Kirklees Council Air Quality Assessment

Development Associated with the Local Plan

Kirklees Council

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Quality information

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Executive Summary

Kirklees Council (KC) is in the process of preparing a new Local Plan, which will set out the District's development plans and ambitions up to 2031. The Plan proposes where developments should be located, the nature of the development and size. KC understands that the Plan must consider the air quality implications of development; the Plan should not recommend a development of a type and size in an area where the air quality impact may be unacceptable,

The air quality assessment presented in this report has considered the potential effect of the proposed Local Plan on annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ for two future year scenarios of 2020, with partial implementation of the Plan, and 2030 with full implementation of the Plan at over 6500 sensitive receptor locations within the Kirklees administrative area.

Receptors within the Kirklees Air Quality Management Areas are all predicted to experience negligible changes in annual mean pollutant concentrations for all pollutants (NO_2, PM_{10} and $PM_{2.5}$), with pollutant concentrations below the objective values at all receptors within the AQMAs in the future years for all three pollutants.

The predicted effect of the proposed Local Plan on annual mean NO_2 concentrations in 2020 is anticipated to be moderate adverse at three receptor locations, slight adverse at 29 receptor locations, slight beneficial at one receptor and of negligible significance across the remainder of the study area. In 2030, the predicted effect of the proposed Local Plan is anticipated to be slight adverse at two receptor locations and of negligible significance everywhere else in the Kirklees area.

For particulate matter (both PM_{10} and $PM_{2.5}$) negligible effects are predicted at all sensitive receptors.

The effect of the Local Plan on local air quality is therefore overall considered to be not significant for air quality.

Acronyms

Term	Meaning Adopted in this Assessment
AADT	Annual Average Daily Traffic (vehicles per day)
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CAFE	Clean Air for Europe
CO	Carbon Monoxide
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EFT	Emission Factor Tools
EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
km/hr	Kilometres per hour
LAQM	Local Air Quality Management
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter of less than 2.5 micrometre
PM_{10}	Particulate Matter with an aerodynamic diameter of less than 10 micrometre
TG	Technical Guidance
$\mu g/m^3$	Microgrammes (of pollutant) per cubic metre (of air)
UK	United Kingdom

Glossary

Term	Meaning Adopted in this Assessment
Air Pollutants	Amounts of foreign and/or natural substances occurring in the atmosphere that may result in adverse effects on humans, animals, vegetation and/or materials
Air Quality Sensitive Receptors	People, property or designated sites for nature conservation that may be at risk from exposure to air pollutants that could potentially arise as a result of the Proposed Local Plan
Ambient Air Quality	The concentrations of gases and particles in the atmosphere (tropospheric boundary layer) to which the general population would be exposed, as opposed to the concentration of pollutants emitted by a specific source
Annual Average Daily Traffic (AADT)	Annual Average Daily Traffic is the average flow on an average day, i.e. Sunday to Saturday inclusive, throughout the year and is expressed as a 24-hour flow.
Annual Mean Concentration	The average (mean) of the hourly pollutant concentrations measured or predicted for a one year period
Air Quality Management Area (AQMA)	An Air Quality Management Area is defined as an area where people are likely to be exposed to unacceptably high air pollution levels, either now or in the future, unless action is taken to reduce exposure to pollutants.
Baseline	The conditions against which potential effects arising from the scheme are identified and evaluated.
Beneficial	Conferring benefit and/or having a positive effect on a receptor.
Consultation	The act of consulting [To take into account; consider, seek advice or information, to have regard for (a person's interest, convenience, etc.) in making plans].
Cumulative Effects/Impacts	The total impacts on a receptor when impacts from all sources are considered.
Design Manual for Roads and Bridges (DMRB)	A series of 15 volumes that provide official standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom.
Emission Factors	The average emission rate of a given pollutant for a given source, relative to units of activity. Used to model future pollution concentrations under different scenarios
Heavy Duty Vehicle (HDV)	A vehicle type classification, including rigid and articulated heavy goods vehicles, plus buses and coaches, that is used by air quality dispersion models
Light Duty Vehicle (LDV)	A vehicle type classification, including motorcycles, cars and light goods vehicles, that is used by air quality dispersion models
Mitigation	Measures taken to avoid, reduce or remove environmental impacts. Mitigation can moderate adverse effects and enhance the beneficial ones arising from the whole or specific elements of the scheme.
Negligible	So small a magnitude that its effect may safely be neglected or disregarded.
Particulate Matter	Solid particles or liquid droplets suspended or carried in the air
Permanent	Long-lasting or non-fading.
Qualitative	Pertaining to or concerned with quality or qualities.
Quantitative	Of or pertaining to the describing or measuring of quantity.
Significant	Important; of consequence.
Site of Special Scientific Interest (SSSI)	A site designated by Natural England as an area of special interest by reason of any of its flora, fauna, geological or physiographical features
Special Area of Conservation (SAC)	An area which has been given special protection under the European Union's Habitats Directive. SACs provide increased protection to a variety of wild animals, plants and habitats and are a vital part of global efforts to conserve the world's biodiversity.
Special Protection Area (SPA)	An area of land, water or sea which has been identified as being of international importance for the breeding, feeding, wintering or the migration of rare and vulnerable species of birds found within the European Union. SPAs are European designated sites, classified under the European Wild

Term	Meaning Adopted in this Assessment
	Birds Directive which affords them enhanced protection.
Statutory	Prescribed or authorised by state.
Temporary	Lasting existing, serving, or effective for a time only; not permanent.
Transport Assessment	An assessment which covers the traffic impacts on the surrounding highway network of a proposed development.
Volatile Organic Compound	A gas emitted from certain solids or liquids. VOCs include a variety of chemicals, some of which are known to have short-term and long-term adverse health effects.

1. Introduction

Kirklees Council (KC) is in the process of preparing a new Local Plan, which will set out the District's development plans and ambitions over the next 18 years. The Plan proposes where developments should be located, the nature of the development and size. KC understands that the Plan must consider the air quality implications of development; the Plan should not recommend a development of a type and size in an area where the air quality impact may be unacceptable.

The air quality assessment considers the effect of the proposed land uses on sensitive receptors (e.g. residential properties) located within Kirklees Council's administrative area in 2020 and 2030, focussed on the effects of changes in traffic flows on the local road network due to the use of land as set out in the Local Plan. The assessment presented in this report does not constitute a detailed assessment of each piece of land and does not consider the effects of construction of these sites.

2. Legislation and Policy Context

2.1 Legislation

2.1.1 European Legislation

The Clean Air for Europe (CAFE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC (Council of European Communities, 1996), its associated Daughter Directives 1999/30/EC (Council of European Communities, 1999), 2000/69/EC (Council of European Communities, 2000), 2002/3/EC (Council of European Communities, 2002), and the Council Decision 97/101/EC (Council of European Communities, 1997) with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Council of European Communities, 2008).

2.1.2 National Legislation

Directive 2008/50/EC (Council of European Communities, 2008) is currently transposed into UK legislation by the Air Quality Standards Regulations 2010 (H.M. Government, 2010), which came into force on 11th June 2010. These limit values are binding on the UK and have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole.

2.1.2.1 National Air Quality Strategy

The UK National Air Quality Strategy (Defra, 2000) was initially published in 2000, under the requirements of the Environment Act 1995 (H.M. Government, 1995). The most recent revision of the strategy (Defra, 2007) sets objective values for key pollutants as a tool to help Local Authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive. Some of these objective values have been laid out within the Air Quality (England) Regulations 2000 (H.M. Government, 2000) and later amendments (H.M. Government, 2002).

The air quality objective values referred to above have been set down in regulation solely for the purposes of local air quality management. Under the local air quality management regime KC has a duty to carry out regular assessments of air quality against the objective values and if it is unlikely that the objective values will be met in the given timescale, they must designate an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) with the aim of achieving the objective values. The boundary of an AQMA is set by the governing local authority to define the geographical area that is to be subject to the management measures to be set out in a subsequent action plan. Consequently it is not unusual for the boundary of an AQMA to include within it relevant locations where air quality is not at risk of exceeding an air quality objective. The UK's national air quality objective values for the pollutants of relevance to this assessment are displayed in Table 1.

Table 1. Air Quality Objective Values for England

Pollutant	Averaging Period	Objective Value	Maximum Permitted Exceedences	Target Date
Nitrogen Dioxide (NO_2)	Annual Mean	40 µg/m^3	None	31/12/05
	Hourly Mean	200 µg/m^3	18 times per year	31/12/05
Particulate Matter (PM_{10})	Annual Mean	40 µg/m^3	None	31/12/04
	24-hour	50 µg/m^3	35 times per year	31/12/04
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	25 µg/m^3	None	2020

2.2 Planning Policy Context

2.2.1 National Planning Policy

2.2.1.1 National Planning Policy Framework (2012)

The National Planning Policy Framework (NPPF) was published in March 2012 (Department of Communities and Local Government, 2012), paragraph 109 of which states:

"The planning system should contribute to and enhance the natural and local environment by:

preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability…"

Annex 2 of the NPPF defines 'Pollution' as:

"Anything that affects the quality of land, air, water or soils, which might lead to an adverse impact on human health, the natural environment or general amenity. Pollution can arise from a range of emissions, including smoke, fumes, gases, dust, steam, odour, noise and light".

There are both national and local policies for the control of air pollution and local action plans for the management of local air quality within KC areas. The effect of the Proposed Development on the achievement of such policies and plans are matters that may be a material consideration by planning authorities when making decisions for individual planning applications. Paragraph 124 of the NPPF states:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

The different roles of a planning authority and a pollution control authority are addressed by the NPPF in paragraph 122:

"... local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

The National Planning Practice Guidance (NPPG) (Department of Communities and Local Government, 2014), provides a summary of the air quality issues set out in the NPPF and goes on to note that the assessment should include the following information:

- The existing air quality in the study area (existing baseline);
- The future air quality without the development in place (future baseline), and
- The future air quality with the development in place (with mitigation).

The guidance then advises that the application should proceed to decision with appropriate planning conditions or planning obligation, if the proposed development (including mitigation) would not lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or fail to comply with the requirements of the Habitats Regulations.

2.2.2 Local Planning Policy

2.2.2.1 Kirklees Council

Kirklees Council is currently transition from UDP to Local Plan after the withdrawal of their Core Strategy on 23rd October 2013 (KC, 2013a). UDP policies saved beyond September 2007 (KC, 2007) remain the current statutory development plans for Kirklees. Policies that repeat a national policy were not saved, so that national policies would directly apply to their administrative area. Because of this, local air quality is covered by the NPPF.

2.3 Local Air Quality Management

Under the requirements of Part IV of the Environment Act (1995) (H.M. Government, 1995), KC have carried out a phased review and assessment of local air quality within the area (KC, 2015).

Kirklees Council has declared two AQMAs within their administrative boundary, one on Leeds Road, Bradley for the exceedence of nitrogen dioxide concentrations, and one along a portion of Huddersfield Road (A644) within Dewsbury for the exceedence of PM_{10} concentrations. Concentrations of nitrogen dioxide above the 40 µg/m^3 objective value have been recorded at several locations outside of the AQMAs, and are currently under detailed assessment.

3. Assessment Methodology and Assessment Criteria

3.1 Overview

There is currently no statutory guidance on the method by which an air quality impact assessment should be undertaken. Several non-statutory bodies have published their own guidance relating to air quality and development control (IAQM & EPUK, 2015). This air quality assessment report has been produced applying existing national regulations, guidance and good practice.

Potentially affected air quality sensitive receptors have been identified, based on their proximity to roads that are predicted to experience a significant change in traffic. Address point data has been used to identify over 6500 such sensitive receptors. The magnitude of the change in air quality statistics at each receptor has been considered. The methods used to determine the significance of effect associated with air quality impacts are described below.

The assessment of effects on air quality has been considered within the Kirklees administrative area. This is the area where the greatest changes in traffic flows due to the local plan would be anticipated, and the traffic model is most robust within the Kirklees area.

Technical detail on the assessment methodology and modelling are set out in Appendix A. This includes information on the following:

- Use of Measurement Data;
- Dispersion model inputs;
- Sensitive Receptors;
- Traffic Data;
- Emission Rates;
- Background Data;
- Model Verification; and
- NO_x to NO_2 Conversion.

The air quality study area is also shown on Figure 1.

3.2 Emissions Assessment of Effects

With regard to road traffic emissions, the change in pollutant concentrations with respect to baseline concentrations has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the baseline and future scenario is also described and this is used to consider the risk of the air quality objective values being exceeded in each scenario.

For a change in annual mean concentration, or hourly mean NO_2 concentration, of a given magnitude, IAQM and EPUK have published recommendations for describing the effects of such impacts at individual receptors (IAQM & EPUK, 2015).

Table 2. Effects Descriptors at Individual Receptors - Annual Mean NO_2 and PM_{10}

Annual Mean Pollutant Conc. at Receptor in Assessment Year (µg/m^3)	Change in Annual Mean Concentration of NO_2/ PM_{10} (µg/m^3 as Proportion of Objective Value)				
	<1% Imperceptible	1% - 2% Very Low	2% - 5% Low	5% - 10% Medium	>10% Large
≤30.0	Negligible	Negligible	Negligible	Slight	Moderate
30.1 – 37.9	Negligible	Negligible	Slight	Moderate	Moderate
38.0 – 40.9	Negligible	Slight	Moderate	Moderate	Substantial
41.0 – 43.9	Negligible	Moderate	Moderate	Substantial	Substantial
≥44.0	Negligible	Moderate	Substantial	Substantial	Substantial

The IAQM and EPUK guidance includes seven explanatory notes to accompany the terminology for the effect descriptors. In particular it is noted that the descriptors are for individual receptors only and that overall significance is determined using professional judgement. Additionally, it is noted that it is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the objective value. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the objective value, rather than being exactly equal to it.

A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.5% (0.2 µg/m^3) is considered to be so small as to be negligible. A change (impact) that is negligible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

A change in predicted annual mean concentrations of $PM_{2.5}$ of less than 0.5% (0.12 µg/m^3) is considered to be so small as to be negligible. A change (impact) that is negligible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

The effect descriptors are set out for the consideration of the potential effects of individual, rather than the cumulative impacts of a set of developments such as those set out in the local plan, however in the absence of specific guidance for the assessment of wider area plans, these descriptors have been used within this assessment.

All relevant receptors that have been selected to represent locations where people are likely to be present are based on Air Quality Objectives that are relevant to public exposure. The Air Quality Objective values have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, the elderly or people who are unwell. As such the sensitivity of receptors was considered in the definition of the Air Quality Objective values and therefore no additional subdivision of human health receptors on the basis of building or location type is necessary.

3.2.1 Assessment of Significance

The significance of all of the reported effects is then considered in overall terms. The potential for the additional traffic to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality are considered if relevant, but the principle focus is any change to the likelihood of future achievement of the air quality objective values set out in Table 1 for the following pollutants:

- Annual mean nitrogen dioxide (NO_2) concentration of 40 µg/m^3;
- Annual mean particulate matter (PM_{10}) concentration of 40 µg/m^3;
- Annual mean fine particulate matter ($PM_{2.5}$) concentrations of 25 µg/m^3;
- 24-hour mean PM_{10} concentration of 50 µg/m^3 not to be exceeded on more than 35 days per year; and
- 1-hour mean NO_2 concentration of 200 µg/m^3 not to be exceeded on more than 18 times per year.

The achievement of local authority goals for local air quality management are directly linked to the achievement of the air quality objective values described above and as such this assessment focuses on the likelihood of future achievement of the air quality objective values.

3.3 Modelled Scenarios

The following five scenarios have been considered using dispersion modelling:

- Baseline year (2015) to allow comparison with 2015 monitoring data and model verification;
- Future Year 2020 assuming no growth associated with allocations in the Local Plan (using 2018 Defra background concentration data and 2018 emission rates);
- Future Year 2020 assuming that the 5 year allocation of growth and transport improvements have occurred (using 2018 Defra background concentration data and 2018 emission rates);
- Future Year 2030 assuming no growth associated with allocations in the Local Plan (using 2023 Defra background concentration data and 2023 emission rates); and
- Future Year 2030 assuming that the 15 year allocation of growth and further transport improvements have occurred (using 2023 Defra background concentration data and 2023 emission rates).

Further details on the choice of background data and vehicle emission rates are set out in Appendix A.

Defra publish vehicle emission rates by pollutant, vehicle type, speed and year, which can be utilised within assessments. These emission rates are anticipated to improve over time due to improvements in vehicle technology as newer vehicles come into the fleet. Similarly, Defra publish background pollutant data covering 1km x 1km grid squares. These background concentrations are also anticipated to improve over time. However, there is uncertainty in the rate of improvements of both vehicle emissions and background concentrations in future years. This assessment has therefore taken a precautionary approach to anticipated improvements and has used emission rates and backgrounds for 2018 to represent the 2020 scenarios and 2023 rates for 2030 scenarios. The use of these years allows for the realisation of some improvements over time, but is a more conservative approach than assuming all of the improvements within the Defra datasets.

4. Existing Conditions

4.1.1 Review and Assessment of Local Air Quality

The review and assessment process in the KC area has led to the designation of two AQMAs (see section 2.3).

AQMA 1 includes the Leeds Road (A62) and Bradley Road (A6107) junction as well as part of the Leeds Road (A62)-A644 junction. It was designated in October 2008 due to an exceedence of the annual NO_2 standard. This AQMA encompasses 79 dwellings as detailed in the latest Air Quality Updating and Screening Assessment (Kirklees Council, 2015). The latest monitoring data suggests that the designation remains valid due to an exceedence of the objective by a diffusion tube within the AQMA (diffusion tube number 33- Bradley, junction of A62/A6107) although a number of other tubes within the AQMA are below the air quality objective.

AQMA 2 is in the Scout Hill area of Kirklees and includes a section of the A644 Huddersfield Road to the west of Dewsbury. This AQMA was declared in March 2009 for a likely breach of the 24 hour mean standard for PM_{10}. This area includes approximately 46 dwellings. The monitoring data suggests that that the number of exceedences of the 24 hour mean PM_{10} objective in 2014 was below the PM_{10} standard however these data are undermined by poor data capture rates (<65%) and the historical data which shows the objective has been exceeded for the previous four years (2010-13).

Sensitive receptors located within both of these AQMAs are considered within this assessment to assess any impact on air quality in these areas as a result of the proposed Local Plan.

4.1.2 Local Monitoring Data

Monitoring data collected by Kirklees Council has been used to verify model performance at locations throughout the study area. The location of and previous concentrations measured at monitoring sites used are described in Appendix A.

Measurement data demonstrates that a number of locations in Kirklees were in excess of the annual mean NO_2 objective in 2015. These exceedences are identified both within and outside the AQMAs, particularly adjacent to major roads within the Kirklees area, such as the A62, A638, A653, A644, A629 and A652 within Huddersfield, Dewsbury, Heckmondwike and Batley.

No monitoring locations were in excess of the annual mean PM_{10} objective in 2015 but no data was available on the measured number of exceeedences of the 24 hour mean PM_{10} objective 2015 at time of writing.

5. Assessment Results

The results of this assessment are presented in this section for the two scenario years of 2020, with partial implementation of the Local Plan, and 2030 with full implementation of the Local Plan for the pollutants NO_2, PM_{10} and $PM_{2.5}$.

The individual significance of effect descriptors for each receptor is shown on Figures 2 to 7 (A-I).

5.1 Assessment of Effects

5.1.1 Air Quality Management Areas

Sensitive receptors were modelled within the designated Air Quality Management Areas (AQMAs) within Kirklees. These receptors are all predicted to experience negligible changes (the calculation of which is described earlier, in Table 2) in annual mean pollutant concentrations for all modelled pollutants (NO_2, PM_{10} and $PM_{2.5}$).

Additionally, pollutant concentrations are predicted to be below the objective values for all modelled pollutants at all receptors within the AQMAs in the modelled future years.

5.1.2 Nitrogen Dioxide (NO_2)

5.1.2.1 Overview

The effect of the Local Plan on sensitive receptors with respect to annual NO_2 concentrations is predicted to be negligible at the vast majority of receptors for both assessment years. The significance of effects at individual receptor locations of annual mean NO_2 in 2020 and 2030 are shown on Figures 2A-2I and 3A-3I respectively.

In 2020 29 of the more than 6500 receptors modelled are predicted to experience a slight adverse change in annual mean NO_2 concentrations with three further receptors predicted to experience moderate adverse changes. One modelled receptor, on Market Place in the area of Heckmondwike to the northwest of Dewsbury, is expected to experience a slight beneficial change in annual mean NO_2 concentrations.

Predicted effects by 2030 with the expected full implementation of the Local Plan the number of receptors predicted to experience a slight adverse impact has reduced from 29 to two sensitive receptors, with no receptors predicted to experience moderate adverse effects.

Additionally, annual mean NO_2 concentrations at all modelled sensitive receptors in the Kirklees administrative area are predicted to be well below the annual mean NO_2 objective of 40 $\mu g/m^3$ in 2030.

In both modelled years predicted pollutant concentrations follow similar patterns of increase across the Kirklees area with the largest increases along those roads closest to the largest and most concentrated areas of land allocations. These changes in annual mean NO_2 concentrations are expected as a result of changes to traffic flows expected on major access roads to the area and changes to traffic flows associated with land allocations outlined in the Kirklees Council Local Plan.

Areas where the greatest changes are predicted to occur are discussed in detail below.

5.1.2.2 Birkenshaw

The three receptors predicted to experience moderate adverse changes in annual mean NO_2 concentrations are located in close proximity to the M62 near the Oxford Road underbridge in the Swincliffe area of Birkenshaw. These predicted impacts are likely a result of expected increases in traffic flows along the M62 in 2020.

In this area annual mean NO_2 concentrations are predicted to approach and (sometimes) exceed the annual mean objective of 40 $\mu g/m^3$. There are a further 15 modelled receptors in the Swincliffe area which are predicted to experience slight adverse effects due to predicted increases in annual mean NO_2 concentrations.

These receptors are confined to a small number of residential properties located adjacent to a short stretch of the M62. The remaining slight adverse impacts are at individual receptors located very close to roads where small changes at concentrations close to or above the objective lead to an overall slight adverse impact.

One of these modelled receptors predicted to experience slight adverse effects is likely affected by predicted changes to traffic flows accessing the M62 at Junction 26 on the Bradford Road approach.

5.1.2.3 Liversedge

Two modelled receptors have been identified in the Liversedge area which are predicted to experience slight adverse effects as a result of changes in annual mean NO_2 concentrations. These are located at the junction of Flush (A638) and Wakefield Road (A649) in the Liversedge area.

5.1.2.4 Dewsbury

In the Dewsbury area two modelled receptors were identified to experience slight adverse effects due to predicted changes in annual mean NO_2 concentrations in 2020.

The first of these is located adjacent to the junction between the A644 and the A638. The predicted slight adverse effect is likely a result of the proximity of the sensitive receptor to the busy junction which is expected to experience increases in traffic flow with the implementation of the Local Plan.

The second modelled receptor in the Dewsbury area predicted to experience a slight adverse effect in the 2020 modelled scenario is located to the south of the A638 on Grosvenor Street. This effect is likely predicted due to the planned addition of an assortment of employment and housing allocations to the south, expected to cause an increase in traffic flows on roads local to the sensitive receptor.

5.1.2.5 Huddersfield

The remaining eight modelled sensitive receptors predicted to experience slight adverse effects from changes in annual mean NO_2 concentrations are located adjacent to a short stretch of the A629 (Wakefield Road), south of Huddersfield. This predicted effect is likely the result of a change in traffic flows in the local area stemming from land allocations set out in the Local Plan. These land allocations are likely to cause traffic flows to increase along the A629 as there is likely to be an increase in traffic through the local area. Local land allocations include an extensive area set aside for employment and allocations for urban green space.

5.1.2.6 Kirkheaton

These modelled receptors are predicted to remain at this level of effect likely due to their proximity to Moorside Road, Kirkheaton. These receptors are predicted to experience a slight adverse impact of change in NO_2 concentration of 2.4 $\mu g/m^3$ in 2030. This increase is predicted potentially as a result of the introduction of housing provision in the area, corresponding to land allocations H276, H439, H3350, H216 and H737 described in the Local Plan, which are expected to cause traffic flows in the area to increase. Whilst a number of modelled receptors are predicted to experience changes of more than 1% of the 40 $\mu g/m^3$ annual mean objective value, these changes are largely anticipated to be negligible due to predicted annual mean concentrations being well below the air quality objective value.

5.1.2.7 Holmfirth

Receptors located in Thongsbridge, to the north of Holmfirth are predicted to experience changes of more than 1% of the objective value, with a maximum change of 1.2 $\mu g/m^3$ predicted in 2020 and 1.4 $\mu g/m^3$ in 2030, likely due to changes in traffic flows associated with land allocations H727a and others in the area.

Increases in NO_2 concentrations of more than 0.4 $\mu g/m^3$ were also predicted at sensitive receptors along the A635, to the north of Holmfirth, due to increases in traffic flows along this road.

Further south into Holmfirth there are no specifically modelled air quality sensitive receptors as there are no roads in this area predicted to experience a significant change in traffic flow. Therefore no significant changes in air quality are anticipated at receptors in this area.

In Holmfirth the largest increase in AADT flows in 2020 is 514 vehicles on Station Road (A635) between Back Lane and Bramble Bank in 2020. The corresponding largest increase in 2030 is on New Mill Road (A635), between Bramble Bank and Springwood Road, and is an increase of 574 vehicles. These changes are well below

the DMRB criteria for an affected link (a change of 1,000 AADT (as described in the Traffic Data section of Appendix A)).

With regards to HDVs, the largest increase in Holmfirth in 2020 is 15 HDVs on New Mill Road (A635), between Bramble Bank and Springwood Road. The corresponding largest increase in 2030 is on Station Road (A635) between Back Lane and Bramble Bank, and is an increase of 56 vehicles. These changes are well below the DMRB criteria for an affected link of 200 HDV.

Similarly the largest change in speed predicted in either year in Homfirth is 2kph, well below the DMRB criteria of 10kph.

5.1.3 Particulate Matter (PM_{10})

The effect of the Local Plan on sensitive receptors with respect to annual mean PM_{10} is predicted to be negligible at all modelled receptors in 2020 and 2030. The significance of effect at individual receptor locations of annual mean PM_{10} is shown on Figures 4A-4I and 5A-5I for 2020 and 2030 models respectively.

The maximum concentration of PM_{10} predicted with the Local Plan in place was 21.1 and 20.8 $\mu g/m^3$ in 2020 and 2030 respectively. This is well below the objective value of 40 $\mu g/m^3$. The largest change predicted in annual mean PM_{10} concentrations is 0.2 $\mu g/m^3$ in 2020 and 0.7 $\mu g/m^3$ in 2030. Larger changes are predicted in 2030 as greater changes in traffic are anticipated compared to 2020, when the full Local Plan will not yet be fully established.

The largest changes in concentrations of particulate matter in 2030 are at receptors located within Kirkheaton. As with the effect on concentrations of NO_2 in this area, this increase is predicted as a result of the introduction of proposed housing provision in the area, corresponding to land allocations H276, H439, H3350, H216 and H737 described in the Local Plan, which are expected to cause traffic flows in the area to increase.

Whilst a number of modelled receptors in this area are predicted to experience changes of more than 1% of the 40 $\mu g/m^3$ annual mean objective value, these changes are anticipated to be of negligible significance due to predicted annual mean concentrations being well below the air quality objective value.

5.1.4 Fine Particulate Matter ($PM_{2.5}$)

The effect of the Local Plan on sensitive receptors with respect to annual mean $PM_{2.5}$ is predicted to be negligible at all modelled receptors in 2020 and 2030. The significance of effect at individual receptor locations of annual mean $PM_{2.5}$ is shown on Figures 6A-6I and 7A-7I for 2020 and 2030 models respectively.

The maximum concentration of $PM_{2.5}$ predicted with the Local Plan in place is 14.2 and 13.7 $\mu g/m^3$ in 2020 and 2030 respectively. This is well below the objective value of 25 $\mu g/m^3$ and the largest change predicted in annual mean $PM_{2.5}$ concentrations 0.4 $\mu g/m^3$ in 2030. These receptors are those located in Kirkheaton and as discussed above.

Larger changes in annual mean concentrations are predicted in 2030 as greater changes in traffic are anticipated compared to 2020, when the full local plan will not yet be fully established.

5.3 Overall Assessment of Effects

Thirty two of the more than 6,500 sensitive receptors modelled within this assessment were predicted to experience slight to moderate adverse effects on annual mean NO_2 concentrations due to the implementation of the Kirklees Local Plan in 2020. In 2030 there are two sensitive receptors predicted to experience slight adverse effects on annual mean NO_2 concentrations due to the implementation of the Kirklees Local Plan. The vast majority of receptors are predicted to experience negligible changes in air quality in both 2020 and 2030 scenarios.

Overall it is therefore concluded that the Kirklees Local Plan is not anticipated to have a significant detrimental effect on air quality.

6. Summary and Conclusions

The air quality assessment presented in this report has considered the potential effect of the proposed Local Plan on annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ for two future year scenarios of 2020, with partial implementation of the Plan, and 2030 with full implementation of the Plan.

Receptors within the Kirklees Air Quality Management Areas are all predicted to experience negligible changes in annual mean pollutant concentrations for all pollutants (NO_2, PM_{10} and $PM_{2.5}$), with pollutant concentrations below the objective values at all receptors within the AQMAs in the future years for all three pollutants.

The predicted effect of the proposed Local Plan on annual mean NO_2 concentrations in 2020 is anticipated to be moderate adverse at three receptor locations, slight adverse at 29 receptor locations, slight beneficial at one receptor and of negligible significance across the remainder of the study area.

In 2030, the predicted effect of the proposed Local Plan is anticipated to be slight adverse at two receptor locations and of negligible significance everywhere else in the Kirklees area.

For particulate matter (both PM_{10} and $PM_{2.5}$) negligible effects are predicted at all sensitive receptors.

The effect of the Local Plan on local air quality is therefore overall considered to be not significant for air quality.

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Appendix A Detailed Methodology

Road Traffic Emissions

The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene and 1,3-butadiene, and sulphur dioxide (SO_2), carbon monoxide (CO), PM_{10} and $PM_{2.5}$ in exhaust emissions. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and the fuel is oxidised to form NO_X, mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere. NO_2 is associated with adverse effects on human health. Better emission control technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

Although SO_2, CO, benzene and 1,3-butadiene are also present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of this proposal. Road traffic emissions of these substances have been reviewed by KC and nowhere within the administrative area is at risk of exceeding these objectives. The proposed Local Plan would not be capable of compromising the achievement of the relevant air quality objectives for the protection of human health for these pollutants. Emissions of SO_2, CO, benzene and 1,3-butadiene from road traffic are therefore not considered further within this assessment.

Exhaust emissions from road vehicles will affect the concentrations NO_2, PM_{10} and $PM_{2.5}$ at sensitive receptors in the vicinity of the proposed Local Plan. Therefore, these pollutants will be the focus of the assessment of the significance of impacts.

The magnitude of road traffic emissions for the Baseline and Future years with Local Plan allocation scenarios are calculated from traffic flow data. The assessment considers the impact of road traffic emissions at receptors adjacent to significantly affected roads as detailed in the Local Plan.

This assessment follows current guidance for the determination of pollutant concentrations, and uses emission factors for road traffic calculated from the most recent version of Defra's Emission Factor Toolkit (EFT Version 7.0; Defra, 2016a).

Use of Measurement Data

KC undertakes extensive monitoring and measurement of concentrations of NO_2 within its administrative area in support of its local air quality management review and assessment process. KC automatic monitor and diffusion tube data are used to verify the model performance.

The data gathered by KC is used to verify model performance at locations throughout the study area. The location of monitoring sites used are described in Appendix B. Five monitoring sites maintained by KC were not included from the model verification process due to localised influences affecting the measured air quality that were not representative of the wider study area, e.g. located adjacent to a bus station.

Dispersion Modelling

This assessment has used the latest version of dispersion model software 'ADMS-Roads' (v4.0.1.0) to quantify baseline pollution levels at selected receptors due to road traffic emissions. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies (CERC, 2016).

Details of general model conditions are provided in Table A1.

Table A1. General ADMS-Road Model Conditions

Variables	ADMS-Roads Model Input
Surface roughness at source	0.8 m (0.2 m at met measurement site)
Minimum Monin-Obukhov length for stable conditions	30 m
Terrain types	Flat
Receptor location	x, y coordinates determined by GIS, z = 1.5m for receptors with some modelled as 4.5m (e.g. flat located above a shop)
Emissions	NO_X, PM_{10}, $PM_{2.5}$

Variables	ADMS-Roads Model Input
Emission factor	EFT version 7.0
Meteorological data	1 year (2015) hourly sequential data from Leeds Bradford Airport
Emission profiles	None
Receptors	Selected receptors only
Model output	Long-term annual mean NO_X concentrations
	Long-term annual mean PM_{10} concentrations
	Long-term annual mean $PM_{2.5}$ concentrations

Sensitive Receptors

The concentration of road traffic emitted pollutants at the roadside or at sensitive receptors is influenced by a number of factors. These include background pollution levels and the volume of emissions from traffic sources, which is dictated by traffic flow rates, composition and speed.

The air quality objective values for pollutants associated with road traffic have been set by the Expert Panel of Air Quality Standards at a level below the lowest concentration at which the more sensitive members of society have been observed to be adversely affected by exposure to each pollutant. Therefore all receptors that represent exposure of the public are of equal sensitivity as any member of the public could be present at those locations.

Impacts from road traffic emissions are quantified at existing representative receptor locations in the vicinity of the modelled roads, where there is the potential for a significant effect from road traffic emissions to occur. Receptor locations were selected based on address point data provided by Kirklees Council.

Where a road is not predicted to experience a change in traffic flows above the DMRB criteria set out in the Traffic Data section below, a significant effect on air quality at receptors is also not anticipated and therefore receptors in these locations are not included within the assessment.

The potential effect of the Local Plan on sensitive ecosystems is presented in the Habitats Regulation Assessment for the Plan. The effect of the Local Plan on ecosystems with regards to air pollution is therefore not repeated in this report.

Traffic Data

The traffic data used within this assessment has been provided by AECOM. AECOM developed the transport demand model covering the Kirklees Council administrative area. It is a full transport demand model developed in line with WebTAG and covering the whole of Kirklees District as well as part of the neighbouring authorities. We have used the model to assess the emerging Kirklees Local Plan along with some transport mitigation schemes.

AADT (annual average daily traffic) flows, HDV proportions, and average speeds were derived from the transport model containing am, pm and inter-peak data using analysis of existing Automatic Traffic counter (ATC) data. Speeds were based on a demand weighted average across the modelled time periods.

The assessment has modelled all road links anticipated to experience a significant change in traffic flows, based on the criteria presented in the Design Manual for Roads and Bridges (DMRB) (DfT, 2007) and set out below:

- road alignment will change by 5m or more; or
- annual average daily traffic (“AADT”) flows will change by 1,000; or
- heavy duty vehicles (“HDV”) (vehicles more than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- daily average speeds will change by 10 km/h or more; or
- peak hour speed will change by 20 km/h or more.

Additional surrounding roads have then also been included within the dispersion model to enable to the prediction of total pollutant concentrations at sensitive receptors. Where there are no sensitive receptors within 200m of a road, that road has not been included within the dispersion model. Where a road is not predicted to experience a change in traffic flows above the criteria set out above, a significant effect on air quality at receptors in that area is also not anticipated and therefore these locations are not included within the assessment.

The modelled road network is included on the Figures showing the assessment results, presented in Figures 2-7, A-I.

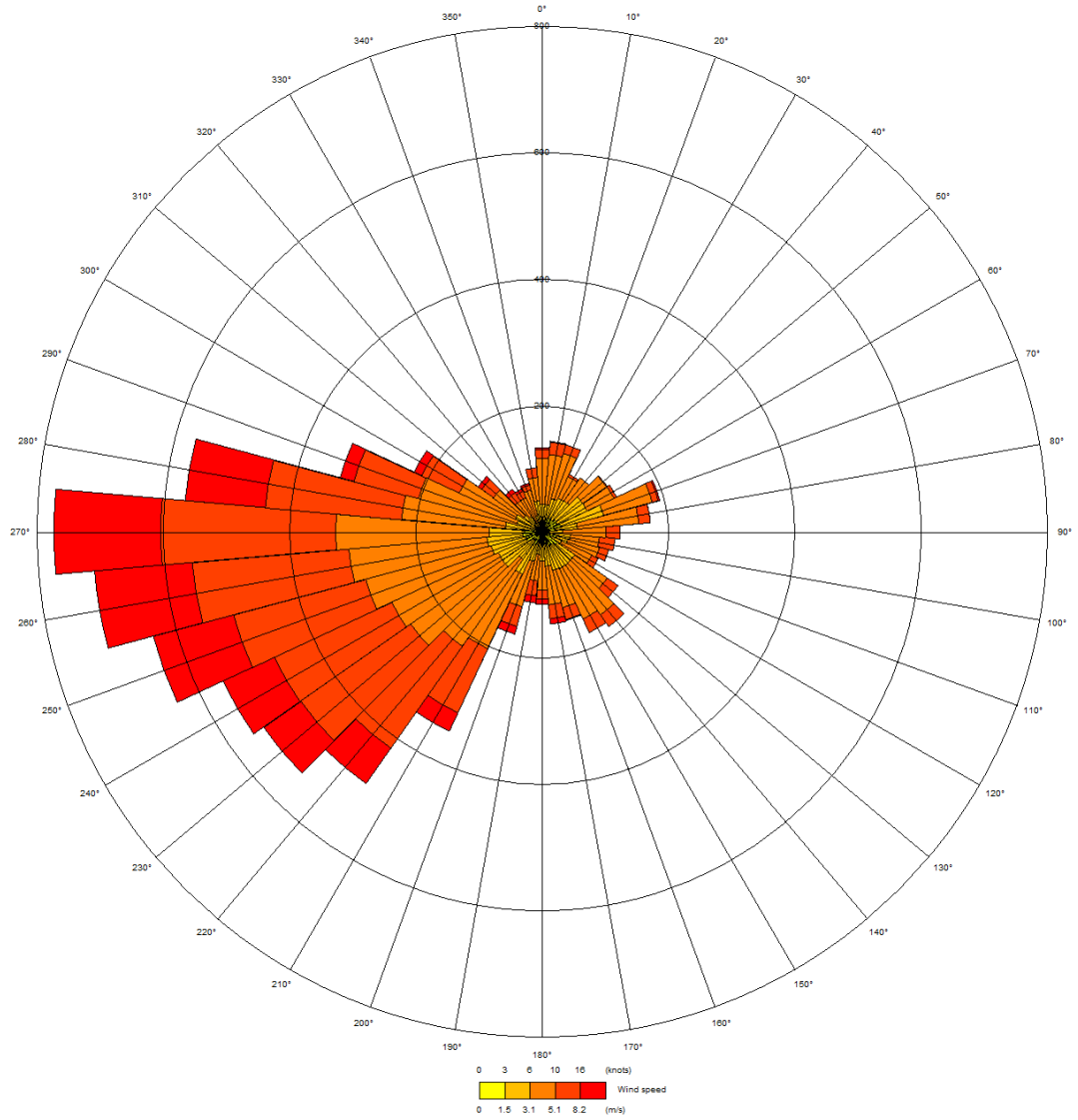
Emissions Data

As set out in section 3.3 Defra publish vehicle emission rates by pollutant, vehicle type, speed and year, which can be utilised within assessments. These emission rates are anticipated to improve over time due to improvements in vehicle technology as newer vehicles come into the fleet. However, there is uncertainty in the rate of improvements of vehicle emissions in future years. This assessment has therefore taken a precautionary approach to anticipated improvements and has used emission rates for 2018 to represent the 2020 scenarios and 2023 for 2030 scenarios. The use of these years allows for the realisation of some improvements over time, but is a more conservative approach than assuming all of the improvements within the Defra datasets. This is considered to provide a cautiously realistic assessment of future pollutant concentrations.

Meteorological Data

One year (2015) of hourly sequential observation data from Leeds Bradford Airport meteorological station has been used in this assessment. The station is located approximately 25 km north of Huddersfield and 20 km north of Dewsbury and experiences meteorological conditions that are representative of the conditions experienced in the Kirklees area. The surface roughness of land surrounding the meteorological station is 0.2 m and at the location of the modelled sources a surface roughness value of 0.8 m has been used to represent the modelled area.

A wind rose for this site is presented below:



Background Data

Background data for concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been sourced from Defra's background pollutant concentration maps (Defra, 2016b) for the relevant 1km by 1km grid squares within which the selected receptors are located. Contributions to the NO_2, PM_{10} and $PM_{2.5}$ backgrounds from road sources including Motorways, Trunk roads and A-roads were removed.

Due to the current uncertainty in the rate of background pollutant concentration improvements in future years, this assessment has used background pollutant concentrations for 2015 to represent existing baseline conditions in 2015, background pollutant concentrations for 2018 to represent the future assessment years in 2020 and background pollutant concentrations for 2023 to represent the future assessment years in 2030. These data are reproduced in Table A2 displaying the range of background concentrations throughout the study area.

Table A2. Defra Air Quality Background Concentrations

Pollutant	2015 (µg/m^3)	2018 for 2020 (µg/m^3)	2023 for 2030 (µg/m^3)
NO_X	17.3 - 42.8	14.8 - 37.5	12.2 - 32.8
NO_2	12.4 - 26.5	10.8 - 23.9	9.1 - 21.4
PM_{10}	11.5 - 17.6	11.2 - 17.4	11 - 17.5
$PM_{2.5}$	8.4 - 12.1	8.2 - 11.8	7.9 - 11.5

Model Verification

Model verification is the exercise undertaken to account for dispersion model bias. This involves aligning model output data with actual measurements gathered at locations within the study area. The factor of the difference between modelled output and measured data is then applied to all representative locations in the model domain.

To account for this model bias, factors of the difference between modelled road NO_X and measured road NO_X was calculated. This process included 42 of the Kirklees Council measurement locations. The accuracy of the adjusted model was considered using the Route Mean Square Error (RMSE) calculation. An RMSE value of within 10% of the national air quality objective (40 µg/m^3) is considered to be ideal (Defra, 2016d), and within 25% (i.e. less than 10 µg/m^3) is considered to be acceptable. The RMSE value for the adjusted model is 7.5 µg/m^3 and is therefore considered to be robust, particularly considering such a large study area. A summary of the factor and associated statistics is provided in Table A3.

Table A3. Defra Air Quality Background Concentrations

Verification Zone	Adjustment Factor	Root Mean Square Error (RMSE)	Fractional Bias
Whole Study Area	2.23	7.5	0.1

The above factor was applied to the predicted road NO_X concentrations prior to the conversion of road NO_X to road NO_2 and addition of NO_2 background concentrations to provide predicted total NO_2 concentrations at the receptors.

There are fewer measurement locations for particulate matter within the study area, however the same process was carried out for PM_{10} measurements and as the adjustment factor was broadly similar, the above factor of 2.23 was also applied to the predicted road PM_{10} and $PM_{2.5}$ concentrations for consistency and as the NO_x factor considered measurements over the whole study area.

NO_X to NO_2 Conversion

To accompany the publication of the guidance document LAQM TG(16), a NO_X to NO_2 converter was made available by Defra as a tool to calculate the road NO_2 contribution from modelled road NO_X contributions (Version 5.1; Defra, 2016c). The tool comes in the form of a Microsoft Excel spreadsheet and uses borough specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_X. This tool was used to calculate the total NO_2 concentrations at receptors from the modelled road NO_X contribution and associated background concentrations. The appropriate local authority (Kirklees) has been specified as the local authority for the majority of receptors although for some receptors included in the model from neighbouring boroughs the correct local authority has been selected. The ‘All other urban UK traffic’ mix was selected to represent the area.

Appendix B Modelled Monitoring Locations

Table B1. Modelled Monitoring Locations and Historical Measured Annual Mean NO_2 Concentrations

Location ID	Tube type	X	Y	2013 ($\mu g/m^3$)	2014 ($\mu g/m^3$)	2015 ($\mu g/m^3$)
CM1 - Trailer 2 *	Industrial	423185	420612	23.9	22	21
CM2 - Roadside 1	Roadside	423247	420761	35.9	37.2	32
CM3 - Roadside 2	Roadside	418240	426553	32.4	33.1	35.7
CM4 - Roadside 3	Roadside	417255	420358	33.2	36	39.8
CM5 - Roadside 4	Roadside	420441	427353	36.9	**43.6**	**44.6**
CM7 - Roadside 6	Roadside	411739	419007	**42.3**	**41.7**	N/A
DT2 - Dewsbury Bus Station	Other	424506	421535	**47.7**	**46.6**	**45.3**
DT3 - Huddersfield Bus Station *	Other	414214	416504	**43.4**	**45.0**	**46.7**
DT13 - Cooper Bridge A62	Roadside	417872	421050	36.9	38.6	38.9
DT14 - Huddersfield Westgate *	Urban Centre	414434	416744	**46.3**	**42.8**	**44.8**
DT15 - Fartown A641	Roadside	414496	417795	37.8	**40.0**	38.3
DT16 - Bradley A6107	Kerbside	417280	420482	35.0	**41.2**	39.2
DT17 - Bradley A62	Roadside	417227	420337	39.9	**41.3**	**42.1**
DT18 - Huddersfield A62 / A616	Roadside	414389	416262	**41.2**	**41.6**	**42.4**
DT20 - Bradley A62	Roadside	417335	420412	39.3	**40.2**	**42.6**
DT21 - Birkenshaw A58	Roadside	420377	427871	35.4	36.9	**40.4**
DT24 - Roadside 4	Roadside	420441	427353	N/A	N/A	N/A
DT25 - Roadside 4	Roadside	420441	427353	N/A	N/A	N/A
DT26 - Roadside 4	Roadside	420441	427353	N/A	N/A	N/A
DT28 - West Town A644	Roadside	423563	421014	**46.4**	**42.6**	39.8
DT29 - Dewsbury A653	Roadside	424853	421828	**40.8**	39.7	**40.7**
DT32 - Huddersfield A62	Roadside	414149	416686	**45.2**	**43.9**	**44.9**
DT33 - Bradley A62 / A6107	Roadside	417418	420479	**52.5**	**47.9**	**43.4**
DT42 - Lindley Moor A643	Roadside	409941	418471	**48.9**	**49.0**	**50.5**
DT43 - Trailer 2	Industrial	423185	420612	**51.8**	**49.0**	N/A
DT44 - Trailer 2	Industrial	423185	420612	34.7	32.7	N/A
DT45 - Trailer 2	Industrial	423185	420612	**42.1**	**41.8**	N/A
DT47 - Huddersfield A62 *	Roadside	414745	416710	**49.0**	**51.8**	**54.7**
DT56 - Liversedge A62 / A649	Roadside	420727	423668	35.9	35.8	33.8
DT57 - Liversedge A638	Roadside	420845	423770	34.9	35.4	33.2
DT58 - Liversedge A62	Roadside	420853	423866	**45.9**	**44.0**	38.9
DT59 - Mirfield A644 *	Kerbside	420304	419766	**43.9**	**40.7**	**42.5**
DT62 - Birkenshaw A651	Roadside	420356	427810	36.6	36.2	36.4
DT63 - Birkenshaw A58	Roadside	420222	427764	**42.6**	**40.7**	38.7
DT67 - Eastborough A653	Roadside	424871	421921	**51.1**	**45.2**	**60.4**

DT68 - Cleckheaton A638	Roadside	418285	426630	**42.3**	**43.0**	**45.3**
DT69 - Eastborough A653	Roadside	424969	422002	**48.0**	**47.4**	**43.0**
DT73 - Eastborough John Street	Roadside	425083	422022	**46.5**	**42.8**	**44.0**
DT74 - Eastborough Calumswood Road	Roadside	425179	422114	38.4	35.8	36.7
DT78 - Fartown A641	Roadside	414480	417720	36.0	36.8	37.5
DT79 - Fartown Willow Ln East	Roadside	414546	417759	36.9	32.1	37.9
DT80 - Outlane Round Ings Rd	Other	407942	417261	**44.5**	**42.2**	**54.2**
DT83 - Liversedge A638	Roadside	421039	423673	**44.2**	**44.6**	**43.8**
DT84 - Thornton Lodge A62	Roadside	413659	416182	**44.1**	38.7	**42.7**
DT85 - Thornton Lodge A62	Roadside	413414	415981	**48.3**	**43.7**	**45.5**
DT88 - Heckmondwike A638	Roadside	421904	423580	**42.9**	**43.7**	**40.0**
DT91 - Waterloo A629	Roadside	417627	416472	37.9	35.2	36.2

* Monitoring location not included in model verification – see Table B4 for more information on specific sites

Table B2. Modelled Monitoring Locations and Historical Measured Annual Mean PM_{10} Concentrations

Location ID	Type	X	Y	2013 (µg/m^3)	2014 (µg/m^3)	2015 (µg/m^3)
CM1 - Trailer 2	Industrial	423185	420612	21.5	17.2	18.5
CM2 - Roadside 1	Roadside	423247	420761	30.3	16.8	19.3
CM3 - Roadside 2	Roadside	418240	426553	19.1	15.9	-
CM4 - Roadside 3	Roadside	417255	420358	22.1	20.1	18.7
CM5 - Roadside 4	Roadside	420441	427353	22.3	20.8	19.1
CM7 - Roadside 6	Roadside	411739	419007	N/A-	17.1	26.0

Table B3. Modelled Monitoring Locations and Historical Number of Exceedences of 24 hour Mean PM_{10} Objective

Location ID	Type	X	Y	2013 No. of Exceedences of 24 hour mean PM_{10} (days)	2014 No. of Exceedences of 24 hour mean PM_{10} (days)	2015 No. of Exceedences of 24 hour mean PM_{10} (days)
CM1 - Trailer 2	Industrial	423185	420612	5 (33.31)	2 (29.44)	-
CM2 - Roadside 1	Roadside	423247	420761	**36 (50.32)**	6 (28.02)	-
CM3 - Roadside 2	Roadside	418240	426553	4 (35.769)	0 (24.81)	-
CM4 - Roadside 3	Roadside	417255	420358	13	8 (32.436)	-
CM5 - Roadside 4	Roadside	420441	427353	13 (40.657)	8 (33.877)	-
CM7 - Roadside 6	Roadside	411739	419007	-	0 (24.879)	-

* If data capture is less than 90% the 90th percentile of 24 hour means is presented in brackets; no data is available for 2015

Table B4. Monitoring Locations Not Included in Model Verification

Location ID	Reason for Non-Inclusion
CM1 - Trailer 2	Located adjacent to car show room and MOT test centre, therefore subject to localised emissions.
DT3 - Huddersfield Bus Station	Located in close proximity to Huddersfield Bus Station and in kerbside location therefore

	not representative of locations of relevant exposure.
DT14 - Huddersfield Westgate	Placed behind a sign therefore likely affected by localised poor air circulation.
DT47 - Huddersfield A62	Monitor placed directly beneath sign therefore likely affected by localised poor air circulation.
DT59 - Mirfield A644	Located between bus stop and pedestrian crossing, opposite supermarket car park therefore not representative of locations of relevant exposure.

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