Pipestone Ltd

Proposed Residential Development
Land West Of Wakefield Road
Mapplewell, Barnsley

Air Quality Assessment
Addendum Technical Note

August 2013

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1.0 Introduction

Pipestone Ltd commissioned WYG Planning and Environment (WYG) to prepare an Air Quality Assessment for a planning application for a proposed residential development on land west of Wakefield Road, Mapplewell, Barnsley.

This document is to present the findings of the dispersion modelling assessment of the proposed scheme, with regards to the impact of the proposed development on the 24-hour mean PM_{10} objective as requested by Barnsley Metropolitan Borough Council (BMBC).

This assessment utilises the same methodology used within the Air Quality Assessment Report (WYG, 16 January 2013) for the annual mean NO_2 and PM_{10}.

2.0 Assessment Methodology

The potential environmental effects of the proposed development are identified, in so far as current knowledge of the site and development allows. The significance of potential environmental effects is assessed according to their scale (magnitude) and the sensitivity of the receptors.

2.1 Predicting Magnitude of Impact

Magnitude (scale of change) is determined by considering the predicted deviation from baseline conditions; quantifiable assessment of magnitude has been undertaken where possible.

Impacts of the proposed development on air quality have been assessed with reference to the baseline conditions and environmental assessment criteria. The rationale for determining the magnitude of an impact is shown in Table 1. The rationale has been derived in part from the magnitude matrix described in Table 4 of the EPUK non statutory guidance 'Development Control: Planning for Air Quality (2010 Update)'.

Table 1 Methodology for Assessing Magnitude of Impacts on Air Quality

Magnitude of Impact(1)	Description	Description
Large	Impact resulting in a considerable change in baseline environmental conditions (i) with severe undesirable/desirable consequences on the receiving environment.	• Air quality varies between the do minimum and do something by more than 10% of the air quality objective. • Substantial risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Medium	Impact resulting in a discernable change in baseline environmental conditions (i) with undesirable/desirable conditions	• Air quality varies between the do minimum and do something by 5 - 10% of the air quality objective. • Moderate risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Small	Impact resulting in a discernable change in baseline environmental conditions with undesirable/desirable conditions that can be tolerated.	• Air quality varies between the do minimum and do something by 1 - 5% of the air quality objective. • Slight risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Imperceptible(2)	No discernable change in baseline environmental conditions.	• Air quality varies between the do minimum and do something by less than 1% of the air quality objective. • Little or no cause for nuisance complaints to be made (Construction).

NOTE (1) An impacts magnitude can be either positive or negative, except for negligible.
(2) If the assessor is certain that a receptor or attribute of a feature will suffer no impact whatsoever then the term 'No Impact' can be used in the place of 'Negligible Impact'. However, it is not usually possible to determine 'No Impact' in many cases with 100% certainty so the term 'Negligible' should be used in these cases.

The stated methodology has been developed by WYG and was based on the example assessment criteria for air quality provided in the Environmental Protection UK guidance document Development Control: Planning for Air Quality for road vehicle exhaust emission impacts.

2.2 Sensitivity of Receptor

Receptors can demonstrate different sensitivities to changes in their environment. For the purpose of this assessment sensitivity is determined as Very High, High, Medium or Low as detailed in Table 2. The factors considered when determining the sensitivity of a receptor are summarised below in Table 2.

Table 2 Methodology for Assessing Sensitivity of Receptor

Sensitivity	Description
Very High	• Do Minimum pollutant concentration already exceeding the relevant AQO. • Receptors of very high sensitivity to dust and odour, such as: hospitals and clinics, retirement homes, painting and furnishing, hi-tech industries and food processing (Construction). • Densely populated areas – more than 100 dwellings within 20m of the development site (Construction)
High	• Do Minimum pollutant concentration already 90 - 100% of the relevant AQO. • Receptors of high sensitivity to dust and odour, such as: schools, residential areas, food retailers, glasshouses and nurseries, horticultural land and offices (Construction). • Densely populated areas – 10-100 dwellings within 20m of the development site (Construction)
Medium	• Do Minimum pollutant concentration between 75-90% of the relevant AQO. • Receptors of medium sensitivity to dust and odour, such as: farms, outdoor storage, light and heavy industry (Construction). • Suburban or edge of town areas (Construction)
Low	• Do Minimum pollutant concentration less than 75% of the relevant AQO • All other dust/odour sensitive receptors not identified above (Construction). • Rural/Industrial areas (Construction).

2.3 Assessment of Impact Significance

Table 3 shows how the interaction of magnitude and sensitivity results in the significance of an environmental effect. If the scale of the impact magnitude is negative then the resulting effect is adverse. If the scale of the impact magnitude is positive then the resulting effect is beneficial.

Table 3 Impact Significance Matrix

Sensitivity of Receptor	Magnitude of Impact			
	Large	Medium	Small	Imperceptible
Very High	Substantial	Moderate	Slight	Negligible
High	Moderate	Moderate	Slight	Negligible
Medium	Slight	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible

2.4 Sensitive Receptors

Receptors that are considered as part of the air quality assessment are primarily those existing receptors that are situated to the north, south and west of the proposed development site, along routes predicted to experience changes in traffic flow as a result of the scheme.

The receptor locations are summarised in Table 4 below and the spatial locations of all of the receptors are illustrated in Figure 1 of the Air Quality Assessment Report

Table 4 Modelled Sensitive Receptors

Discrete Sensitive Receptor		UK NGR (m)	
		X	Y
R1	407 Wakefield Road	434166.5	409602.7
R2	397 Wakefield Road	434187.9	409592.2
R3	418 Kirkstall Road	434100.1	409584.7
R4	396 Kirkstall Road	434225.2	409505.6
R5	2 Bar Lane	434027.9	409623.7
R6	20 Bar Lane	433936.7	409646.7
R7	9 Bar Lane	433931.0	409684.3
R8	1 Wakefield Road	434053.0	409687.4
R9	Eastfield Arms, Public House, Wakefield Road	433994.3	409708.7
R10*	26 Eastfield Crescent*	433961.3	409790.7
R11	78 Paddock Road	433674.0	410286.7
R12	2 Parkview Road	433602.7	410351.2
R13	62 Paddock Road	433591.6	410319.3
R14	23 Paddock Road	433503.4	410377.5
R15	62 Eastfield Crescent	433881.0	409956.8
R16	76 Eastfield Crescent	433840.2	409906.7
R17	18 Cloudberry Way	433678.2	409861.4
R18	20 Waythorne Close	433479.3	409967.3
R19	66 Paddock Road	433630.4	410299.6
R20	16 Park View Road	433502.5	410493.1
R21	The Old Police Station, Wakefield Road	433491.1	410535.7
R22	12 Wakefield Road	433408.9	410617.6

Discrete Sensitive Receptor		UK NGR (m)	
		X	Y
R23	26 Wakefield Road	433395.4	410698.3
R24	Lee Lane Farm	434765.4	411282.6
R25	2 Shaw Lane	433437.9	410554.2
R26	7 Shaw Lane	433327.3	410533.6
R27	2 Paddock Close	433438.3	410517.1
R28	17 Paddock Road	433339.0	410479.2
R29	Proposed Property Adjacent to Site Access	433763.8	410143.8
R30	Proposed Property Adjacent to Site Access	433740.6	410129.2
R31	Proposed Property Adjacent to Site Access Link B	433683.9	410107.4
R32	Proposed Property Adjacent to Site Access Link A	433797.7	410068.3
R33	Proposed Property Adjacent to Site Access Link A	433821.0	410046.7
R34	Proposed Property Adjacent to Site Access Link A	433826.0	409986.8

NOTE *Non-Residential receptors marked with asterisk.

3.0 Assessment of Air Quality Impacts - Operational Phase

In the context of the proposed development, transportation is identified as the dominant emission source that is likely to cause potential risk of exposure of air pollutants at receptors.

The operational phase assessment therefore consists of quantified predictions of the changes in nitrogen dioxide and particulate matter exposure as a result of the operational phase of the development, due to changes in traffic movement.

In accordance with the traffic data provided to WYG, the operational phase assessment has been undertaken with an assumed operational year of 2017. The assessment scenarios are therefore:

- 2017 'Do Minimum' = Baseline + Committed Development
- 2017 'Do Something' = Committed Development + Proposed Residential Development

3.1 Existing and Predicted Traffic Flows

Projected 2017 'do minimum' and 'do something' traffic data has been provided by Bryan G Hall Ltd for the operational phase assessment in the form of AM and PM Peak turn-counts. These were scaled to represent Annual Average Daily Traffic figures (AADT) using adjustment factors of 10.5 for AM and PM flows.

For the purposes of the air quality assessment only roads predicted to experience significant changes in flows have been included in the air quality model. These represent the primary access routes to the proposed development site. Where unavailable, traffic speeds have been estimated based on site observations and national speed limits. All of the roads within the dispersion model are illustrated in Figure 1 of the Air Quality Assessment Report.

Emission factors for the projected 2017 'do minimum' and 'do something' scenarios have been calculated using Defra's EFT version 5.1.3 (Updated August 2012). It should be noted that at the time of assessment the latest available EFT version was 5.1.3.

CERC have been advised by the LAQM Helpdesk that 'there are no major changes in core emissions between 5.1.3 and 5.2c, just very minor tweaks'. As such it is not considered necessary to update the model to include the EFTv5.2c emission factors.

Road junctions have been modelled with the assumption of a 50m slow-down phase, prior to the junction line. This slow-down phase has been modelled at a speed of 20km/h. Detailed traffic figures are provided in Appendix A of the Air Quality Assessment Report.

3.2 Background Concentrations

The use of background concentrations within the modelling process ensures that pollutant sources other than traffic are represented appropriately. Background sources of pollutants include industrial, domestic and rail emissions within the vicinity of the study site.

Background concentrations as used within the prediction calculations were referenced from the UK National Air Quality Information Archive database based on the National Grid Co-ordinates of 1 x 1 km grid squares nearest to the development site. In April 2012 Defra issued revised 2010 background maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$ which incorporate updates to the input data used for modelling. The updated mapped background concentrations are summarised in Table 5 below.

Table 5 Predicted Background Concentrations

UK NGR		2010 Predicted Background Concentration (µg/m^3)
X	Y	PM_{10}
434500	409500	15.56
433500	409500	15.35
433500	410500	15.50
UK NGR		**2017 Predicted Background Concentration (µg/m^3)**
X	Y	PM_{10}
434500	409500	14.53
433500	409500	14.31
433500	410500	14.42

Table 5 indicates that there were no background exceedances of the relevant AQOs within the vicinity of the proposed development during 2010 and 2017. As a worst-case, mapped background concentrations for 2010 have been used throughout the assessment.

3.3 Model Verification

Model verification involves the comparison of modelled data to monitored data in order to gain the best possible representation of current pollutant concentrations for the assessment years. The verification process is in general accordance with that contained in Annex 3 of the LAQM TG (09) guidance note and uses the most recently available diffusion tube monitoring data to best represent this.

The verification process consists of using the monitoring data and the published background air quality data in the UK National Air Quality Information Archive to calculate the road traffic contribution of nitrogen oxides (NO_X) at the monitoring locations. Outputs from the ADMS Roads model are provided as predicted road traffic contribution NO_X emissions. These are converted into predicted roadside contribution NO_2 exposure at the relevant receptor locations based on the updated approach to deriving NO_2 from NO_X for

road traffic sources published in paragraphs 2.22 to 2.27 of Local Air Quality Management LAQM TG(09). The calculation was derived using the NO_X to NO_2 worksheet in the online LAQM tools website hosted by DEFRA.

A model correction of 5.4901 was applied to roadside predicted NO_X concentrations before converting to NO_2. This figure demonstrates that the model was under predicting the road traffic emissions at the monitoring locations, probably due to the effects of congestion and stop-start driving behaviour in the study area and the effects of increased tailpipe emissions as traffic accelerates away from the roundabouts and junctions. Table 6 below summarises the final model / monitored data correlation following the application of the relevant adjustment factor.

Table 6 Comparison of Roadside Modelling & Monitoring Results for NO_2

Tube location	NO_2 µg/m^3		
	Monitored NO_2	Modelled NO_2	Difference (%)
32	29.10	29.10	0.00

The final model produced data at the monitoring location within 25% of the monitoring results, as recommended within LAQM TG (09).

The model is therefore considered to be verified and suitably representative of local emissions and exposures. Reference should be made to Figure 3 of the Air Quality Assessment Report for a visual illustration of the model correlation coefficient.

3.4 Summary of Model Inputs

Table 7 Summary of ADMS Roads model Inputs

Parameter	Description	Input Value
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), nitrogen dioxide (NO_2), Ozone (O_3) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included
Meteorology	Representative meteorological data from a local source	**Robin Hood Airport 2010**, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	**1.5m** representing a typical surface roughness for large urban areas
Latitude	Allows the location of the model area to be set	United Kingdom = **52º**
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Mixed Urban/Industrial = **30m.**
Elevation of Road	Allows the height of the road link above ground level to be specified.	All road links were set at ground level = **0m**.
Road Width	Allows the width of the road link to be specified.	Road width used depended on data obtained from OS map data for the specific road link

Parameter	Description	Input Value
Topography	This enables complex terrain data to be included within the model in order to account for turbulence and plume spread effects of topography	No topographical information used
Time Varied Emissions	This enables daily, weekly or monthly variations in emissions to be applied to road sources	Time varied emissions were not used.
Road Type	Allows the effect of different types of roads to be assessed.	**Urban Road** (not London) settings were used
Road Speeds	Enables individual road speeds to be added for each road link	Based on national speed limits and 20km/h for slowdown sections
Canyon Height	Allows the model to take account turbulent flow patterns occurring inside a street with relatively tall buildings on both sides, known as a "street canyon".	No canyons used within the model
Road Source Emissions	Road source emission rates are calculated from traffic flow data using the Defra toolkit of traffic emission factors.	The **EFT Version 5.1.3** dataset was used.
Year	Predicted DfT emissions rates depend on the year of emission.	**2010** data for the base year model validation; and **2017** data for the operational phase assessment

3.5 ADMS Modelling Results

3.5.1 Traffic Assessment

The ADMS Model has predicted concentrations of PM_{10} at relevant receptor locations adjacent to roads likely to be effected by the development. The model outputs are based on fully verified model results from the ADMS Roads model. The following tables summarise the atmospheric dispersion model predictions of air quality at the relevant receptor locations. Only receptors close to roads where there is predicted to be a change in emissions have been assessed.

Short term (24-hour Mean) Particulate Matter

Following consultation with BMBC[1] an assessment of the 24-hour mean PM_{10} concentrations at relevant receptor locations was carried out.

For the short term averaging period the UK DEFRA methodology has been followed.

The 90.41%-ile 24-hour Development Contribution PM_{10} + 2 x (annual mean background PM_{10}) was utilised to predict short term PM_{10} concentrations at existing receptor locations.

Table 8 presents a summary of the predicted change in 24-hour mean PM_{10} concentrations at relevant receptor locations in the projected opening year of 2017, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

[1] Email from Chris Shields Technical Officer (Pollution Control), (Dated 14/08/2013)

Table 8 Predicted 2017 90.41%ile 24-hour Mean Concentrations of PM_{10} at Modelled Receptor Locations (µg/m^3)

Receptor		90.41%-ile 24-hour Mean PM_{10} (µg/m^3)		
		2017 Do Minimum	2017 Do Something	Development Contribution
R1	407 Wakefield Road	36.13	36.42	0.29
R2	397 Wakefield Road	35.76	36.03	0.27
R3	418 Kirkstall Road	32.35	32.51	0.16
R4	396 Kirkstall Road	31.64	31.77	0.12
R5	2 Bar Lane	32.56	32.89	0.33
R6	20 Bar Lane	31.76	32.09	0.33
R7	9 Bar Lane	32.59	33.09	0.50
R8	1 Wakefield Road	34.78	35.15	0.37
R9	Eastfield Arms, Public House, Wakefield Road	31.68	31.86	0.18
R10*	26 Eastfield Crescent*	31.87	32.03	0.17
R11	78 Paddock Road	31.61	31.74	0.13
R12	2 Parkview Road	30.82	30.89	0.07
R13	62 Paddock Road	30.40	30.45	0.05
R14	23 Paddock Road	30.08	30.13	0.04
R15	62 Eastfield Crescent	32.37	32.58	0.22
R16	76 Eastfield Crescent	29.73	29.84	0.11
R17	18 Cloudberry Way	29.37	29.47	0.09
R18	20 Waythorne Close	29.25	29.33	0.08
R19	66 Paddock Road	30.51	30.58	0.07
R20	16 Park View Road	31.38	31.46	0.08
R21	The Old Police Station, Wakefield Road	33.51	33.68	0.17
R22	12 Wakefield Road	30.91	30.99	0.09
R23	26 Wakefield Road	31.04	31.14	0.10
R24	Lee Lane Farm	29.90	29.91	0.00
R25	2 Shaw Lane	32.26	32.33	0.07
R26	7 Shaw Lane	30.79	30.82	0.03
R27	2 Paddock Close	31.75	31.79	0.03
R28	17 Paddock Road	31.03	31.04	0.01
R29	Proposed Property Adjacent to Site Access	-	31.59	-
R30	Proposed Property Adjacent to Site Access	-	30.94	-
R31	Proposed Property Adjacent to Site Access Link B	-	30.27	-
R32	Proposed Property Adjacent to Site Access Link A	-	31.26	-
R33	Proposed Property Adjacent to Site Access Link A	-	31.70	-
R34	Proposed Property Adjacent to Site Access Link A	-	30.61	-

As indicated in Table 8, the maximum predicted increase in the annual average exposure to particulate matter at any existing receptor, due to changes in traffic movements associated with the development, is 0.50µg/m^3 at 9 Bar Lane (R7).

No exceedances of the 24-hour mean objective are predicted at any of the modelled sensitive receptor locations.

The significance of changes in traffic flow associated with the development with respect to 24-hour mean PM_{10} exposure has been assessed with reference to the criteria in section 2.0. The outcomes of the assessment are summarised in Table 9.

Table 9 Significance Effects at Key Receptors in 2017 (24-hour Mean Particulate Matter)

Receptor		Change (% of AQO)	Magnitude	Sensitivity	Significance
R1	407 Wakefield Road	0.57	Imperceptible	Low	Negligible
R2	397 Wakefield Road	0.55	Imperceptible	Low	Negligible
R3	418 Kirkstall Road	0.31	Imperceptible	Low	Negligible
R4	396 Kirkstall Road	0.25	Imperceptible	Low	Negligible
R5	2 Bar Lane	0.66	Imperceptible	Low	Negligible
R6	20 Bar Lane	0.66	Imperceptible	Low	Negligible
R7	9 Bar Lane	1.00	Small	Low	Negligible
R8	1 Wakefield Road	0.75	Imperceptible	Low	Negligible
R9	Eastfield Arms, Public House, Wakefield Road	0.37	Imperceptible	Low	Negligible
R10*	26 Eastfield Crescent*	0.34	Imperceptible	Low	Negligible
R11	78 Paddock Road	0.25	Imperceptible	Low	Negligible
R12	2 Parkview Road	0.14	Imperceptible	Low	Negligible
R13	62 Paddock Road	0.10	Imperceptible	Low	Negligible
R14	23 Paddock Road	0.09	Imperceptible	Low	Negligible
R15	62 Eastfield Crescent	0.43	Imperceptible	Low	Negligible
R16	76 Eastfield Crescent	0.22	Imperceptible	Low	Negligible
R17	18 Cloudberry Way	0.18	Imperceptible	Low	Negligible
R18	20 Waythorne Close	0.15	Imperceptible	Low	Negligible
R19	66 Paddock Road	0.13	Imperceptible	Low	Negligible
R20	16 Park View Road	0.17	Imperceptible	Low	Negligible
R21	The Old Police Station, Wakefield Road	0.33	Imperceptible	Low	Negligible
R22	12 Wakefield Road	0.17	Imperceptible	Low	Negligible
R23	26 Wakefield Road	0.20	Imperceptible	Low	Negligible
R24	Lee Lane Farm	0.01	Imperceptible	Low	Negligible
R25	2 Shaw Lane	0.15	Imperceptible	Low	Negligible
R26	7 Shaw Lane	0.06	Imperceptible	Low	Negligible
R27	2 Paddock Close	0.07	Imperceptible	Low	Negligible
R28	17 Paddock Road	0.02	Imperceptible	Low	Negligible

The magnitude of the effects in 2017 of changes in traffic as a result the proposed development, with respect to 24-hour mean PM_{10} exposure, is determined to be 'small' to 'imperceptible'. The significance has been determined to be 'negligible' based on the methodology outlined in section 2.0. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

4.0 Summary and Conclusions

WYG undertook an Air Quality Assessment (AQA) for a proposed residential development at land west of Wakefield Road, Mapplewell, Barnsley. The AQA was undertaken in accordance with the methodology and parameters previously described within this technical note, to address comments received from BMBC. Predicted short term PM_{10} concentrations were compared with the relevant AQO.

The maximum predicted increase in 24-hour mean exposure to PM_{10} at all modelled receptors, as a result of the impacts of changes in traffic flow, is predicted to be 0.50µg/m^3 at 9 Bar Lane (R7).

No modelled receptors are predicted to experience PM_{10} concentrations in exceedance of the short term Air Quality Objective.

The magnitude of the effects of the proposed development, with respect to 24-hour mean PM_{10} exposure, is determined to be 'small' to 'imperceptible'. The significance has been determined to be 'negligible'.

None of the modelled proposed receptor locations are predicted to experience pollutant concentrations in exceedances of the relevant AQOs, as such the proposed development site is considered to be suitable residential use.

Following the adoption of the recommended mitigation measures, the development is not considered to be contrary to any of the national, regional or local planning policies.