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Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO_2) in Glasgow Urban Area (UK0024)

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Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR
Telephone 020 7238 6000
Website: www.defra.gov.uk

Information about this publication and further copies are available from:

Atmosphere and Local Environment Programme
Defra
Area 5F, Ergon House
17 Smith Square
London SW1P 3JR
Email address: *euairquality@defra.gsi.gov.uk*

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Contents

1. Introduction

1.1. This document

This document is the Glasgow Urban Area (UK0024) air quality plan for the achievement of the EU air quality limit values for nitrogen dioxide (NO_2).

This plan presents the following information:

• General information regarding the Glasgow Urban Area agglomeration zone
• Details of NO_2 exceedence situation(s) within the Glasgow Urban Area agglomeration zone
• Details of local air quality measures that have been implemented, will be implemented or are being considered for implementation in this agglomeration zone.

This air quality plan for Glasgow Urban Area should be read in conjunction with the separate UK overview document and the list of UK and national measures that are available on the Defra website (http://www.defra.gov.uk/environment/quality/air/air-quality/eu/). The UK overview document sets out, amongst other things, the authorities responsible for delivering air quality improvements and the national measures that are applied in some or all UK zones. The measures presented in this plan and the accompanying UK overview and list of UK measures show how the UK will ensure that compliance with the NO_2 limit values is achieved as soon as possible.

This plan should also be read in conjunction with the supporting UK technical report (http://www.defra.gov.uk/environment/quality/air/air-quality/eu/), which presents information on assessment methods, input data and emissions inventories used in the analysis presented in this plan.

1.2. Context

Two NO_2 limit values for the protection of human health have been set in the Air Quality Directive (2008/50/EC). These are:

• The annual limit value: an annual mean concentration of no more than 40 μgm^{-3}
• The hourly limit value: no more than 18 hourly exceedances of 200 μgm^{-3} in a calendar year

The Air Quality Directive stipulates that compliance with the NO_2 limit values will be achieved by 01/01/2010. However, where the limit values cannot be achieved by then, the Directive also allows Member States to postpone this attainment date until 01/01/2015 provided air quality plans are established demonstrating how the limit values will be met by this extended deadline.

1.3. Zone status

The assessment undertaken for the Glasgow Urban Area agglomeration zone indicates that the annual limit value is likely to be exceeded in 2010 and in 2015 but achieved by 2020 through introduction of measures included in the baseline modelling, a low emission zone (LEZ) scenario (if applied) and the non-quantifiable local measures outlined in this plan.

The assessment undertaken for the Glasgow Urban Area agglomeration zone indicates that the hourly limit value is likely to be exceeded in 2010, but achieved by 2015 through introduction of the measures in the baseline and the non-quantifiable local measures outlined in this plan. Postponement of the compliance date to 2015 is sought for this limit value in this zone.

1.4. Plan structure

General administrative information regarding this agglomeration zone is presented in section 2.

Section 3 then presents the overall picture with respect to NO_2 levels in this agglomeration zone for the 2008 reference year of this air quality plan. This includes the declaration of exceedance situations

within the agglomeration zone and presentation of a detailed source apportionment for each exceedance situation.

An overview of the measures already taken and to be taken within the agglomeration zone both before and after 2010 is given in section 4.

Baseline modelled projections for 2010, 2015 and 2020 for each exceedance situation are presented in section 5. The baseline projections presented here include, where possible, the impact of measures that have already been taken and measures for which the relevant authority has made a firm commitment to take the measure(s). However, it has not been possible to quantify the impact of all measures. This section therefore also explains which measures have been quantified, and hence included in the model projections, and which measures have not been quantified.

Details of an LEZ scenario under consideration as part of our investigation of additional measures to achieve the NO_2 limit values is presented in section 6.

2. General Information about the Zone

2.1. Administrative information

Zone name: Glasgow Urban Area
Zone code: UK0024
Type of zone: agglomeration zone
Reference year: 2008
Extent of zone: Figure 1 shows the area covered by the Glasgow Urban Area agglomeration zone

Local Authorities within the agglomeration zone: Figure 2 shows the location of Local Authorities within the agglomeration zone. A list of these Local Authorities is also given below. The numbers in this list correspond to the numbers in Figure 2.

1. East Dunbartonshire Council
2. East Renfrewshire Council
3. Glasgow City Council
4. North Lanarkshire Council
5. Renfrewshire Council
6. South Lanarkshire Council
7. West Dunbartonshire Council

(Note: Local Authority boundaries do not necessarily coincide with zone boundaries. Hence Local Authorities may be listed within more than one zone plan.)

Figure 1. Map showing the extent of the Glasgow Urban Area agglomeration zone (UK0024).

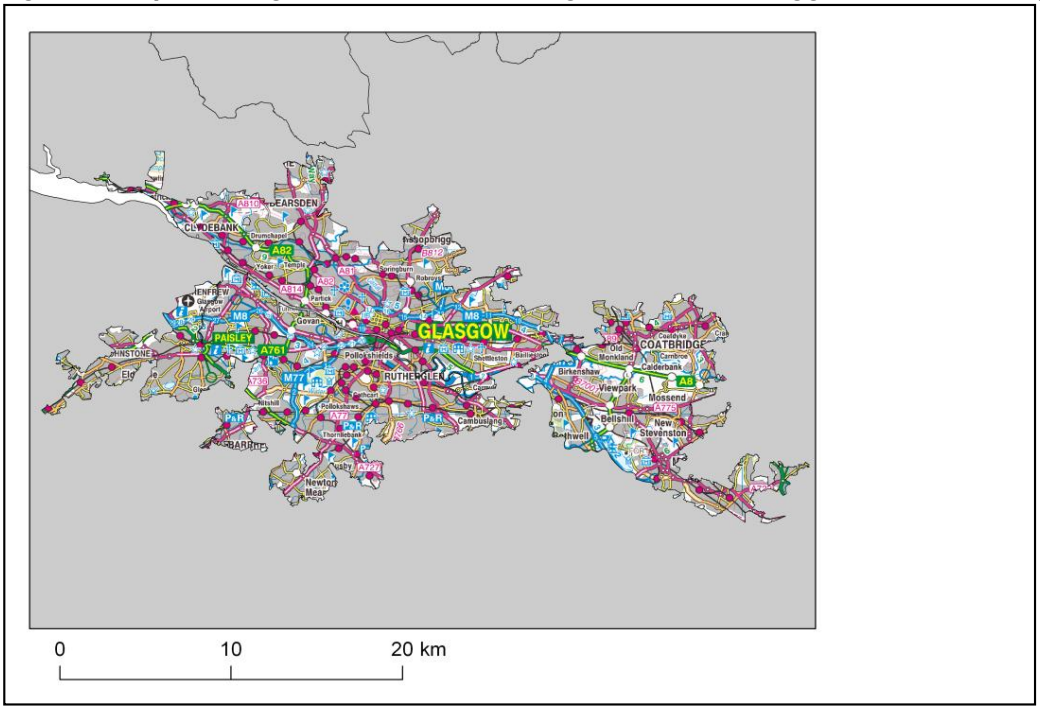
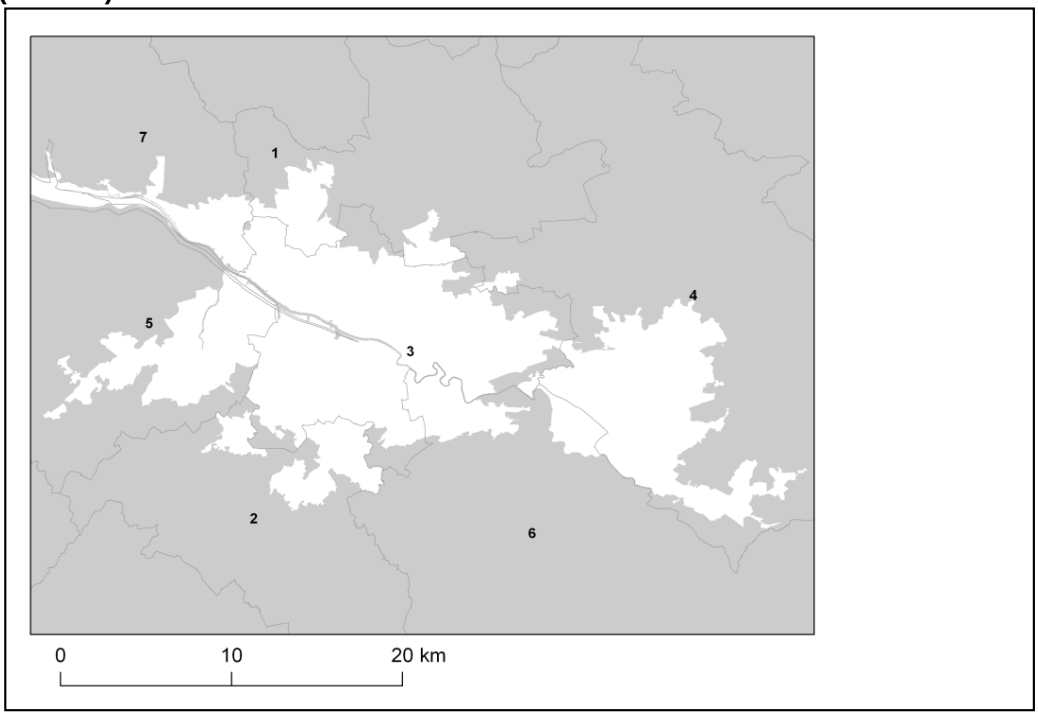


Figure 2. Map showing Local Authorities within the Glasgow Urban Area agglomeration zone (UK0024).



2.2. Assessment details

Measurements
NO_2 measurements in this zone were available in 2008 from the following national network monitoring stations (NO_2 data capture for each station in 2008 shown in brackets):

• Glasgow Centre GB0641A (76.9%)
• Glasgow City Chambers GB0452A (98.1%)
• Glasgow Kerbside GB0657A (94.9%)

Full details of monitoring stations within the Glasgow Urban Area agglomeration zone are available from http://uk-air.defra.gov.uk/networks/network-info?view=aurn.

Modelling
Modelling for the 2008 reference year has been carried out for the whole of the UK (see the UK technical report). This modelling covers the following extent within this zone:

• Total background area within zone (approx): 366 km^2
• Total population within zone (approx): 1083323 people
• Total road length where an assessment of NO_2 concentrations have been made: 300.6 km in 2008 (and similar lengths in previous years).

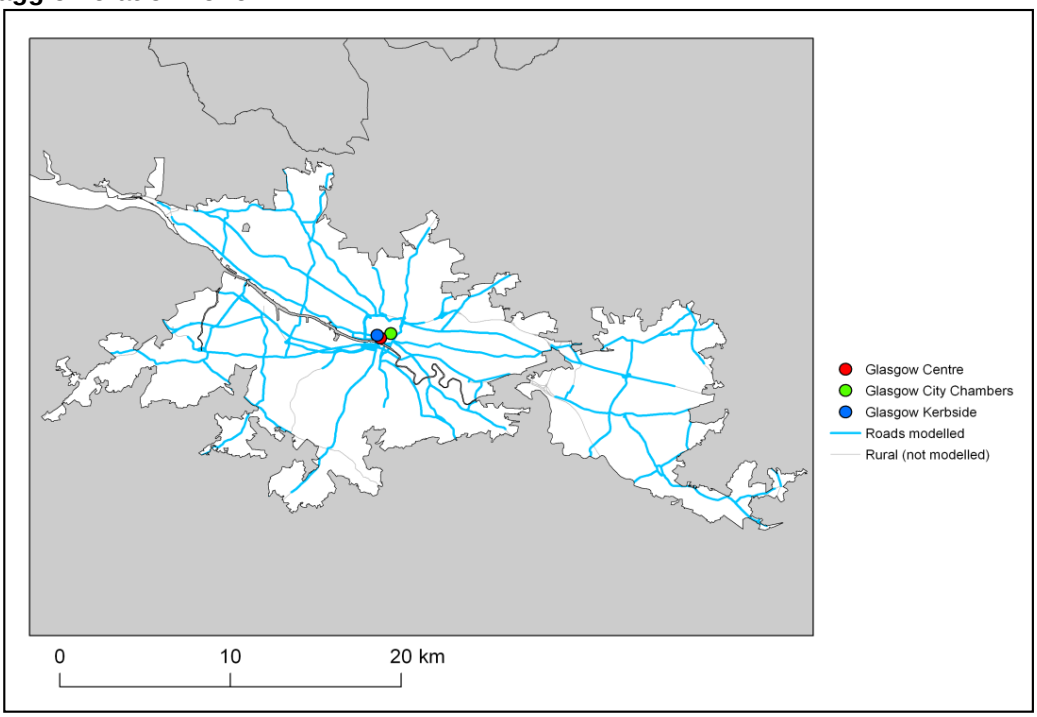
Zone maps
Figure 3 presents the location of the NO_2 monitoring stations within this zone for 2008 and the roads for which NO_2 concentrations have been modelled. NO_2 concentrations at background locations have been modelled across the entire zone at a 1 x 1 km^2 resolution.

2.3. Reporting Under European Directives

Since 2001 the UK has reported annually on air quality concentrations using a standard excel questionnaire (Decision 2004/461/EC). These questionnaires are available online from http://cdr.eionet.europa.eu/gb/eu/annualair

In addition, the UK has reported on air quality plans and programmes (Decision 2004/224/EC) on an annual basis depending on the reported concentrations in the previous year. Plans and programmes were first reported in this zone in 2003. Plans and programmes for 2003 and all other years for which they have been required are available from http://cdr.eionet.europa.eu/gb/eu/aqpp.

Figure 3. Map showing the location of the NO_2 monitoring sites with valid data in 2008 and roads where concentrations have been modelled within the Glasgow Urban Area (UK0024) agglomeration zone.



3. Overall Picture for 2008 reference year

3.1. Introduction

There are two limit values for the protection of health for NO_2. These are:

• The annual limit value (annual mean concentration of no more than 40 μgm^{-3})
• The hourly limit value (no more than 18 hourly exceedances of 200 μgm^{-3} in a calendar year)

Within the Glasgow Urban Area agglomeration zone there were exceedances of both these limit values in 2008. Therefore, two exceedance situations have been declared in this zone, one for the annual mean limit value (NO_2_UK0024_Annual_1) and one for the hourly limit value (NO_2_UK0024_Hourly_1). These are described below.

For both NO_2 limit values, a margin of tolerance for 2008 and other years has been defined in the Air Quality Directive (2008/50/EC). Data comparing assessed concentrations at locations within this agglomeration zone with the 2008 margin of tolerance are presented in the annual reporting questionnaire for 2008 (http://cdr.eionet.europa.eu/gb/eu/annualair).

3.2. Reference year: NO_2_UK0024_Annual_1

The NO_2_UK0024_Annual_1 exceedance situation covers all exceedances of the annual mean limit value in the Glasgow Urban Area agglomeration zone in 2008.

Compliance with the annual limit value in this exceedance situation has been assessed using a combination of air quality measurements and modelling. Table 1 presents measured annual mean concentrations at national network stations in this exceedance situation since the 1st Daughter Directive (1999/30/EC) came into force in 2001. This shows that there were measured exceedances of the annual limit value at Glasgow City Chambers (GB0452A) and Glasgow Kerbside (GB0657A) in 2008. Table 2 summarises modelled annual mean NO_2 results in this exceedance situation for the same time period. This table shows that, in 2008, 75.9 km of road length was modelled to exceed the annual limit value. There were no modelled background exceedances of this limit value. Table 2 also shows that the maximum modelled annual mean NO_2 concentration in 2008 was 83.1 μgm^{-3}. Maps showing the modelled annual mean NO_2 concentrations for 2008 at background and at roadside locations are presented in Figures 4 and 5 respectively. All modelled exceedances of the annual limit value are coloured orange or red in these maps.

The maximum measured concentration in the zone varies due to changes emissions and varying meteorology in different years. However, the models are also updated each year to take into account the most up-to-date science, so the modelled results for different years may not be directly comparable.The increase in the maximum modelled annual mean NO_2 concentration between 2008 and 2009 (83.1 μgm^{-3} to 90.6 μgm^{-3}) occurred because the location with the highest modelled concentration in this agglomeration zone moved between 2008 and 2009. This change in location occurred because of an increase in the total traffic count data at the location with the highest concentration in 2009.

The modelling carried out for this exceedance situation has also been used to determine the annual mean NO_X source apportionment for all modelled locations, along with an indicative annual mean NO_2 source apportionment. Table 3 presents summary source apportionment information in this exceedance situation for 2008, including:

• The modelled NO_X and indicative NO_2 source apportionment for the section of road with the highest modelled NO_2 concentration in this exceedance situation in 2008. This is important information because it shows which sources need to be tackled at the point with the largest compliance gap in the exceedance situation. It is not possible to calculate an unambiguous source apportionment for annual mean NO_2 concentrations for the reasons discussed in the UK Technical Report. We have, however, developed a method to provide an indicative source apportionment for annual mean NO_2 concentrations for these air quality plans. This method involves calculating the maximum and minimum possible contribution from each source to the NO_2 concentration. The final source apportionment has been calculated as the average of the minimum and maximum contributions for

each source, with the results normalised so that the contributions sum to the total modelled NO_2 concentration. Further information on the methods used for source apportionment are provided in the UK Technical Report.

• The maximum NO_X contribution from each source from across all the roads included in this exceedance situation in 2008. This is important information because it highlights all the key sources that need to be tackled within the exceedance situation in order to achieve compliance across the entire area of the exceedance situation.

Figure A1.1 in Annex 1 presents the annual mean NO_X source apportionment for each section of road within the NO_2_UK0024_Annual_1 exceedance situation (i.e. the source apportionment for all exceeding roads only) in 2008. Roads have been grouped into motorways, trunk roads and primary road in this figure.

Table 1. Measured annual mean concentrations at national network stations in NO_2_UK0024_Annual_1 for 2001 onwards, μgm^{-3}. (Data capture shown in brackets) (a)

Site name (EOI code)	2001	2002	2003	2004	2005	2006	2007	2008	2009
Glasgow Centre (GB0641A)	34 (86%)	32 (95%)	39 (43%)	36 (89%)	33 (96%)	31 (96%)	31 (92%)	35 (77%)	42 (91%)
Glasgow City Chambers (GB0452A)	46 (99%)	47 (95%)	50 (96%)	49 (98%)	46 (95%)	47 (98%)	47 (97%)	48 (98%)	46 (97%)
Glasgow Kerbside (GB0657A)	71 (99%)	74 (97%)	75 (99%)	68 (96%)	62 (98%)	68 (93%)	70 (92%)	82 (95%)	78 (97%)

(a) Annual Mean Limit Value = 40 μgm^{-3}

Table 2. Annual mean NO_2 model results in NO_2_UK0024_Annual_1 for 2001 onwards

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Road length exceeding (km)	160.5	69.6	205.6	150.7	159.7	156.6	124.6	75.9	91.9
Background area exceeding (km^2)	17	0	15	0	0	0	0	0	0
Maximum modelled concentration (μgm^{-3}) (a)	64.8	62.2	77.5	73.9	77.9	87.4	85.3	83.1	90.6

(a) Annual Mean Limit Value = 40 μgm^{-3}

Table 3. Source apportionment summary information for 2008 in NO_2_UK0024_Annual_1 (μgm^{-3}).

Spatial scale	Component	Highest road link (a)		Maximum (b)
		NOx	NO2 (d)	NOx
Regional background sources (i.e. contributions from distant sources of > 30 km from the receptor)	Total	4.4	(c)	
	From within the UK	2.1	(c)	2.2
	From transboundary sources (includes shipping and other EU Member States)	2.3	(c)	2.5
Urban background sources (i.e. sources located within 0.3 - 30 km from the receptor)	Total	27.5	12.4	-
	From road traffic sources	21.7	3.8	31.5
	From industry (including heat and power generation)	1.7	(c)	20.9
	From agriculture	0.0	(c)	0.0
	From commercial/residential sources	2.2	(c)	19.6
	From shipping	0.0	(c)	3.6
	From off road mobile machinery	1.4	(c)	8.2
	From natural sources	0.0	(c)	0.0
	From transboundary sources	0.0	(c)	0.0
	From other urban background sources	0.5	(c)	2.7
Local sources (i.e. contributions from sources < 0.3 km from the receptor)	Total	184.8	70.7	-
	From cars	45.2	16.8	45.2
	From HGV rigid	57.2	21.2	57.7
	From HGV articulated	53.0	19.8	63.3
	From Buses	9.4	3.7	69.6
	From LGVs	19.8	9.2	20.0
	From motorcycles	0.1	0	0.3
Total (i.e. regional background + urban background + local components)		216.8	83.1	-

(a) The road with the highest modelled annual mean NO_2 concentration in this exceedance situation in 2008 is a section of the A8, traffic count point id 74419 (OS grid (m): 269700, 663870).
(b) This column gives the maximum contribution for each component from all the roads included in the exceedence situation.
(c) The combined modelled annual mean NO_2 concentration contribution for these components is 8.6 μgm^{-3}. A more detailed NO_2 source apportionment is currently unavailable for these sectors.
(d) Source apportionment for NO_2 is indicative, see UK Technical Report.

Figure 4. Map of modelled background annual mean NO_2 concentrations 2008. Modelled exceedances of the annual limit value are shown in orange and red.

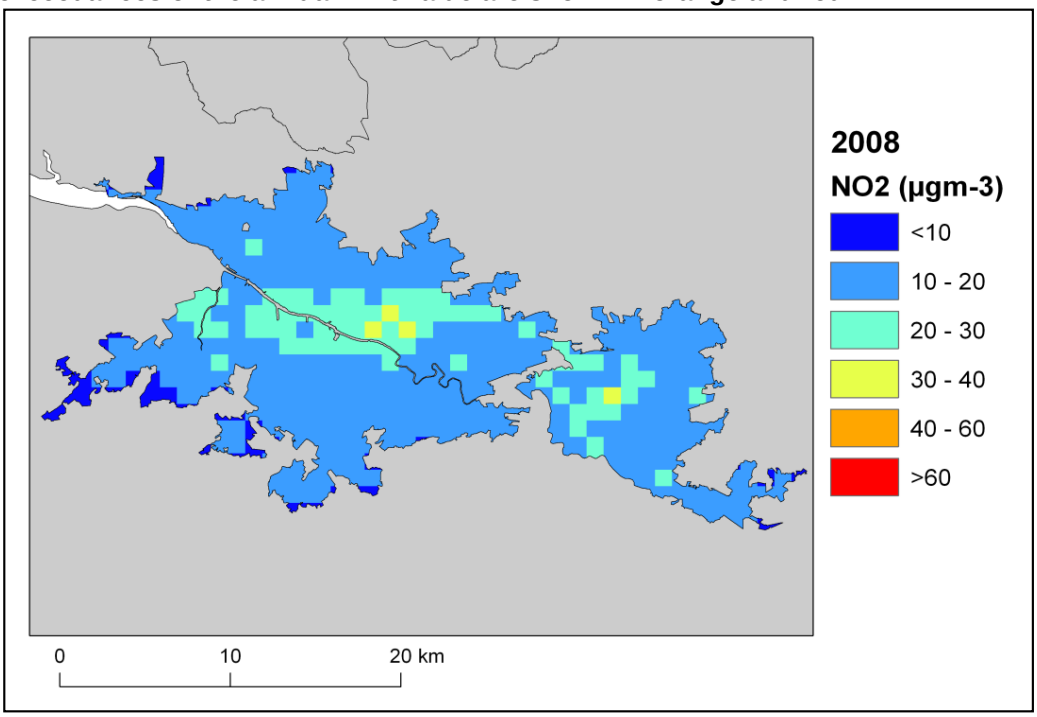
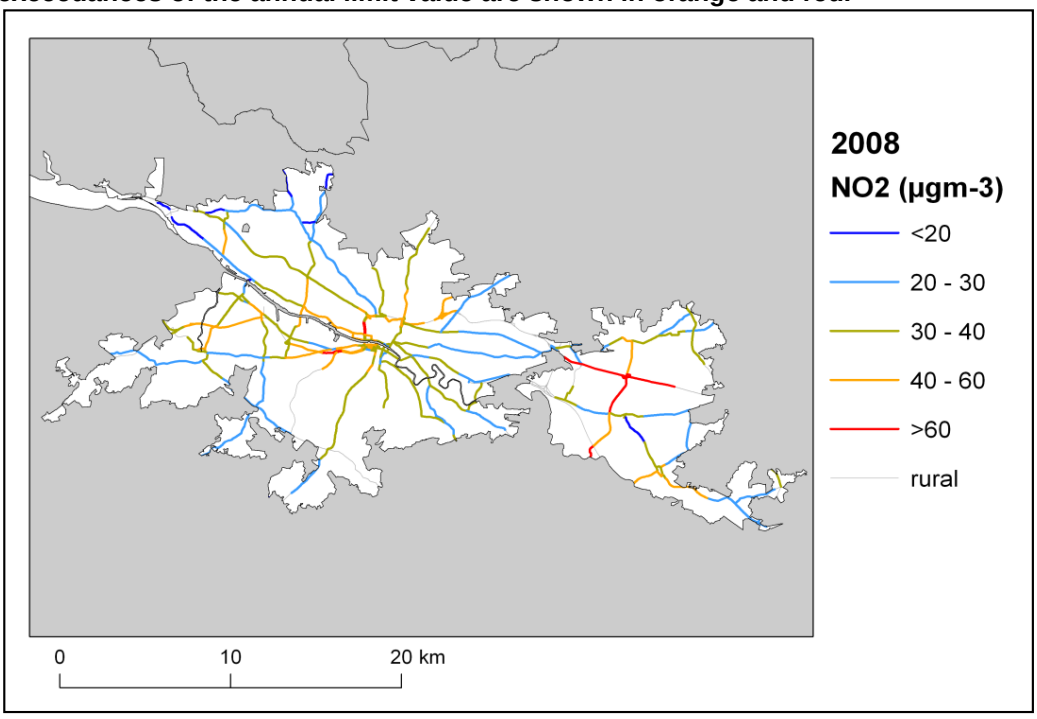


Figure 5. Map of modelled roadside annual mean NO_2 concentrations 2008. Modelled exceedances of the annual limit value are shown in orange and red.



3.3. Reference year: NO_2_UK0024_Hourly_1

This exceedance situation covers all exceedances of the hourly NO_2 limit value in Glasgow Urban Area agglomeration zone in 2008.

Compliance with the hourly limit value in this exceedance situation has been assessed using air quality measurements only. Table 4 presents measured exceedance statistics at national network stations in this exceedance situation since the 1st Daughter Directive (1999/30/EC) came into force in 2001. This shows that there were measured exceedances of the hourly limit value in 2008 at Glasgow Kerbside (GB0657A).

No modelling is available for the hourly limit value in the UK. However, the hourly limit value is generally less stringent than the annual limit value (AQEG, 2004). Hence, the geographical area where the hourly limit value is exceeded within this agglomeration zone is likely to be smaller than the area where the annual limit value is exceeded. Additionally, it is reasonable to assume that when compliance is achieved for the annual limit value, compliance with the hourly limit value will also have been achieved.

No source apportionment information is available for the hourly limit value because this limit value has not been modelled. Hence it should be assumed that the annual mean source apportionment for NO_2_UK0024_Annual_1 also applies here.

Table 4. The measured number of exceedances of the hourly limit value at national network sites in Glasgow Urban Area for each calendar year from 2001 onwards. (Data capture shown in brackets) (a)

Site name (EOI code)	2001	2002	2003	2004	2005	2006	2007	2008	2009
Glasgow Centre (GB0641A)	0 (86%)	21 (95%)	0 (43%)	0 (89%)	1 (96%)	2 (96%)	0 (92%)	0 (77%)	48 (91%)
Glasgow City Chambers (GB0452A)	8 (99%)	5 (95%)	0 (96%)	0 (98%)	0 (95%)	0 (98%)	2 (97%)	0 (98%)	12 (97%)
Glasgow Kerbside (GB0657A)	54 (99%)	38 (97%)	36 (99%)	14 (96%)	9 (98%)	3 (93%)	21 (92%)	72 (95%)	57 (97%)

(a) Hourly Limit Value = No more than 18 hourly exceedances of 200 μgm^{-3} in a calendar year

4. Measures

4.1. Introduction

This section (section 4) gives details of measures that address exceedances of the NO_2 limit values within Glasgow Urban Area agglomeration zone. This includes both measures that have already been taken and measures for which there is a firm commitment that they will be taken.

Section 5 then explains the extent to which it has been possible to incorporate the impacts of these measures into the baseline modelling carried out for this assessment.

4.2. Source apportionment

It is important to understand which sources are responsible for causing the exceedance in order to most effectively tailor measures to address the NO_2 exceedance situation(s) described in section 3 above. This can be achieved by considering the source apportionment for the exceedance situation, also presented in section 3. A summary of what the source apportionment shows and the implications for which measures would therefore be appropriate is given here.

Local road traffic was the dominant source in this exceedance location in the reference year. The largest contribution was from articulated HGVs and rigid HGVs contributing about 25% each of total NO_X on some of the roads with the highest concentrations. Cars, articulated HGVs and rigid HGVs were important sources on the motorway roads with the highest concentrations in this exceedance situation. Rigid HGVs, articulated HGVs, cars and LGVs were important sources on the trunk roads with the highest concentrations. Buses and on some roads cars, rigid HGVs and articulated HGVs were important sources on the primary roads with the highest concentrations.

This indicates that appropriate measures should impact on local road traffic sources in this zone. Other measures may also be beneficial depending on the source apportionment for the urban background.

4.3. Measures

Measures potentially affecting NO_2 in this agglomeration zone have been taken and/or are planned at a range of administrative levels. These are:

- European Union
- National (i.e. England, Scotland, Wales, Northern Ireland or whole UK)
- Local (i.e. UK Local Authorities)

Details of European Union measures (e.g. euro standards, fuel quality directives, integrated pollution prevention and control) can be found on the European Commission's website (http://ec.europa.eu/environment/air/index_en.htm). Details of national measures are given in the UK overview document and list of UK and National measures.

Relevant Local Authority measures within this exceedance situation are listed in Table A2.1 (see Annex 2). Relevant Local Authority measures are considered to be those measures which directly target, or are in close geographical proximity to roads and/or background grid squares in exceedance of one or other of the NO_2 limit values. Other Local Authority measures may also have been taken in this zone, but they are not listed in this table. All the measures listed in Table A2.1 have been carried out, are in the process of being carried out or a firm commitment had been made to carry them out on the timetables listed at the point at which information on local measures was collected.

4.4. Measures timescales

Timescales for national measures are given in the UK overview document and list of UK and National measures.

Information on local measures was collected in autumn 2009. Hence, any Local Authority action plans and measures adopted by Local Authorities after this time have not been included in this air quality plan. Many of the measures listed in Annex 2 will either have happened before autumn 2009 or have been planned for implementation before or during 2010. Others will be planned for after 2010. It should be noted that many of the measures taken before or during 2010 will continue to have a beneficial impact on air quality after the end of 2010.

Local Authorities report on progress with the implementation of their action plans annually and review action plan measures regularly. Where future Local Authority measures to improve air quality are under consideration these would be included in future local authority action plans and published by the local authority.

4.5. Measures specific to the location of highest predicted concentration within this exceedance situation

This section provides information about the additional measures that are being taken that are specific to the location of highest predicted concentration within this exceedance situation.

Local_Transport_Scotland_E1 M8 Newhouse - Baillieston road scheme

The M8, which links Edinburgh and Glasgow, includes a section of A road between Newhouse and Baillieston to the east of Glasgow. This is to be upgraded to motorway by Transport Scotland. This upgrade will be largely offline and will generally move the main traffic lanes away from residential areas and points of public access. The upgrade is currently scheduled to commence in 2013/14 with a projected construction phase of up to four years. Baseline projections show that compliance will be achieved in this exceedance situation by 2020. Modelling projections indicate that the upgrade will ensure compliance in this exceedence situation; therefore compliance is expected by 2018 at the latest. This is on the basis that the scheme will reduce the road component of NO_2 concentrations by approximately 25% at worst case residential locations near to the current A8 road. (see Note: Predicted Nitrogen Dioxide EU limit value Exceedances in North Lanarkshire. Report by AQC for Transport Scotland March 2009, available from [NO_2 TEN website] and environmental impact assessment available from http://www.m8completion.com/m8/files/oct07/M8%20B-N%20NTS%20updated%202007%20final%20web.pdf).

5. Baseline Model Projections

5.1. Overview of model projections

Baseline projections for 2010
Model projections for 2010, starting from the 2008 reference year described in section 3, have been calculated in order to determine whether compliance with the NO_2 limit values is likely to be achieved for each exceedance situation by the original deadline for compliance of 01/01/2010. Details of the methods used for the baseline emissions and concentration projections modelling are provided in the the UK technical report.

For national measures, it has not been possible to quantify the impact of all measures on emissions and ambient concentrations. The impact for all quantifiable measures has been included in the baseline projections.

The impacts of the individual Local Authority measures have not been explicitly included in the baseline model projections. However, measures may have been included implicitly if they have influenced the traffic counts for 2007 (used as a basis for the compilation of the emission inventory) or in the traffic activity projections to 2010 and beyond (used to calculate the emission projections). It should be recognised that these measures will have a beneficial impact on air quality, even if it has not been possible to quantify this impact here.

A number of the local measures in Table A2.1 can be considered to be 'smarter choices' measures (see http://www.dft.gov.uk/pgr/sustainable/smarterchoices/ctwwt/ for a detailed description of this type of measure). We have quantified the impact of this group of measures on a national scale within the projections. Details of how this has been done can be found in the UK technical report. Table A2.1 indicates which local measures we have considered to be 'smarter choices'.

Baseline projections for 2015
Model projections for 2015, starting from the 2008 reference year described above, have been calculated in order to determine whether compliance with the NO_2 limit values is likely to be achieved for each exceedance situation by the revised deadline for compliance of 01/01/2015 on the basis of EU-wide measures and the measures currently planned. This modelling is described in detail in the UK technical report. Many of the measures listed in annex 2 of this document and the supporting list of UK and national measures will continue or will continue to have an impact beyond the original deadline for compliance of 01/01/2010.

5.2. Baseline projections: NO_2_UK0024_Annual_1

Table 5 presents summary results for the baseline model projections for 2010, 2015 and 2020 for the NO_2_UK0024_Annual_1 exceedance situation. This shows that the maximum modelled annual mean NO_2 concentration predicted for 2010 in this exceedance situation is 71.5 μgm^{-3}. By 2015, the maximum modelled annual mean NO_2 concentration is predicted to drop to 45.2 μgm^{-3}. Hence, the model results suggest that compliance with the NO_2 annual limit value is unlikely to be achieved by 2015 under baseline conditions in this exceedance situation.

The projected modelled NO_X and indicative NO_2 annual mean source apportionments for 2010, 2015 and 2020 at the location with the biggest compliance gap in 2008 are presented in Table 6. In 2010 and 2015, the model results suggest that this location will continue to have the highest annual mean NO_2 concentration within this exceedance situation. However, in 2020 the model indicates that the location with the highest annual mean NO_2 concentration within this exceedance situation will be elsewhere. Information regarding the new location with the highest NO_2 concentration, including the source apportionment is given in Table 7. The locations of maximum concentration in each year are given in the footnote to this table. This source apportionment information is useful because it shows which sources need to be tackled at the point with the largest compliance gap in the exceedance situation.

Table 8 shows the maximum NO_X contribution from each source apportionment component from any road across the whole exceedance situation. This source apportionment information is useful because

it highlights all the key sources that need to be tackled within the exceedance situation in order to achieve compliance across the entire area of the exceedance situation. It should be noted that this table only includes roads which continue to be in exceedance in the relevant year. Hence, for example, the road with the largest contribution from cars in 2010 may no longer be included in the table in 2015 if the road is predicted to be compliant in 2015.

Figures 6 and 7 show maps of projected annual mean NO_2 concentrations in 2010, 2015 and 2020 at background and roadside locations respectively. Maps for 2008 are also presented here for reference.

It should be noted that the baseline projections presented here include the impacts of measures, where they can be quantified, that have already been or will be implemented.

Table 5. Annual mean NO_2 model results in NO_2_UK0024_Annual_1

	2008	2010	2015	2020
Road length exceeding (km)	75.9	46.3	7.7	0.0
Background area exceeding (km^2)	0	0	0	0
Maximum modelled concentration (μgm^{-3}) (a)	83.1	71.5	45.2	28.5

(a) Annual Mean Limit Value = 40 μgm^{-3}

Table 6. Modelled source apportionment for 2010, 2015 and 2020 under baseline conditions for traffic count point 74419 on the A8 (the road section with the maximum modelled annual mean NO_2 concentration in 2008 in NO_2_UK0024_Annual_1. OS grid (m): 269700, 663870). 2008 results are also presented here for reference (units: μgm^{-3}).

Spatial scale	Component	NOx				NO2 (indicative)			
		2008	2010	2015	2020	2008	2010	2015	2020
Regional background sources (i.e. contributions from distant sources of > 30 km from the receptor)	Total	4.4	3.9	3.4	2.7	(a)	(b)	(c)	(d)
	From within the UK	2.1	1.8	1.6	1.3	(a)	(b)	(c)	(d)
	From transboundary sources (includes shipping and other EU Member States)	2.3	2.0	1.8	1.4	(a)	(b)	(c)	(d)
Urban background sources (i.e. sources located within 0.3 - 30 km from the receptor)	Total	27.5	22.5	15.4	9.7	12.4	10.6	8.0	5.8
	From road traffic sources	21.7	17.0	10.8	5.6	3.8	3.6	3.3	3.1
	From industry (including heat and power generation)	1.7	1.6	1.5	1.4	(a)	(b)	(c)	(d)
	From agriculture	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From commercial/residential sources	2.2	2.2	1.9	1.7	(a)	(b)	(c)	(d)
	From shipping	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From off road mobile machinery	1.4	1.3	0.7	0.5	(a)	(b)	(c)	(d)
	From natural sources	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From transboundary sources	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From other urban background sources	0.5	0.4	0.4	0.4	(a)	(b)	(c)	(d)
Local sources (i.e. contributions from sources < 0.3 km from the receptor)	Total	184.8	152.9	86.2	39.1	70.7	60.9	37.1	18.6
	From cars	45.2	30.4	20.9	13.9	16.8	12.1	9.2	6.7
	From HGV rigid	57.2	50.9	26.3	9.3	21.2	19.4	10.8	4.2
	From HGV articulated	53.0	46.2	23.3	7.6	19.8	17.7	9.6	3.5
	From Buses	9.4	8.4	5.0	2.3	3.7	3.4	2.1	1.0
	From LGVs	19.8	17.0	10.7	5.9	9.2	8.3	5.4	3.1
	From motorcycles	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total (i.e. regional background + urban background + local components)		216.8	179.3	105.0	51.6	83.1	71.5	45.2	24.4

(a) The total annual mean NO_2 contribution for all components labelled (a) in 2008 was modelled to be 8.6 μgm^{-3}.
(b) The total annual mean NO_2 contribution for all components labelled (b) in 2010 is predicted to be 7 μgm^{-3}.
(c) The total annual mean NO_2 contribution for all components labelled (c) in 2015 is predicted to be 4.8 μgm^{-3}.
(d) The total annual mean NO_2 contribution for all components labelled (d) in 2020 is predicted to be 2.7 μgm^{-3}.

Table 7. Modelled source apportionment for 2010, 2015 and 2020 under baseline conditions for traffic count point with the highest concentration in these years in NO_2_UK0024_Annual_1 (a). 2008 results are also presented here for reference (units: μgm^{-3}).

Spatial scale	Component	NOx				NO2 (indicative)			
		2008	2010	2015	2020	2008	2010	2015	2020
Regional background sources (i.e. contributions from distant sources of > 30 km from the receptor)	Total	4.4	3.9	3.4	2.7	(b)	(c)	(d)	(e)
	From within the UK	2.1	1.8	1.6	1.3	(b)	(c)	(d)	(e)
	From transboundary sources (includes shipping and other EU Member States)	2.3	2.0	1.8	1.4	(b)	(c)	(d)	(e)
Urban background sources (i.e. sources located within 0.3 - 30 km from the receptor)	Total	27.5	22.5	15.4	37.3	12.4	10.6	8.0	18.0
	From road traffic sources	21.7	17.0	10.8	10.0	3.8	3.6	3.3	13.3
	From industry (including heat and power generation)	1.7	1.6	1.5	6.2	(b)	(c)	(d)	(e)
	From agriculture	0.0	0.0	0.0	0.0	(b)	(c)	(d)	(e)
	From commercial/residential sources	2.2	2.2	1.9	17.0	(b)	(c)	(d)	(e)
	From shipping	0.0	0.0	0.0	1.3	(b)	(c)	(d)	(e)
	From off road mobile machinery	1.4	1.3	0.7	2.0	(b)	(c)	(d)	(e)
	From natural sources	0.0	0.0	0.0	0.0	(b)	(c)	(d)	(e)
	From transboundary sources	0.0	0.0	0.0	0.0	(b)	(c)	(d)	(e)
	From other urban background sources	0.5	0.4	0.4	0.7	(b)	(c)	(d)	(e)
Local sources (i.e. contributions from sources < 0.3 km from the receptor)	Total	184.8	152.9	86.2	21.8	70.7	60.9	37.1	10.5
	From cars	45.2	30.4	20.9	11.4	16.8	12.1	9.2	5.7
	From HGV rigid	57.2	50.9	26.3	2.7	21.2	19.4	10.8	1.2
	From HGV articulated	53.0	46.2	23.3	3.0	19.8	17.7	9.6	1.4
	From Buses	9.4	8.4	5.0	1.2	3.7	3.4	2.1	0.5
	From LGVs	19.8	17.0	10.7	3.2	9.2	8.3	5.4	1.7
	From motorcycles	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.1
Total (i.e. regional background + urban background + local components)		216.8	179.3	105.0	61.8	83.1	71.5	45.2	28.5

(a) The road with the maximum annual mean NO_2 concentration in different years is as follows. 2008: A section of the A8 (count point id 74419). 2010: A section of the A8 (count point id 74419). 2015: A section of the A8 (count point id 74419). 2020: A section of the M8 (count point id 80447). (OS grid (m): 269700, 663870; 269700, 663870; 269700, 663870; 269700, 663870).
(b) The total annual mean NO_2 contribution for all components labelled (b) in 2008 was modelled to be 8.6 μgm^{-3}.
(c) The total annual mean NO_2 contribution for all components labelled (c) in 2010 is predicted to be 7 μgm^{-3}.
(d) The total annual mean NO_2 contribution for all components labelled (d) in 2015 is predicted to be 4.8 μgm^{-3}.
(e) The total annual mean NO_2 contribution for all components labelled (e) in 2020 is predicted to be 4.7 μgm^{-3}.

Table 8. The maximum NO_X contribution from each source from across all the roads included in the exceedance situation on which exceedances remain in 2010, 2015 and 2020 under baseline conditions. Zeros indicate that there are no exceedances in the relevant year.

Spatial scale	Component	NOx			
		2008	2010	2015	2020
Regional background sources (i.e. contributions from distant sources of > 30 km from the receptor)	From within the UK	2.2	1.9	1.6	0.0
	From transboundary sources (includes shipping and other EU Member States)	2.5	2.2	1.9	0.0
Urban background sources (i.e. sources located within 0.3 - 30 km from the receptor)	From road traffic sources	31.5	24.2	10.8	0.0
	From industry (including heat and power generation)	20.9	18.0	2.5	0.0
	From agriculture	0.0	0.0	0.0	0.0
	From commercial/residential sources	19.6	19.7	4.0	0.0
	From shipping	3.6	3.5	0.0	0.0
	From off road mobile machinery	8.2	7.6	1.2	0.0
	From natural sources	0.0	0.0	0.0	0.0
	From transboundary sources	0.0	0.0	0.0	0.0
	From other urban background sources	2.7	2.3	0.6	0.0
Local sources (i.e. contributions from sources < 0.3 km from the receptor)	From cars	45.2	30.4	20.9	0.0
	From HGV rigid	57.7	51.3	26.5	0.0
	From HGV articulated	63.3	55.2	27.8	0.0
	From Buses	69.6	62.3	5.0	0.0
	From LGVs	20.0	17.2	10.8	0.0
	From motorcycles	0.3	0.2	0.1	0.0

Figure 6. Background baseline projections of annual mean NO_2 concentrations in 2010, 2015 and 2020. 2008 is also included here for reference. Modelled exceedances of the annual limit value are shown in orange and red.

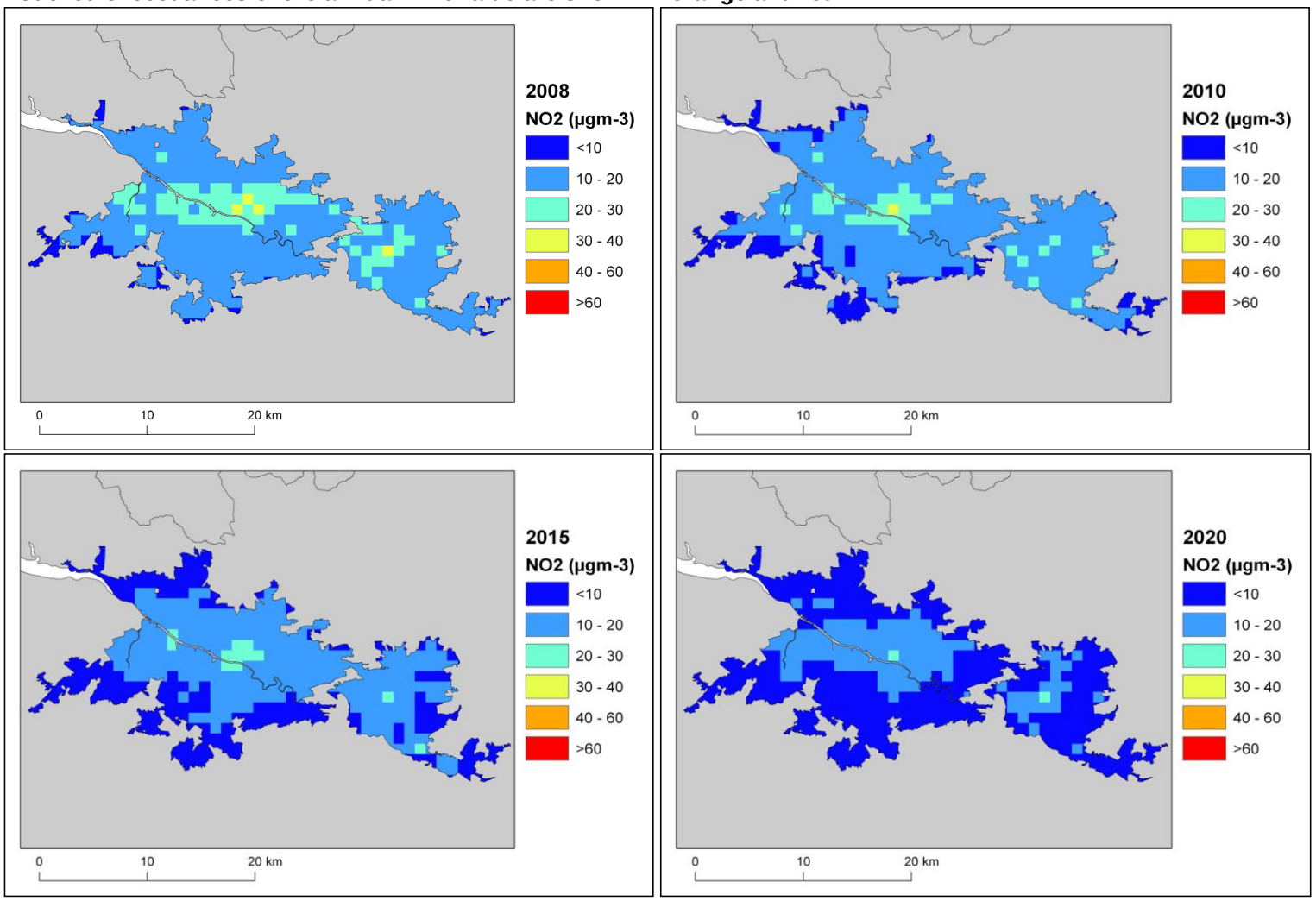
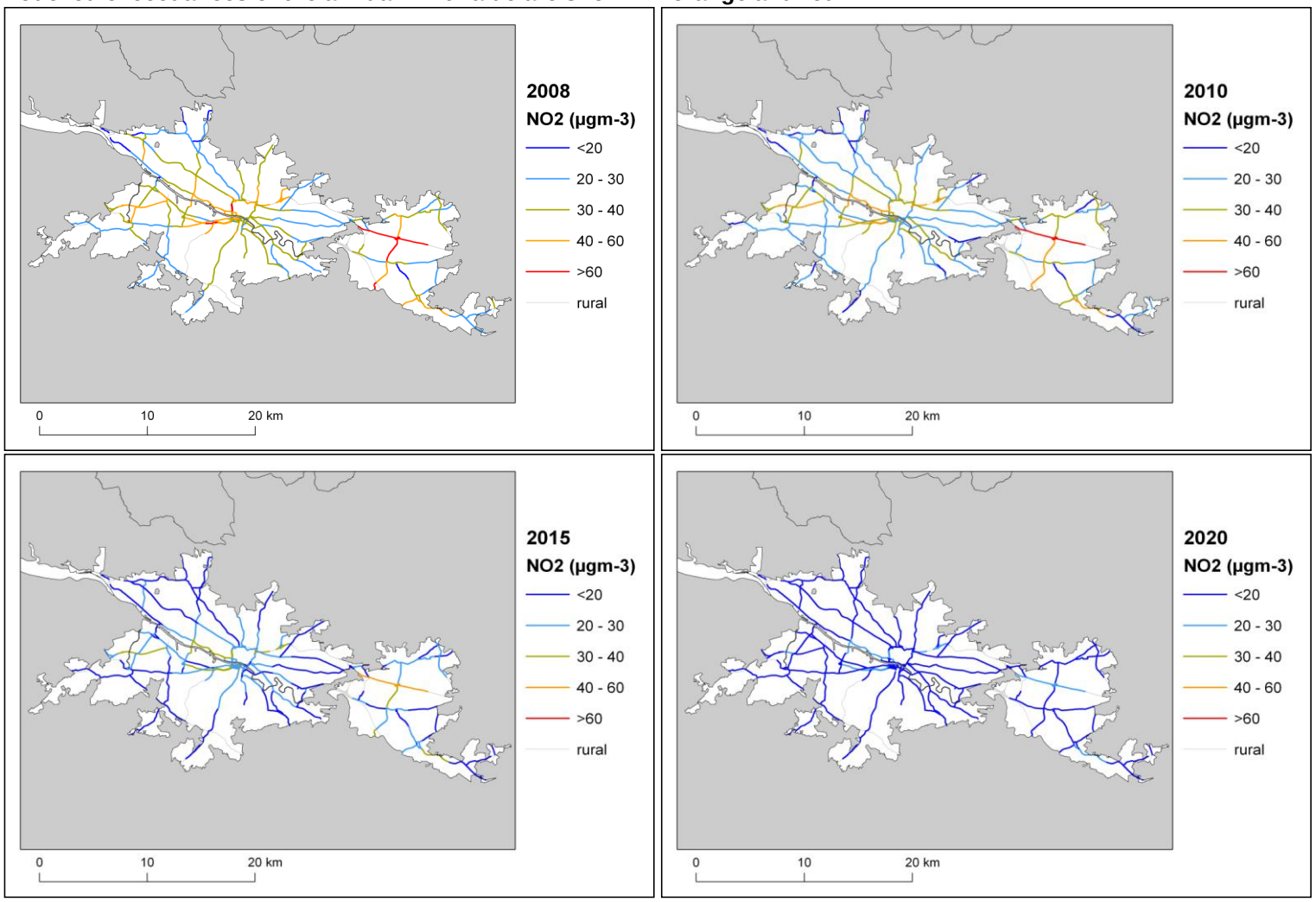


Figure 7. Roadside baseline projections of annual mean NO_2 concentrations in 2010, 2015 and 2020. 2008 is also included here for reference. Modelled exceedances of the annual limit value are shown in orange and red.



5.3. Baseline projections: NO_2_UK0024_Hourly_1

Table 9 presents summary results for the baseline model projections for 2008, 2010, 2015 and 2020 for the NO_2_UK0024_Hourly_1 exceedance situation. Specifically this table shows how many hours are predicted to exceed 200 μgm^{-3}, in the calendar year listed, at monitoring stations with a measured exceedance of the hourly limit value in 2008. To be compliant with the hourly limit value, hourly NO_2 may not exceed 200 μgm^{-3} more than 18 times in any given calendar year. The model 'data capture' is also shown in brackets. This 'data capture' reflects the proportion of the year for which the model was able to predict hourly NO_2 concentrations. More information about model 'data capture' and how the model works is available in the UK technical report.

Table 9 shows that compliance with the hourly limit value is expected to be achieved in this exceedance situation by 2015, when only 3 hours are modelled to exceed 200 μgm^{-3} at Glasgow Kerbside, which is the monitoring site with highest number of modelled hourly exceedances in 2015.

No source apportionment information is available for the hourly limit value because this limit value has not been modelled. Hence it should be assumed that the annual mean source apportionment for NO_2_UK0024_Annual_1 also applies here.

It should be noted that the baseline projections presented here include the impacts of additional measures, where they can be quantified, that have already been or will be implemented.

Table 9. The modelled number of exceedances of the hourly limit value at national network sites in Glasgow Urban Area. (Data capture shown in brackets) (a)

Site name (EOI code)	2008	2010	2015	2020
Glasgow Kerbside (GB0657A)	48 (69.1%)	24 (68.9%)	3 (68.5%)	3 (68%)

(a) Hourly Limit Value = No more than 18 hourly exceedances of 200 μgm^{-3} in a calendar year

6. Projections including the impact of the low emissions zone (LEZ) scenario

6.1. Overview of model projections

Further model projections for 2015 and 2020 have also been calculated that include the impact of the LEZ scenario. This scenario is under consideration as part of our investigation of additional measures to achieve the NO_2 limit values. The scenario modelled here would require all HGVs and buses to meet at least Euro IV emission standards for NO_X and PM_{10} in 2015 in order to travel on roads other than the strategic long distance road network within the selected Local Authority boundaries. More details of the work underway to explore the feasibility and costs of a national LEZ framework are provided in the UK overview document and a description of the modelling assumptions included in the LEZ scenario is available in the UK technical report.

The LEZ scenario has been modelled for this zone because initial screening work indicated that, should it be applied, it would be effective at either reducing the gap to or achieving compliance with the limit value. The model results for these projections are presented in this section.

Projections for comparison with the 1-hour limit value have not been calculated for the LEZ scenario.

Further work is underway to investigate the feasibility and practicality of a national framework for LEZ as an additional measure to reduce concentrations of NO_2. These investigations include:

• the likely effectiveness of any scheme at controlling air pollutant emissions and delivering increased compliance with European air quality standards within the timescales specified by the EU Ambient Air Quality Directive;
• the effectiveness and reliability of available NO_X abatement equipment, taking into account evidence on the performance of Euro standards;
• the cost and resource such a measure might place upon national and/or local government;
• administrative and enforcement considerations for the scheme and the implications of this for Government Executive Agencies;
• the likely take-up of the scheme by local authorities and others;
• how any scheme would relate to ongoing certification work at EU and UNECE level.

These investigations will continue over the coming months and decisions will be made following the investigation as to whether or not it is feasible to introduce a national LEZ Framework and the details of any scheme. Should a local authority decide to introduce an LEZ, final decisions on the nature and extent of such a measure would be for the local authority to make taking into account local circumstances and any national arrangements put in place. These might not reflect what has been modelled in the scenario.

The LEZ scenario examines the impact of a LEZ applied within the selected local authorities listed in the supporting technical report. The local authorities relevant to this zone are

• Glasgow City Council
• North Lanarkshire Council
• Renfrewshire Council
• South Lanarkshire Council

The impact of the LEZ scenario on projected NO_2 concentrations in 2015 will be greatest in these local authorities. There are also expected to be smaller benefits in other areas as a result of the changes to the national HGV fleets required to ensure LEZ compliance within the LEZ locations. The impact of these fleet changes on projected NO_2 concentrations in 2015 have been assessed in all zones for which the baseline projections do not show compliance with the annual mean limit value in 2015.

6.2. LEZ scenario projections: NO_2_UK0024_Annual_1

Table 11 presents summary results for the LEZ scenario model projections for 2015 and 2020 for the NO_2_UK0024_Annual_1 exceedance situation. This shows that the maximum modelled annual mean NO_2 concentration predicted for 2015 for the LEZ scenario in this exceedance situation is 40.1 μgm^{-3}. Hence, the model results suggest that compliance with the NO_2 annual limit value is unlikely to be achieved by 2015 for the LEZ scenario in this exceedance situation. The model results do, however, show that the NO_2 annual mean limit value is likely to be achieved in this exceedance situation in 2020, when the maximum modelled annual mean NO_2 concentration predicted to be 28.4 μgm^{-3}.

The projected modelled NO_X and indicative NO_2 annual mean source apportionments for 2010, 2015 and 2020 at the location with the biggest compliance gap in 2008 are presented in Table 12. In 2010 and 2015, the model results suggest that this location will continue to have the highest annual mean NO_2 concentration within this exceedance situation. However, in 2020 the model indicates that the location with the highest annual mean NO_2 concentration within this exceedance situation will be elsewhere. Information regarding the new location with the highest NO_2 concentration, including the source apportionment is given in Table 13. The locations of maximum concentration in each year are given in teh footnote to this table. This source apportionment information is useful because it shows which sources need to be tackled at the point with the largest compliance gap in the exceedance situation.

Table 14 shows the maximum NO_X contribution from each source apportionment component from any road across the whole exceedance situation. This source apportionment information is useful because it highlights all the key sources that need to be tackled within the exceedance situation in order to achieve compliance across the entire area of the exceedance situation. It should be noted that this table only includes roads that continue to be in exceedance in the relevant year. Hence, for example, the road with the largest contribution from cars in 2010 may no longer be included in the table in 2015 if the road is predicted to be compliant in 2015.

Figures 8 and 9 show maps of projected annual mean NO_2 concentrations for the LEZ scenario in 2015 and 2020 at background and roadside locations respectively. Maps for 2008 and baseline projections for 2010 are also presented here for reference.

Table 11. Annual mean NO_2 model results in NO_2_UK0024_Annual_1. 2015 and 2020 results are for the LEZ scenario. Results for 2008 and baseline projections for 2010 are also shown

	2008	2010	2015	2020
Road length exceeding (km)	75.9	46.3	1.2	0.0
Background area exceeding (km^2)	0	0	0	0
Maximum modelled concentration (μgm^{-3}) (a)	83.1	71.5	40.1	28.4

(a) Annual Mean Limit Value = 40 μgm^{-3}

Table 12. Modelled source apportionment for 2015 and 2020 for the LEZ scenario for traffic count point 74419 on the A8 (the road section with the maximum modelled annual mean NO_2 concentration in 2008 in NO_2_UK0024_Annual_1 OS grid (m): 269700, 663870). 2008 and 2010 baseline projections results are also presented here for reference (units: μgm^{-3}).

Spatial scale	Component	NOx				NO2 (indicative)			
		2008	2010	2015	2020	2008	2010	2015	2020
Regional background sources (i.e. contributions from distant sources of > 30 km from the receptor)	Total	4.4	3.9	3.4	2.7	(a)	(b)	(c)	(d)
	From within the UK	2.1	1.8	1.6	1.3	(a)	(b)	(c)	(d)
	From transboundary sources (includes shipping and other EU Member States)	2.3	2.0	1.8	1.4	(a)	(b)	(c)	(d)
Urban background sources (i.e. sources located within 0.3 - 30 km from the receptor)	Total	27.5	22.5	14.0	9.6	12.4	10.6	7.6	5.8
	From road traffic sources	21.7	17.0	9.4	5.5	3.8	3.6	3.3	3.1
	From industry (including heat and power generation)	1.7	1.6	1.5	1.4	(a)	(b)	(c)	(d)
	From agriculture	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From commercial/residential sources	2.2	2.2	1.9	1.7	(a)	(b)	(c)	(d)
	From shipping	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From off road mobile machinery	1.4	1.3	0.7	0.5	(a)	(b)	(c)	(d)
	From natural sources	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From transboundary sources	0.0	0.0	0.0	0.0	(a)	(b)	(c)	(d)
	From other urban background sources	0.5	0.4	0.4	0.4	(a)	(b)	(c)	(d)
Local sources (i.e. contributions from sources < 0.3 km from the receptor)	Total	184.8	152.9	73.8	38.1	70.7	60.9	32.5	18.1
	From cars	45.2	30.4	20.9	13.9	16.8	12.1	9.3	6.7
	From HGV rigid	57.2	50.9	20.1	8.9	21.2	19.4	8.5	4.1
	From HGV articulated	53.0	46.2	19.0	7.5	19.8	17.7	8.0	3.4
	From Buses	9.4	8.4	2.9	1.8	3.7	3.4	1.3	0.8
	From LGVs	19.8	17.0	10.7	5.9	9.2	8.3	5.4	3.1
	From motorcycles	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total (i.e. regional background + urban background + local components)		216.8	179.3	91.1	50.4	83.1	71.5	40.1	23.9

(a) The total annual mean NO_2 contribution for all components labelled (a) in 2008 was modelled to be 8.6 μgm^{-3}.
(b) The total annual mean NO_2 contribution for all components labelled (b) in 2010 is predicted to be 7 μgm^{-3}.
(c) The total annual mean NO_2 contribution for all components labelled (c) in 2015 is predicted to be 4.2 μgm^{-3}.
(d) The total annual mean NO_2 contribution for all components labelled (d) in 2020 is predicted to be 2.6 μgm^{-3}.

Table 13. Modelled source apportionment for 2015 and 2020 for the LEZ scenario for traffic count point with the highest concentration in these years in NO_2_UK0024_Annual_1. (a) 2008 and 2010 baseline projections results are also presented here for reference (units: μgm^{-3}).

Spatial scale	Component	NOx				NO2 (indicative)			
		2008	2010	2015	2020	2008	2010	2015	2020
Regional background sources (i.e. contributions from distant sources of > 30 km from the receptor)	Total	4.4	3.9	3.4	2.7	(b)	(c)	(d)	(e)
	From within the UK	2.1	1.8	1.6	1.3	(b)	(c)	(d)	(e)
	From transboundary sources (includes shipping and other EU Member States)	2.3	2.0	1.8	1.4	(b)	(c)	(d)	(e)
Urban background sources (i.e. sources located within 0.3 - 30 km from the receptor)	Total	27.5	22.5	14.0	37.1	12.4	10.6	7.6	17.9
	From road traffic sources	21.7	17.0	9.4	9.8	3.8	3.6	3.3	13.3
	From industry (including heat and power generation)	1.7	1.6	1.5	6.2	(b)	(c)	(d)	(e)
	From agriculture	0.0	0.0	0.0	0.0	(b)	(c)	(d)	(e)
	From commercial/residential sources	2.2	2.2	1.9	17.0	(b)	(c)	(d)	(e)
	From shipping	0.0	0.0	0.0	1.3	(b)	(c)	(d)	(e)
	From off road mobile machinery	1.4	1.3	0.7	2.0	(b)	(c)	(d)	(e)
	From natural sources	0.0	0.0	0.0	0.0	(b)	(c)	(d)	(e)
	From transboundary sources	0.0	0.0	0.0	0.0	(b)	(c)	(d)	(e)
	From other urban background sources	0.5	0.4	0.4	0.7	(b)	(c)	(d)	(e)
Local sources (i.e. contributions from sources < 0.3 km from the receptor)	Total	184.8	152.9	73.8	21.8	70.7	60.9	32.5	10.5
	From cars	45.2	30.4	20.9	11.4	16.8	12.1	9.3	5.7
	From HGV rigid	57.2	50.9	20.1	2.7	21.2	19.4	8.5	1.2
	From HGV articulated	53.0	46.2	19.0	3.0	19.8	17.7	8.0	1.4
	From Buses	9.4	8.4	2.9	1.2	3.7	3.4	1.3	0.5
	From LGVs	19.8	17.0	10.7	3.2	9.2	8.3	5.4	1.7
	From motorcycles	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.1
Total (i.e. regional background + urban background + local components)		216.8	179.3	91.1	61.5	83.1	71.5	40.1	28.4

(a) The road with the maximum annual mean NO_2 concentration in different years is as follows. 2008: A section of the A8 (count point id 74419). 2010: A section of the A8 (count point id 74419). 2015: A section of the A8 (count point id 74419). 2020: A section of the M8 (count point id 80447). (OS grid (m): 269700, 663870; 269700, 663870; 269700, 663870; 269700, 663870).
(b) The total annual mean NO_2 contribution for all components labelled (b) in 2008 was modelled to be 8.6 μgm^{-3}.
(c) The total annual mean NO_2 contribution for all components labelled (c) in 2010 is predicted to be 7 μgm^{-3}.
(d) The total annual mean NO_2 contribution for all components labelled (d) in 2015 is predicted to be 4.2 μgm^{-3}.
(e) The total annual mean NO_2 contribution for all components labelled (e) in 2020 is predicted to be 4.6 μgm^{-3}.

Table 14. The maximum NO_X contribution from each source from across all the roads included in the exceedance situation on which exceedances remain in 2010, 2015 and 2020 under baseline conditions. Zeros indicate that there are no exceedances in the relevant year.

Spatial scale	Component	NOx			
		2008	2010	2015	2020
Regional background sources (i.e. contributions from distant sources of > 30 km from the receptor)	From within the UK	2.2	1.9	1.6	0.0
	From transboundary sources (includes shipping and other EU Member States)	2.5	2.2	1.8	0.0
Urban background sources (i.e. sources located within 0.3 - 30 km from the receptor)	From road traffic sources	31.5	24.2	9.4	0.0
	From industry (including heat and power generation)	20.9	18.0	1.5	0.0
	From agriculture	0.0	0.0	0.0	0.0
	From commercial/residential sources	19.6	19.7	1.9	0.0
	From shipping	3.6	3.5	0.0	0.0
	From off road mobile machinery	8.2	7.6	0.7	0.0
	From natural sources	0.0	0.0	0.0	0.0
	From transboundary sources	0.0	0.0	0.0	0.0
	From other urban background sources	2.7	2.3	0.4	0.0
Local sources (i.e. contributions from sources < 0.3 km from the receptor)	From cars	45.2	30.4	20.9	0.0
	From HGV rigid	57.7	51.3	20.1	0.0
	From HGV articulated	63.3	55.2	19.0	0.0
	From Buses	69.6	62.3	2.9	0.0
	From LGVs	20.0	17.2	10.7	0.0
	From motorcycles	0.3	0.2	0.1	0.0

Figure 8. Background projections of annual mean NO_2 concentrations in 2015 and 2020 for the LEZ scenario. 2008 and baseline projections for 2010 are also included here for reference. Modelled exceedances of the annual limit value are shown in orange and red.

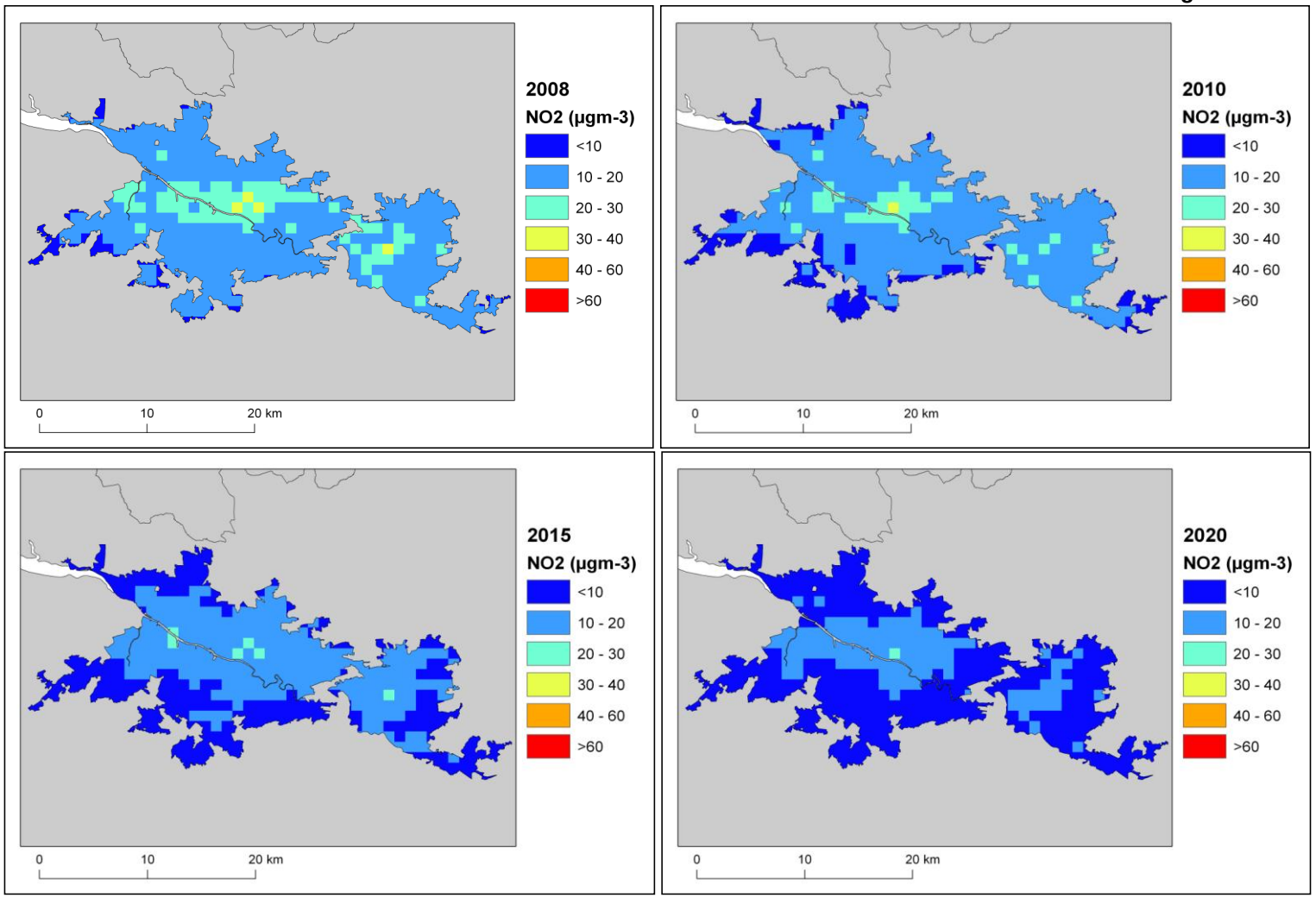
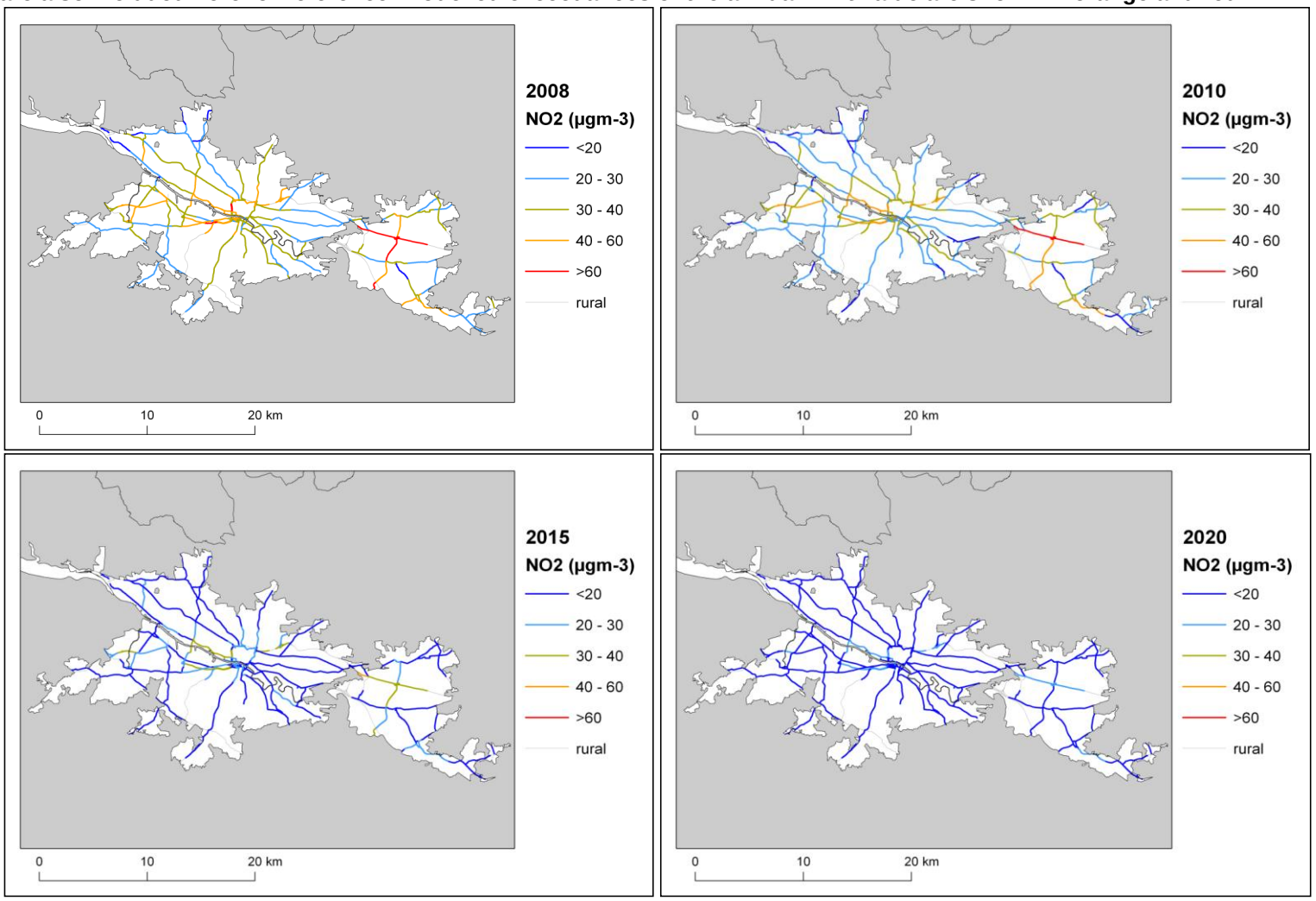


Figure 9. Roadside projections of annual mean NO_2 concentrations in 2015 and 2020 for the LEZ scenario. 2008 and baseline projections for 2010 are also included here for reference. Modelled exceedances of the annual limit value are shown in orange and red.



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Decision 2004/461/EC. Commission Decision of 29 April 2004 laying down a questionnaire to be used for annual reporting on ambient air quality assessment under Council Directives 96/62/EC and 1999/30/EC and under Directives 2000/69/EC and 2002/3/EC of the European Parliament and of the Council. From the Official Journal of the European Union, 30.4.2004, En series, L 156/78

UK technical report, UK overview document and List of UK and National measures are available at http://www.defra.gov.uk/environment/quality/air/air-quality/eu/

CDR Central Data Repository. http://cdr.eionet.europa.eu/

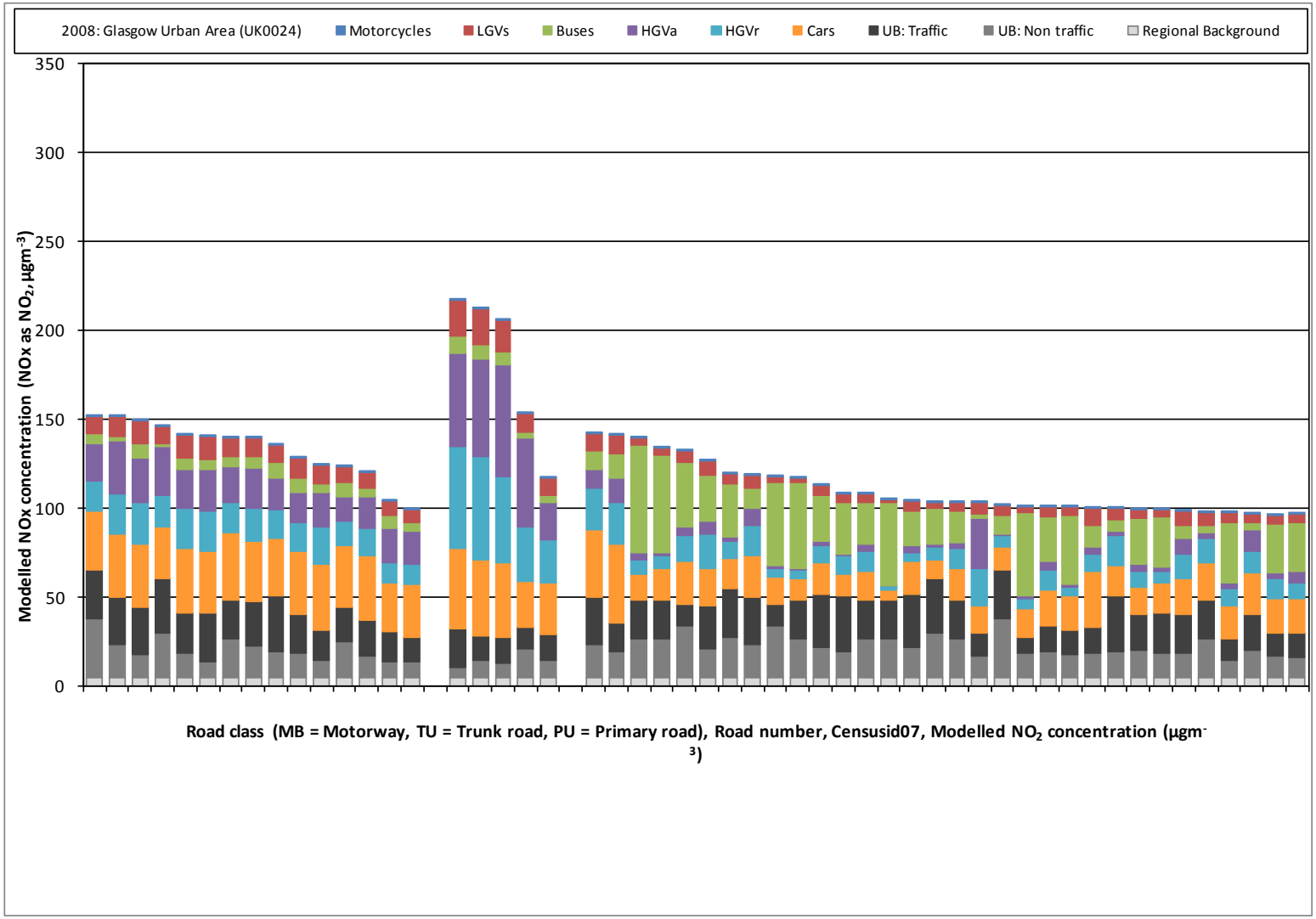
Air Quality Directive 2008/50/EC. Council Directive 2008/50/EC, of 21 May 2008. On ambient air quality and cleaner air for Europe. From the Official Journal of the European Union, 11.6.2008, En series, L152/1

1st Daughter Directive 1999/30/EC. Council Directive 1999/30/EC, of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air (The First Daughter Directive). From the Official Journal of the European Communities, 29.6.1999, En Series, L163/41.

List of Annexes

Annex 1: Source apportionment graphs

Figure A1.1 Annual mean roadside NO_X source apportionment plots for all roads exceeding the annual mean NO_2 limit value in 2008



Annex 2: Tables of measures

Table A2.1 Relevant Local Authority measures taken before or during 2010 within Glasgow Urban Area (UK0024)

LA (a)	Measure code (b)	Title	Description	Other information
Glasgow	Local_Glasgow_A1	Scheme of installing variable message signs linked to car parking space availability	Following a successful pilot project in the northern area of the City centre, the scheme of installing variable message signs linked to car parking space availability is to be extended to the remaining car parks in the City centre. This measure will assist the aims of reducing city centre congestion and improving air quality.	• Type: Technical • Sources affected: Transport • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Medium/long term • Regulatory: Yes • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Glasgow_A2	Vehicle emission testing.	Glasgow City Council has adopted the powers introduced by the Scottish Government that enable local authorities to check vehicles at the roadside and ensure that they are not exceeding prescribed exhaust emission limits. Drivers whose vehicles exceed the emission limits during roadside tests may be issued with a fixed penalty notice of £60. This measure aims to reduce the number of polluting vehicles on the road and raise public awareness on the importance of vehicle maintenance to reduce emissions levels	• Type: Technical • Sources affected: Transport • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Medium/long term • Regulatory: No • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Glasgow_A3	Tackling emissions from stationary idling vehicles.	Leaving your engine running unnecessarily while stationary produces pollution. Glasgow City Council has been given the ability to tackle emissions from stationary idling vehicles, by requiring drivers to switch off engines when parked. Authorised Local Authority Officers can instruct motorists to switch off their engines while parked and issue fixed Penalty notices of £20 to those who do not co-operate.	• Type: Economic/fiscal • Sources affected: Transport • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Medium/long term • Regulatory: No • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Glasgow_E1	Development of of cycle route network	Cycling and walking are important aids to fitness and can represent a viable alternative to the use of cars. Glasgow City Council has approved the development of a 375 km network of cycle routes, which aims to provide safe and direct access to city destinations.Cycling and walking are important aids to fitness and can represent a viable alternative to the use of cars. Glasgow City Council has approved the development of a 375 km network of cycle routes, which aims to provide safe and direct access to city destinations.	• Type: Economic/fiscal • Sources affected: Transport • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Medium/long term • Regulatory: Yes • Smarter Choices (c) : No • Reference (d):

LA (a)	Measure code (b)	Title	Description	Other information
Glasgow	Local_Glasgow_G4	School Travel Plans.	The number of children travelling to school by car has almost doubled over the last 20 years. This practice can cause localised congestion and associated pollution around schools, particularly around school starting and finishing times. Glasgow City Council has appointed a team of School Travel Plan Co-ordinators to help schools develop their own School Travel Plans to find alternative ways of travelling to and from school.	• Type: Education/information • Sources affected: Transport • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Medium term • Regulatory: No • Smarter Choices (c) : Yes • Reference (d):
Glasgow	Local_Glasgow_B1	Enforcement of air quality legislation, including the Clean Air Act 1993 and the Environmental Protection Act 1990.	Glasgow City Council enforces air quality legislation, including the Clean Air Act 1993 and the Environmental Protection Act 1990. Glasgow has been designated a Smoke Control Area, making it an offence to emit smoke from a chimney, furnace or any fixed boiler in the area, or to burn unauthorised fuels. In addition, smoke from bonfires and the burning of waste often constitute a nuisance and can lead to complaints from members of the public. Fumes and smoke from such sources contribute to the air pollution problem in Glasgow and the Council will continue to proactively enforce legislation relating to smoke control, with strong emphasis on education.	• Type: Education/information • Sources affected: Transport; Industry including heating and power production; Commercial and residential sources • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Long term • Regulatory: No • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Glasgow_A4	Glasgow City Council - improving its own environmental performance and reducing the environmental impact of its staff/ activities.	Glasgow City Council is committed to improving its own environmental performance and reducing the environmental impact of its staff and their activities on air quality. Glasgow City Council strives to reduce emissions from its large fleet of vehicles and ensures that all its vehicles are properly serviced and maintained. An ongoing programme of vehicle emissions testing is also being carried out to make certain that polluting vehicles are not being used for council business.	• Type: Technical • Sources affected: Transport; Commercial and residential sources • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Medium/long term • Regulatory: Yes • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Glasgow_F1	Walk to School Week	International Walk to School Week is held each May to encourage children and their parents to adopt a healthier lifestyle by walking to school insteads of using the car. Each May the Council raises awareness of the benefits of walking to school by inviting all primary schools to participate in Walk to School Week. Parents and guardians can improve their health and teach road safety simply by	• Type: Other • Sources affected: Transport • Spatial scale: local • Implementation date: 2004 • Reduction timescale: Short term • Regulatory: No • Smarter Choices (c) : Yes • Reference (d):

LA (a)	Measure code (b)	Title	Description	Other information
			walking their child to school.	
Glasgow	Local_Glasgow_F2	Leading by example	The Council will demonstrate best practice in the operation of its vehicle fleet. Glasgow City Council operates a fleet of over 2000 vehicles within the city. It is therefore essential that the council takes steps to cut harmful emissions from its own fleet where possible.	• Type: Other • Sources affected: Transport • Spatial scale: local • Implementation date: 2009 • Reduction timescale: Short term • Regulatory: No • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Glasgow_F3	Car Clubs	The Council will make on-road spaces available for car club vehicles.	• Type: Other • Sources affected: Transport • Spatial scale: local • Implementation date: 2009 • Reduction timescale: Short term • Regulatory: No • Smarter Choices (c) : Yes • Reference (d):
Glasgow	Local_Glasgow_F4	Low Emission Zones	The Council will undertake a detailed feasability study with a view to introducing LEZs in Glasgow.	• Type: Other • Sources affected: Transport • Spatial scale: local • Implementation date: 2009 • Reduction timescale: Short term • Regulatory: No • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Glasgow_F5	Public Service Vehicles	The Council will pursue the use of traffic regulation conditions to control bus emissions within AQMAs	• Type: Other • Sources affected: Transport • Spatial scale: local • Implementation date: 2009 • Reduction timescale: Short term • Regulatory: No • Smarter Choices (c) : No • Reference (d):
Glasgow	Local_Transport_Scotland_E1	M8 Newhouse - Baillieston road scheme	The M8, which links Edinburgh and Glasgow, includes a section of A road between Newhouse and Baillieston to the east of Glasgow. This is to be upgraded to motorway by Transport Scotland. This upgrade will be largely offline and will generally move the main traffic lanes away from residential areas and points of public access.	• Type: Technical • Sources affected: Transport • Spatial scale: local • Implementation date: 2013/2014 • Reduction timescale: Long term • Regulatory: No • Smarter Choices (c) : No • Reference (d): Personal Communication

LA (a)	Measure code (b)	Title	Description	Other information
Renfrewshire	Local_Renfrewshire_A1	Minimise Bus Idling times	Enforcement of maximum idling period of 2 minutes, or requirement for drivers to switch off engines after 2 minutes.	• Type: Education/information • Sources affected: Transport • Spatial scale: local • Implementation date: 2007 • Reduction timescale: Short term • Regulatory: No • Smarter Choices (c) : No • Reference (d): Local_zone24_Renfrewshire_AQActionplan_1

(a) Name of responsible Local Authority.
(b) The Letter in the measure code indicates the main source sector that will be affected by the measure. Letters are assigned as follows: A - measures to reduce emissions from mobile sources, B - measures to reduce emissions from stationary sources, C - fuels and petrol stations, D - Economic incentives to reduce emissions (e.g. congestion charging, controlled parking zones), E - measures related to traffic planning/redesigning infrastructure, F - information/educational measures, G - change of transport mode (e.g. scheme to encourage people out of cars and onto bikes), H - Other.
(c) Measures have been classified as 'smarter choices' or not based on expert judgement
(d) References available for download from: http://uk-air.defra.gov.uk/library/NO_2ten/