owned by all. We believe this has to change. The revised model described and recommended above at **G2**, directly serving the accountable ministers, would focus minds and actors to deliver. It also ensures simple line of sight from strategy, to planning, through delivery action to accountability.

10.14 Performance reports, quarterly and annually need to be owned by the various partners and delivery and outcome target holders and an action response must be visible as a cross public service result. The simpler stronger and more accountable the targets the better the results and the more likely both improvements will be visible but that they will also be taken seriously and owned.

10.15 If the approach detailed above is followed, effective management and the robust holding to account of those responsible becomes easier. If these latter are taken seriously, then reporting becomes meaningful and important. It can also then be fitted into corporate, team and personal delivery and developmental targets and plans and seen to be what matters and what gets delivered.

Resources

10.16 The Review Steering Group and Working Groups have not costed the various recommendations made at this stage. For good reasons. We believe that the policies required to deliver genuinely clean air in Scotland require partnership working, high-functioning, simple and powerful oversight and delegation, re-energised monitoring and reporting, directive and directed delivery, asset renewal, market tools to influence and shape both demand and supply, delivery of existing commitments from various government, local authority, agency and private operator budgets and also a range of actions

and behaviour changes from businesses, the public service and the private citizen. Some behaviours involve spending less and differently. Some require spending more and then delivering huge savings in other portfolio and budget areas. A systemic and joined up approach is needed. There is little in what we have described and recommended that does not deliver not only long term substantial savings in health (sickness) costs but delivers countless benefits in terms of economic efficiency, amenity, health (wellness) and quality of life. That is the real benefit of a progressive, integrated and energetic strategy for tackling air pollution and achieving a transformed mobility approach in Scotland.

Journey from here

10.17 Given the findings set out above and the interconnectedness of several aspects of the strategy needed to deliver reduced air pollution alongside the many other policy imperatives currently in play, from addressing climate change issues to tackling inequalities, ill health, obesity, poverty, housing, etc., the review has found that the existing CAFS strategy should continue but needs to be both more integrated and more effective in detail. There are many findings and recommendations contained here and they differ somewhat in size, complexity, possible legislative needs, resource requirements and so on. Several recommendations overlap and come together to describe a suite of proposed actions that should lead, we believe to significant further improvements in air quality and resulting amenity and health benefits.

10.18 If these are accepted, a framework for the new or revised strategy should seek further to prioritise them and to establish very clearly the measures and conditions required to secure them and demonstrate that they have been progressed and the outputs and outcomes sought, delivered. Aspects of those requirements could also be addressed as part of a wider consultation on this report.

11. Conclusions

11.1 This review has established that air pollution is a complex and serious continuing issue and significant steps towards taking it seriously have been made.

11.2 There is also clearly much more to do to achieve the desired outcomes across Scotland that ensure public health is comprehensively protected and a suitably integrated approach to transport, environment, planning and health is taken. This approach is essential for the health and wellbeing of society, its mobility for economic and social needs as well as for the delivery of the high standards of quality of life that we all expect.

11.3 Scotland is generally performing quite well by EU and global comparison, with ambient and regulated pollution levels generally continuing to fall. The rate of decline in pollution is now reducing and this suggests that the easier actions or at least those deemed priorities, urgent and important have been taken and we are now dealing with the harder issues, where interventions may be more expensive, disruptive or unpopular. To achieve the progress and improvements sought, and some are still required in legal terms, these interventions may also be necessary. How we deliver them and how quickly and extensively we progress will now be critical.

11.4 Key air quality attributes are largely EU compliant and some are already below WHO recommended levels.

11.5 There are however localised poor quality areas and particular challenges around: transport pollution, provision, constraints, and NO_x and PM performance; and ammonia levels relating primarily to agriculture; and the pace of change in some areas, particularly public behaviour around the car, given options available and perceived.

11.6 Given what we know and continue to learn about the harm represented by breathing polluted air, the main question is how much lower should our target levels for pollutants be and how quickly do we wish to choose to get there. We have failed to deliver elements of the suite of relevant EU and domestic standards currently in place. Meeting these would and should be an urgent priority for Scotland.

11.7 It is too early to make meaningful observations about the impact of LEZs but valuable lessons are being learned for the second wave cities from Glasgow's early experience. Potentially radical plans for Edinburgh became visible during this review and its LEZ should achieve significant improvements. However, a final plan for the city is not yet clear and efforts have been made that could limit its effectiveness and displace serious pollution impacts. It is also clear that our four major cities are all different and require bespoke solutions while not confounding the need for and benefits of coherence, especially for the goods sector and for public understanding and overall delivery of improvement generally.

11.8 The air pollution and transport data on which key conclusions can be reached and upon which modelling to design and manage LEZs and other interventions is based are however less than perfect and require at least some modification to improve their robustness and utility. There then needs to be more effective use of data and modelling, based on a. the need for and quality of continuous traffic monitoring data, and b. improved air pollution monitoring.

11.9 There are questions to answer on the design and implementation of LEZs. This includes decisions under consideration to exclude any of the main polluting vehicle categories. It is critical that the main polluters are prioritised and that careful consideration is given to the nature and consequences of the restrictions applying, and their fit with AQMAs, including ensuring a positive impact of interventions overall.

11.10 CAFS appears to have had a positive impact in raising the profile in public policy and the wider consciousness of air pollution. It has begun the process of integration of the elements of a genuinely joined up strategy to tackle air pollution. A significant proportion of the original actions has been delivered or is progressing to the 2020 target dates. Progress has been slower however in several areas and needs more focus and energetic implementation.

11.11 Specific problematic areas in relation to urban NO_x and PM, and locations where congestion is prevalent and older diesel engines still dominate, require to be addressed by reduction in vehicles, improving fleets and better management of access and flow of all motor transport. Improvements in some areas should not lead to deteriorations elsewhere, either through fleet “cascade” effects or displaced congestion or pressures.

11.12 Active transport and overall mobility fit still clearly require significantly improved public engagement, behaviour change and improved options and information. In the shorter term, management and information alongside planned and necessary vehicle changes can help if vehicle numbers do not increase. In the longer term spatial planning and mobility provision needs to be significantly improved.

11.13 There is constructive engagement between stakeholders but more focus is needed in order to ensure effective delivery in areas of overlapping operational and performance management areas. Local government monitoring and transport management and spatial and transport planning need to fit more effectively with the responsibilities and operational activities of Transport Scotland and SEPA. Visible and politically empowered as well as simpler partnership between the key players is needed in policy and operational areas. When the next plan is clear, it needs to be owned and understood by all delivery bodies and responsibility and accountability for the components must be equally clear.

11.14 There are challenges around the leadership and management of transport context: achieving modal shifts; the speed of cleaner engine uptake;

counteracting car numbers increasing and sole occupancy; tackling congestion, not least at specific pinch-point locations and reducing it as well as managing effects; greatly enhanced infrastructure and support for goods and active segment options, etc. It is to be hoped that appropriately aligned, constructive and complementary arrangements and actions will be forthcoming from the imminent NTS, thereby maximising fit with and impact of the recommendations of this review.

11.15 The fact that, almost unique among air pollutants, ammonia levels have not fallen suggests that interventions are now urgently required to tackle issues in the agriculture sector. This concerns the need to ensure better management of fertiliser application and management in relation to dairy and beef as well as pig and poultry units. This matters generally but is most acute where these may be located close to and upwind of urban areas, receptors and monitors and may also act in conjunction with particulates to exacerbate pollution issues. Tackling these might also address odour complaints. Modifications are necessary to agricultural management guidance, to training and support, to basic animal housing and management practices and to the handling of wastes, manures, and fertilisers.

11.16 It remains clear that poor air quality damages health and there is increasing evidence of population-level and specific impacts that require to be addressed. Evidence is growing but causation is hard to prove, given the multi-dimensional nature of the air we breathe and the other pressures on health we are all exposed to. There are philosophical and practical issues around precaution versus certainty on causation around health effects but precaution supports action on the basis of current evidence. Care will be needed to develop the evidence base and public health policy and messages to be deployed, including the strategy for sensitive receptors. Reducing levels of pollution, especially PM and NO_x remains the priority. Where possible active transport users, pedestrians and vulnerable groups should be separated from areas of exposure risk.

11.17 Actions on any individual component of our recommendations need to be taken in the broad context of public policy. This means specifically, for air pollution actions, that they are planned in conjunction with climate management and public safety and resilience effort, for example, as well as around higher amenity approaches for recreation, work, commercial and retail activities.

11.18 Air pollution appears disproportionately to affect the already disadvantaged and vulnerable. Inequalities appear to be compounded in that existing deprivation and low access to economic opportunity, combine with poor health and poor activity levels, poor access to affordable mobility and likely exposure to air pollution. These component issues necessitate an integrated strategic approach.

11.19 There is a clear need to help with public choices by means of more and better public information on pollution and transport options. Over time, tackling the cultural issues around modal shift and behavioural change,

including greatly enhancing understanding of effective, tolerable and affordable incentives and disincentives seems crucial.

11.20 Further effort and delivery is needed on the design and increased utility of the public realm - planning and designing our way to a cleaner and healthier environment, maximising safety, amenity and ease of movement as well as minimising exposures especially for sensitive receptors.

11.21 Effort is also required to tackle governance and performance management – who does what, is held responsible for delivery and collaboration, and how do we know how we are progressing. Existing structures are overly complex and inadequately accountable and effective.

12. Next Steps

12.1 It is hoped that the Scottish Government will take on board the findings of the review contained in this report and take forward the conclusions and recommendations into a public consultation on actions to be taken for the next stage of Scotland's Air Quality Strategy in the interests of everyone in Scotland.

12.2 It continues to be clear that air pollution is a complex, multi-dimensional problem and there is in the short-term no magic solution to all the challenges involved. Operational LEZs addressing all vehicle types and planning and implementation of integrated public and active mobility options will enhance mobility, amenity and health conditions. Careful monitoring which then results in active interventions to address poorer performance will be necessary and should be expected.

12.3 Whilst good progress has been made and key elements of CAFS have been effective, there is a lot to do, with cost and behavioural dimensions that are potentially significant. Wider and deeper public engagement is necessary to deliver modal and behaviour changes as well as more coherent placemaking and a range of related public policies. The costs of not doing so will continue to impact us all, however, in terms of negative health impacts, congestion, public safety, loss of amenity and a failure to maximise the potential for better quality of life and ultimately improved economic performance.

12.4 There is a lot too that can be done, now, based upon better data, better modelling, better public information and thereby improved and more integrated policy-making and implementation, planning and choice-making to ensure that progress achieved so far is continued and some of the blockages identified and brakes on progress are tackled. This seems eminently achievable, with significant health and amenity benefits for all.

12.5 A failure to make timeous progress with further emissions management, with infrastructure and services as well as spatial planning and placemaking improvements will likely further exacerbate health inequalities and overall risks to public health for much of the population.

12.6 This review offers a range of recommendations likely to deliver continuing improvements. We have done well to get to this point but efforts need to continue apace.

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