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Note on Projecting NO_2 concentrations

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Move Forward with Confidence

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1. Introduction

1.1 General

The LAQM Helpdesk previously published a Frequently Asked Question (FAQ) in relation to trends of NOx and/or NO_2 concentrations[1] . This FAQ highlighted that recent monitoring data suggests that reductions in NOx and NO_2 concentrations have been much smaller than forecast. The FAQ suggests that on some occasions local authorities may wish to consider the emerging information in relation to future predictions when producing their statutory reports. This note provides some further information on the alternative methods that might be useful for local authorities to consider in the interim whilst awaiting updates to currently available methods. This note is not part of the Technical Guidance for Local Air Quality Management 2009[2] and as such does not form statutory guidance.

In some areas, the current methods for predicting future air quality concentrations of NO_2 as outlined in Defra guidance LAQM.TG(09) may result in an overly optimistic prediction of air quality for assessment covering years 2011 to around 2020. As summarised in detail by Carslaw et al[3] , emissions especially those from some diesel vehicles and older petrol cars, are not thought to be reducing as expected. Moreover, it is still unclear if Euro VI standards will deliver the expected reductions in emissions as they become increasingly prevalent within the vehicle fleet post-2015.

Future emissions factors will be taken from the European Environment Agency COPERT 4 tool. Pending these new emissions factors being available, local authorities have asked for further clarification on how alternative methods could be applied to future predictions of air quality. This note considers a number of approaches for those local authorities that are concerned about future NO_2 concentrations and how these may pertain to achieving the air quality objectives for NO_2. Alternative methods may be used to show the level of variability in the outcomes depending on the assumptions used for modelling of future years and help to account for the difference between the trends from emissions projections and those seen in monitored concentrations of NO_2.

In preparation of this note it is assumed that the reader is familiar with the general concepts and methods used to assess NO_2 concentrations, and is aware of the emerging issues in relation to NO_2 trends as described in recent Defra reports[2]. Reference is also made to guidance issued by EPUK[4] in relation to planning and air quality which is a document commonly used by local authorities when considering development control issues and does not form any statutory guidance issued by Defra.

1.2 Role of alternatives

This note aims to set out some of the alternatives, providing suitable and relatively simplistic methods which do not necessarily require excessive resources or costs, as well as providing an indication of the levels of reduction in the predictions made, and the pros/cons of different methods.

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[1] Measured nitrogen oxides (NO_x) and/or nitrogen dioxide (NO_2) concentrations in my local authority area do not appear to be declining in line with national forecasts. Should I take *this into account in my Review and Assessment work?* Defra Local Air Quality Management Review and Assessment Helpdesk, September 2010 - http://laqm.defra.gov.uk/laqm-faqs/faq5.html

[2] http://archive.defra.gov.uk/environment/quality/air/airquality/local/guidance/documents/tech-guidance-laqm-tg-09.pdf

[3] Carslaw, D, Beevers, S, Westmoreland, E, Williams, M, Tate, J, Murrells, T, Stedman, J, Li, Y, Grice, S, Kent, A, and Tsagatakis, I. 2011. Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Prepared for DEFRA, 18th July 2011. http://uk-air.defra.gov.uk/reports/cat05/1108251149_110718_AQ0724_Final_report.pdf

[4] EPUK, Development Control: Planning for Air Quality (2010 Update), April 2010

A range of alternative options are presented, but no prescriptive method is recommended. Alternative approaches to predicting future concentrations, either through detailed modelling or projection, will inevitably present a potential range of outcomes, as concentrations in future years will vary depending on the methods and assumptions used. It is necessary to consider each situation on its own merits, and the variability of the outcomes will depend on a number of different factors including type of location, years assessed, and the nature of impacts – for example depending on the type of developments.

Some alternative methods may involve additional work, which could entail extra resources and costs. For example, varying assumptions about background concentrations and/or vehicle emissions in future years may require revised dispersion modelling.

1.3 When should alternative approaches be considered?

In the first instance it may only be considered necessary to undertake tests using alternative methods where:

- baseline monitoring or verified modelling for the area being considered indicates that NO_2 concentrations above 36 $\mu g/m^3$ (10% within the objective) have occurred in the past 3 years; and/or
- where predicted impacts are equivalent or greater than a small magnitude impact (0.4 – 2 $\mu g/m^3$) based on EPUK Guidance[5] (assuming methodology in line with LAQM.TG(09).

Other factors that may also be important when considering the need for alternative approaches include:

- The information that local monitoring data already provides in terms of the risk of exceeding the air quality objectives;
- Where there are known sensitivities to air quality issues such as existing or proposed declarations of Air Quality Management Areas, and presence of sensitive receptors;
- The availability of local information on long terms trends at background and roadside locations. These may establish how concentrations have been reducing in recent years. Local authorities might wish to consider 5 years monitoring when establishing recent trends, as shorter term trends can be overly influenced by individual years;
- The period over which base and future years are defined. The more years between these the greater the potential for overly conservative assumptions (e.g. holding background at 2006 levels for an assessment in 2017 may be too conservative);
- Where an authority is concerned about cumulative impacts of various measures or developments over time, or where a large development is proposed. Therefore, a local authority may require alternatives to be considered even where the above are not satisfied.

However, it is not considered possible to confirm definitively the circumstances when alternatives would be required to be assessed as every situation is different, and there may be other reasons for considering alternative methods.

[5] This note does not pertain to the overall need for an air quality assessment and relates only to the potential need for considering alternative methods. The requirement for an air quality assessment may be set down by the planning authority to comply with its own policy framework and/or at the project level via EIA regulations.

2. Different approaches to alternatives

The use of alternatives may assist local authorities and people preparing air quality assessments in support of planning applications in establishing whether additional measures or mitigation should be considered because concentrations may be closer to, or above, the air quality objective for NO_2.

Alternatives may consider a wide range of options including, but not limited to:

- Background concentrations (2.1)
- Vehicle emissions (2.2)
- A combination of background and vehicle emissions (2.3)
- Pollutant concentration projections (2.4)
- Local pollution trends (2.5)

The decision behind the choice of approach and the methodology behind any calculations carried out should be fully described in any assessment reports.

2.1 Assumptions about background concentrations

It may be appropriate to keep background concentrations in future years the same as the baseline year. Where possible for the baseline year, monitored background concentrations should be used, or where LAQM.TG(09) background maps are used, then these should be compared to available background monitoring in order to ensure they reflect monitoring data. This approach is consistent with LAQM.TG(09).

Local information can be used where available to assess whether background concentrations are falling, and whether these are in line with the projections on which the background maps are based. In many cases background concentrations are falling, but not as much as expected based on the currently available emissions factors. It may be possible for a local background trend to be determined. However, when determining local background trends it is recommended that a minimum of 5 years of data should be used, and that information from multiple representative sites must be used. Where diffusion tubes are used these should be bias adjusted and only those sites with 9 months or more data should be used (i.e. not annualised results).

Methods including adjustment of individual background maps and sectors may also be suitable. Such methods will entail more detailed dis-aggregation and re-aggregation of NOx contributions, and require a recalculation of NO_2 background (as described in LAQM.TG(09).

In order to assist local authorities, including those who may not have the required amount of data to obtain local trends, Section 2.4 of this report provides a table of alternative background projection factors that may be useful. This may then suggest the need to carry out more detailed consideration of background assumptions.

Where there is a lack of information, the 2008 background maps may be a reasonable starting point for projection using the alternative background projection factors as the maps for this year have been verified against 2008 monitoring data.

2.2 Assumptions about vehicle emissions

Emerging evidence[6] suggests that emissions of NOx from some vehicles are much greater than previously expected. Information indicates that it is diesel cars and LGVs which are mostly affected, although some old petrol cars may also have higher emissions than thought, and some HGVs equipped with SCR abatement may emit higher NOx emissions, especially in urban driving conditions. This means that currently, under some circumstances, available emissions factors are likely to be underestimating the amount of NOx and NO_2 being emitted for some vehicles.

In order to account for this, in the absence of a revised Emission Factor Toolkit (incorporating the latest COPERT 4 Emission Factors, the current Emissions Factors Toolkit can be used to hold some vehicle emissions steady at 2006 levels (diesel cars and LGVs for example). The vehicle volumes can still be representative of the future year under consideration (as this allows for vehicle growth or other increases in traffic that may need to be considered) but assumes there has been no improvement in emission factors since 2006. These emissions can then be recombined with the emissions estimates from other vehicles (calculated with the EFT using the standard methodology and correct year), and can, for example, be used in dispersion models.

[6] Carslaw, D, Beevers, S, Westmoreland, E, Williams, M, Tate, J, Murrells, T, Stedman, J, Li, Y, Grice, S, Kent, A, and Tsagatakis, I. 2011. Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Prepared for DEFRA, 18th July 2011. http://uk-air.defra.gov.uk/reports/cat05/1108251149_110718_AQ0724_Final_report.pdf

Example of how to use of EFT to hold diesel and LGV emissions at 2006 levels for 2015 traffic flows.

Step 1: Calculate 2006 Emission Rates
In the EFT, Select NO_X , Air Quality Modelling, Source Breakdown by Vehicle and base year of 2006

Input the following (this examples assumed 1000 vehicles per day in 2015 with 12% HDV @ 30kph.

Source_Name	Traffic Flow	%HDV	Speed (kph)	No of Hours	Road Type
2006 emission	1000	12	30	24	4

The output (A) is:

Source Name	Pollutant Name	Emission Rates (g/km)	Petrol Cars (g/km)	Diesel Cars (g/km)	Taxi (g/km)	Petrol LGV (g/km)	Diesel LGV (g/km)	Rigid HGV (g/km)	Artic HGV (g/km)	Buses (g/km)	Motorcycles (g/km)
2006 emission	NOx	1334.0	188.7	98.9	30.3	4.3	97.2	350.3	222.0	339.8	2.5

Step 2: Calculate 2015 Emission Rates

In the EFT, Select Nox, Air Quality Modelling, Source Breakdown by Vehicle and base year of 2015

Source_Name	Traffic Flow	%HDV	Speed (kph)	No of Hours	Road Type
2015 emission	1000	12	30	24	4

Source Name	**Pollutant Name**	**Emission Rates (g/km)**	**Petrol Cars (g/km)**	**Diesel Cars (g/km)**	**Taxi (g/km)**	**Petrol LGV (g/km)**	**Diesel LGV (g/km)**	**Rigid HGV (g/km)**	**Artic HGV (g/km)**	**Buses (g/km)**	**Motorcycles (g/km)**
2015 emission	NOx	453.1	31.4	67.6	10.5	2.7	28.7	92.8	60.5	157.5	1.4

Step 3: Sum the emission rates assuming 2006 for diesel cars, taxis, diesel LGV, and 2015 for the rest.

Source Name	Pollutant Name	**Combined Emission Rates (g/km)**	Petrol Cars (g/km)	Diesel Cars (g/km)	Taxi (g/km)	Petrol LGV (g/km)	Diesel LGV (g/km)	Rigid HGV (g/km)	Artic HGV (g/km)	Buses (g/km)	Motorcycles (g/km)
2006 emission	NOx	**572.6**	31.4	98.9	30.3	2.7	97.2	92.8	60.5	157.5	1.4

Step 4: Calculate combined g/km/sec emission rate

572.6 / (24*60*60) = 0.00663 g/km/sec

This new combined emission rate is approximately 25% higher than the emission rate of 0.00524 g/km/sec assuming 2015 emission for all vehicles. For comparison, the assumption assuming all vehicle emissions remain as 2006 would result in emissions rates approximately 300% higher (0.154 g/km/sec).

It is important to note that the fleet assumptions (e.g. diesel cars and LGVs) will be based on the year 2006 (including Euro standards, mileage and degradation factors) and therefore the resulting emissions are estimates only as changes in mileage and degradation factors for older vehicle will not be accounted for. However this provides a practical method to lessen the reductions in emissions in these vehicles that would otherwise be calculated, but it is only an estimate.

A similar approach may be taken for HGVs, however, this may be overly conservative as information suggests it is only newer vehicles (and especially those fitted with SCR operating in urban areas) that are affected. Therefore, it would not be recommended that all HGV emissions were assumed to be constant for all future years as this is likely to be too conservative. In particular, this approach should be considered carefully where motorways or others roads with significant numbers of HGVs are involved as information suggests HGV emissions are following the expected decline at higher speeds. Similarly, holding all types of vehicle emissions as constant for all future years, or at 2006 levels may also be overly conservative as no reductions in petrol and HGV emissions would be considered.

For any methods which consider holding vehicle emissions factors steady at 2006 (or baseline year levels) it should be noted that this may be conservative where future years beyond 2017 are being considered. This is because the Euro VI vehicles are not expected to make up more than 30% of the car and LGV fleet until around 2017, but greater improvements in fleet emissions are expected once these vehicles form a significant proportion of the fleet and therefore improving trends in emissions are anticipated. However, is still unclear if Euro VI standards (including HGVs and buses) will deliver the expected reductions in emissions as they become increasing important within the vehicle fleet beyond 2015.

2.3 A combination of assumptions about background and vehicle emissions

It may be appropriate to use a combination of assumptions about background levels and vehicle emissions, for example where both background and roadside monitoring data do not appear to be declining. This helps to ensure that consideration is given to lower reductions in background levels as well as relevant vehicle emissions in assessments, recognising the policy drivers within the UK Air Quality Strategy.

Combinations which maintain background concentrations at baseline levels (or 2008 mapped background) for all years, as well as assuming that there is no change in vehicle emissions is likely to be overly conservative especially where the year of assessment is beyond 2017.

For the purposes of assessing alternatives and potential impacts of various measures, local authorities may want to consider the conservative estimate of future results. This may help local authorities understand where there are risks in achieving the air quality objectives, or where the impacts of different action plan measures, or developments, assuming current information, may be overly optimistic. In the latter case, some consideration of additional measures may be needed, for example, to provide further reductions in emissions and concentrations, and exposure. Where a worse-case assessment indicates that the objectives would be met and impacts are acceptable (following consideration of mitigation as appropriate) then it may not be necessary to consider any further measures or mitigation.

2.4 Assumptions about pollutant concentration projections

Another option that may provide a simple alternative approach is the use of estimates of trends presented in recent reports. The information on trends provided by Carslaw et al[7] within recent Defra reports suggest that the following reductions of annual NO_2 concentrations, on average, have been monitored across the UK (Table 1) over the past few years. Further detail of methods used to derived these reductions and the uncertainties and variations across the different sites are provided within the report.

Table 1 (from Carslaw et al[1])	Average Percentage Reduction per Year (%) based on data from 2004 to 2009	
Location Description	NOx	NO_2
UK Roadside (11 monitoring sites)	-1.4	-0.6
UK Urban Centre (10 sites)	-0.8	-0.4
UK Urban Background (17 sites)	-2.1	-0.8
Inner London (10 sites)	-0.6	-0.5
Outer London (13 sites)	-1.7	-0.8
UK Rural (10 sites)	-1.9	-1.4
Motorway (3 sites)	-3.4	-0.8

These average trends have been used to provide alternative projection factors that may be used by local authorities who would like to consider an alternative assessment -based on average national trends of future NO_2 concentrations - as provided in Table 2 below. These have also been set out similarly to those in BOX 2.1 (Amended as part of LAQM.TG(09)[8]) as the format is familiar to local authorities and those undertaking review and assessment.

Table 2 Alternative Projection Factors for Annual Mean NO_2 Concentrations in Future Years		
Average % Reduction Per Year [a]	-0.87	-0.68
Year	Background[b]	Roadside[c]
2006	1	1
2007	0.991	0.993
2008	0.983	0.987
2009	0.974	0.980
2010	0.966	0.973
2011	0.957	0.967
2012	0.949	0.960
2013	0.941	0.954
2014	0.933	0.947
2015	0.925	0.941
2016	0.917	0.935
2017 [d]	0.909	0.928
2018 [d]	0.901	0.922
2019 [d]	0.893	0.916
2020 [d]	0.885	0.910

(a) Carslaw et al, (b)Average of UK Urban Centre, UK Urban Background and UK Rural (c)Average of UK Roadside, Inner London, Outer London and Motorway, (d) Sensitivity projection factors for these years may be conservative as reductions are expected to improve beyond 2017 due to increased proportions of Euro VI vehicles

[7] Carslaw, D, Beevers, S, Westmoreland, E, Williams, M, Tate, J, Murrells, T, Stedman, J, Li, Y, Grice, S, Kent, A, and Tsagatakis, I. 2011. Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Prepared for DEFRA, 18th July 2011. http://uk-air.defra.gov.uk/reports/cat05/1108251149_110718_AQ0724_Final_report.pdf

[8] http://laqm.defra.gov.uk/documents/Is_the_example_in_Box_2.1_TG09_correct.pdf

Note that the factors produce the same reduction for the number of years regardless of starting point as reduction is the same per year. So the factor between 2007 and 2012 (over 6 years) for a roadside site is (0.960/0.993)= 0.967, is the same as 2013 and 2018 (0.922/0.954)=0.967.

For example, the measured NO_2 concentration at a roadside site in 2008 is 42.3 $\mu g/m^3$ Using Table 2 alternative projection factors to estimate the concentration in 2013 would be

$$42.3 \times (0.954/0.987) = 40.9\ \mu g/m^3.$$

This would compare to projected concentration of 29.1 $\mu g/m^3$ based on LAQM.TG(09) projection factors where: 42.3 x (0.687/1) = 29.1 $\mu g/m^3$. It would therefore be reasonable to consider that the annual mean NO_2 concentration is likely to lie somewhere between 40.9 $\mu g/m^3$ and 29.1 $\mu g/m^3$. More information on how to interpret this range is provided below.

Similarly, a monitored background in 2009 provides an annual background NO_2 concentration of 23 $\mu g/m^3$. An estimate for background concentrations in 2015 would be 23 x (0.925/0.974) = 21.8 $\mu g/m^3$.

2.5 Assumptions about local pollution trends

Local monitoring data may provide useful information about pollution trends at both background and roadside sites. In many cases, concentrations are generally reducing at background sites and where the base year for an assessment is before 2008, it may be overly conservative to keep background concentrations the same for all future years, in particular beyond 2017 (partly in relation to Euro VI fleet proportions).

Local trends should be determined carefully based on at least 3 monitoring sites (within each site category considered e.g. 3 roadside sites) with at least 5 years of monitoring data (including sufficient data capture and no requirement for annualisation of results). In the first instance, it is recommended that trends based on Section 2.4 be considered as these are based on a large number of automatic monitoring sites across the UK and the results have been determined to be statistically significant.

Trends determined from long term diffusion tube monitoring sites may be more uncertain than those based on automatic monitoring stations, where possible automatic monitoring stations should be used to derive local trends.

Where local trends are derived, these should consider different site types as the trends may be different for example at background versus roadside sites. Where information is available it may be possible to derive a kerbside trend, although monitoring sites should be representative of exposure. In some cases, it may be suitable to combine roadside and kerbside sites if trends are similar across these site types.

3. Understanding results

3.1 How should the range of concentrations be interpreted?

Where a wide range of concentrations is presented, the likelihood of the projected concentrations may need consideration. Continuing with the example above, the sensitivity test results indicate that there is a risk that the air quality objective for NO_2 may continue to be exceeded, albeit marginally. The year being assessed in this example is 2013 and it would be reasonable to assume that the current trends would be appropriate and that the resulting concentration of 40.9$\mu g/m^3$ is unlikely to be overly conservative. Therefore considerations of additional options to; reduce further the concentrations; reduce increases in exposure such as through mitigation measures; or through other planning considerations, may be warranted, depending on the circumstances and wider results.

However, if the same example were used but the year of assessment was 2017 then, in relation to further mitigation, the assessment for these years may be considered to be slightly conservative and may reduce the amount of mitigation required to meet the objective (although the need for mitigation is not only determined by the need to meet the air quality objective depending on the overall impacts).

As is the case for any development (and as described within EPUK Guidance[9]), professional judgement about impacts, consideration of local information, and other planning considerations should be taken into account.

3.2 Use of alternative factors in detailed modelling studies

A simplistic "gap analysis" between LAQM.TG(09) and alternative projections (as shown in Table 2) may be suitable in order to avoid the need for extensive remodelling and assessment associated with varying assumptions about background and traffic emissions, although this may be required depending on the circumstances.

Example 1:

For example, based on Table 2, the alternative projection factor between 2008 and 2013 is (0.954/0.987)=0.967.

Using the LAQM.TG(09) addendum projections the factor is 0.687.

The ratio of the alternative factor and TG(09) factor is 0.967/0.687 = 1.408.

This ratio can be applied to the modelled results for 2013, for example, "Do-Something" (with development) and "Do-Minimum" (without development) scenarios as this provides an estimate of the concentrations that might be expected should the emerging trends information apply (as shown in Table 3). The alternative results can then be considered as part of the planning process and any significant impacts may need further consideration as described above. In this case, some further discussion may be warranted as there is a risk that the objective may be exceeded.

Table 3	Factors	Base 2008	DM2013	DS2013
(a) TG(09) based results		41.0	27.5	28.9
(b) TG(09) Factor 2008-2013	0.687			
(c) Alternative Factor 2008-2013	0.967			
(d) Ratio Alternative/TG(09)	1.408			
Alternative Results (a x d)			38.7	40.7

However, in cases where the Do-Minimum scenario incorporates local traffic growth, for example due to committed developments in the area, it may be necessary to considered the actual modelled concentrations in both the baseline and do-minimum scenarios before considering the ratio to apply as an alternative test.

In relation to planning, the alternative projections provided in Table 2 could be applied to do-minimum and do-something development scenarios, and then the magnitude and impact significance could be assessed, for example using the EPUK Guidance. This can be carried out without the need to remodel as described in Example 2 of Section 2.7 and example 2 shows this approach.

[9] EPUK, Development Control: Planning for Air Quality (2010 Update), April 2010.

Example 2: A development is proposed to open in 2020. Predictions based on verified baseline modelling have been reported for 2010 (the baseline), and for a Do-Minimum Scenario without development (but with committed development) in 2020, and with development (the Do-Something scenario) in 2020.

Results based on LAQM.TG(09) methods and alternative results derived through a simple gap analysis based on difference between TG(09) and Alternative Projection Factors(after Carslaw et al) are shown in Table 4.

Table 4			Following LAQM.TG(09) Methods		Ratio A	Ratio B		Alternative Results based on application of Gap Factor	
Receptor Name	Receptor Type	2010 Base	Do-minimum	Do-something	TG09 Modelled 2010 Base/2020 Do-Minimum	Alternative Projection Factor between 2010 and 2020 based on Carslaw et al	Gap Factor (Ratio B/ Ratio A)	2020 Do-Minimum	2020 Do-Something
Receptor 1	Roadside	33.0	18.3	18.7	0.555	=0.910/0.973 =0.935	1.685	30.9	31.5
Receptor 2	Roadside	32.4	18.1	18.4	0.557		1.678	30.3	30.9
Receptor 3	Roadside	36.0	19.3	19.7	0.536		1.745	33.7	34.3
Receptor 4	Roadside	37.8	19.8	20.2	0.524		1.785	35.4	36.0
Receptor 5	Roadside	**42.9**	21.5	21.9	0.500		1.868	**40.1**	**40.9**
Receptor 6	Roadside	36.8	19.3	19.6	0.525		1.782	34.4	35.0
Receptor 7	Roadside	32.9	18.1	18.4	0.549		1.703	30.8	31.3
Receptor 8	Roadside	**55.1**	26.2	26.7	0.475		1.969	**51.5**	**52.5**
Receptor 9	Roadside	**41.9**	21.2	21.8	0.507		1.845	39.1	**40.5**
Receptor 10	Roadside	31.5	17.6	17.9	0.558		1.675	29.5	30.0
Receptor 11	Roadside	31.6	17.6	17.9	0.558		1.676	29.6	30.1
Receptor 12	Roadside	32.4	17.9	18.4	0.551		1.697	30.3	31.3
Receptor 13	Roadside	32.1	17.7	18.4	0.553		1.690	30.0	31.1
Receptor 14	Roadside	31.9	17.7	18.3	0.554		1.688	29.8	30.9
Receptor 15	Roadside	33.5	18.2	18.5	0.542		1.724	31.3	31.9
Receptor 16	Roadside	33.6	18.2	18.5	0.541		1.728	31.5	32.0
Receptor 17	Roadside	33.3	18.1	18.6	0.545		1.716	31.1	32.0
Receptor 18	Roadside	31.3	17.5	17.9	0.558		1.675	29.3	30.0
Receptor 19	Roadside	33.3	18.1	18.4	0.543		1.721	31.1	31.6
Receptor 20	Roadside	33.2	18.1	18.4	0.544		1.719	31.1	31.6

Exceedences of the objective are shown in highlighted **bold**.

Table 5 below shows the impact magnitude and significance assessment based on EPUK Guidance for both sets of results.

Table 5	Following LAQM.TG(09) Method				Following Alternative Method			
Receptor Name	Change in Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change as % of Objective	EPUK Magnitude	EPUK Significance	Change in Annual Mean NO_2 Concentration ($\mu g/m^3$)	Change as % of Objective	EPUK Magnitude	EPUK Significance
Receptor 1	0.36	0.9%	Imperceptible	Negligible	0.61	1.5%	Small	Negligible
Receptor 2	0.34	0.9%	Imperceptible	Negligible	0.58	1.4%	Small	Negligible
Receptor 3	0.35	0.9%	Imperceptible	Negligible	0.61	1.5%	Small	Negligible
Receptor 4	0.36	0.9%	Imperceptible	Negligible	0.64	1.6%	Small	Slight Adverse
Receptor 5	0.42	1.1%	Small	Negligible	0.79	2.0%	Small	Slight Adverse
Receptor 6	0.35	0.9%	Imperceptible	Negligible	0.62	1.6%	Small	Negligible
Receptor 7	0.29	0.7%	Imperceptible	Negligible	0.50	1.2%	Small	Negligible
Receptor 8	0.50	1.2%	Small	Negligible	0.97	2.4%	Small	Slight Adverse
Receptor 9	0.76	1.9%	Small	Negligible	1.39	3.5%	Small	Slight Adverse
Receptor 10	0.30	0.7%	Imperceptible	Negligible	0.50	1.2%	Small	Negligible
Receptor 11	0.30	0.7%	Imperceptible	Negligible	0.50	1.2%	Small	Negligible
Receptor 12	0.57	1.4%	Small	Negligible	0.96	2.4%	Small	Negligible
Receptor 13	0.66	1.6%	Small	Negligible	1.11	2.8%	Small	Negligible
Receptor 14	0.61	1.5%	Small	Negligible	1.04	2.6%	Small	Negligible
Receptor 15	0.35	0.9%	Imperceptible	Negligible	0.60	1.5%	Small	Negligible
Receptor 16	0.31	0.8%	Imperceptible	Negligible	0.53	1.3%	Small	Negligible
Receptor 17	0.50	1.3%	Small	Negligible	0.86	2.2%	Small	Negligible
Receptor 18	0.41	1.0%	Small	Negligible	0.69	1.7%	Small	Negligible
Receptor 19	0.29	0.7%	Imperceptible	Negligible	0.50	1.3%	Small	Negligible
Receptor 20	0.30	0.8%	Imperceptible	Negligible	0.52	1.3%	Small	Negligible

The alternative test results in a different impact magnitude and significance assessment at some receptors. Discussion regarding additional mitigation may be warranted even though the magnitude of impacts are generally small. In this case, as the assessment year is 2020 the results may be conservative, and this should be considered when determining the need for additional mitigation. Therefore professional judgement remains an important element of the decision making process.

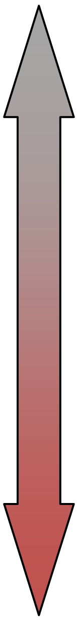
More information on assessment of significance is provided in EPUK Guidance[10].

[10] EPUK, Development Control: Planning for Air Quality (2010 Update), April 2010.

3.3 How optimistic are alternatives?

In general, results based on the alternative projection factors in Table 2 are likely to be reasonable estimates particularly between 2011 and 2015. However, they may present the most conservative results especially beyond 2017. However, in some circumstance, particularly those where diesel LGVs and cars are more prevalent in the fleet mix, then assuming background is held constant and no reduction in diesel car or LGV emissions are assumed may produce slightly higher results. An indicative range of how optimistic alternative results are is suggested below:

Greatest annual reduction



- LAQM.TG(09)

- Diesel cars/LGV emissions held constant
- Background held constant

- Background and diesel car/LGV emissions held constant.

- Average National Trend (Carslaw et al)
- Decreasing Local Trends

- Background and all vehicle emissions held constant
- Increasing Local Trends.

Least annual reduction

It must be reiterated that the order of these tests will depend on a number of variables including the type of road being considered, the location, relative proportions of vehicle types, the years being assessed and the gap between the years being assessed. It should be noted that alternative methods described here are not exhaustive and there may be a wider range of options suitable for consideration where necessary.

This process may be useful to local authorities to understand any specific areas where they may consider the impacts require further mitigation or other planning considerations. It is also important that where an AQMA already exists, options are considered to reduce the potential conflicts with Air Quality Action Plans or other air quality policies which may arise as a result of the findings based on alternative methods.

This type of consideration is consistent with the approaches outlined in EPUK Guidance on Planning Control.