

Air Quality Assessment
Whaley Road, Barnsley

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And Rocpower Ltd

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Executive Summary

ENVIRON UK Ltd was commissioned by Hargreaves Services Plc and Rocpower Ltd to carry out an air quality assessment of a proposed biofuel power generation plant to be located at a former sub station on Whaley Road, Barnsley. The site is located within the Metropolitan Borough of Barnsley. This assessment is provided in support of the planning application for the proposals, which are to be submitted to the local authority, Barnsley Metropolitan Borough Council (BMBC).

The proposed site is located on the outskirts of Barnsley, approximately 2.5 km northwest of the city centre. The site was previously an electricity sub station and forms part of an existing industrial estate.

The proposed site will incorporate five 1.6 MWe second-hand engines, which will run on biofuel, to generate electricity, which will be fed into the national grid. A review of the Environmental Permitting (England and Wales) Regulations 2007 indicates that the trigger threshold for permitting (under part B of the regulations) is an aggregate rated thermal capacity in excess of 20MW. As the aggregated thermal capacity of the proposed site is 19 MW, an environmental permit application is not required. However, as a result of objections to the site by Biofuel Watch, BMBC has requested an air quality assessment of the proposed installation.

Emissions from the installation have been provided by Rocpower Ltd, and have been obtained from a monitoring exercise carried out in May 2011 at a similar facility, operated by Rocpower, located in Featherstone. The monitoring was carried out with engines running on tall oil. Ground level concentrations of pollutants have been predicted assuming a stack height of 17.5, 20 and 22.5 m and compared with the relevant air quality objectives.

The predicted process contribution (PC) at both the point of maximum concentration and at each of the receptor locations have been compared with the relevant air quality objectives. To determine the significance of the releases, the results have been assessed using the criteria given in the Environment Agency's H1 Guidance.

The predicted PCs from all stack heights, whilst below the objective concentrations, were above the level at which they could be considered to be insignificant for nitrogen dioxide. However, PCs of particulates, both PM_{10} and $PM_{2.5}$ were less than 1% of the annual objective and less than 10% of the short term objective and are therefore considered to be insignificant.

Where the process concentrations cannot be considered to be insignificant, the next stage in the assessment process is to consider the process contribution together with the existing background concentration, to calculate the Predicted Environmental Concentration (PEC) to determine the overall impact on air quality.

Consideration of the PEC from emissions arising from a 17.5 m stack indicated that there was potential that the combined impact would result in an exceedance of the annual mean at the point of maximum concentration. Therefore this stack height has been discounted.

Calculation of the annual mean PEC for nitrogen dioxide from either a 20 or 22.5 m stack is less than 70% of the annual mean objective at each of the residential receptors. It is therefore considered that there is no risk of the contribution from the facility causing a breach of the air quality objective at any residential property, given the existing background concentrations in the vicinity of the facility.

The PEC calculated at the point of maximum concentration and at point A and C along the public track, located to the east of the railway track, is over 70% of the annual mean objective, although concentrations are not predicted to exceed the objective. The maximum PEC with a 20 m stack is 38 μgm^{-3}, some 95% of the objective, whilst raising the stack height to 22.5m the maximum PEC is 34 μgm^{-3}, 85% of the objective. However, the annual mean objective only applies at locations where the public might be regularly exposed such as building facades of residential properties, schools and hospitals. The objective does not apply at locations where public exposure is expected to be short-term. Public exposure along the public track, to the east of the railway, and at the point of maximum concentration which occurs further to the north east on agricultural land, is considered to be short-term, therefore the annual mean objective does not apply.

The short-term PEC for nitrogen dioxide are below 70% of the objective limit of 200 μgm^{-3} at all receptor locations and at the point of maximum concentration with a 20m stack and below 60% of the objective with a 22.5 m stack. Therefore there is minimal risk of the short term objective being exceeded with either stack height.

In summary, although emissions of nitrogen dioxide arising from the proposed energy generation plant from either a 20 or 22.5 m stack cannot be considered as insignificant based on the criteria given in the H1 guidance, subsequent analysis of the data, in conjunction with local background concentrations, indicates that the there is negligible risk of emissions from the facility resulting in a breach of the air quality objectives at the identified residential receptor locations. Whilst higher concentrations are predicted at the point of maximum concentration and on a public track, located adjacent to the railway line to the east, in these locations concentrations of pollutants are predicted to meet the relevant air quality objectives.

Raising the stack from 20 to 22.5 m has the greatest impact on peak concentrations, i.e. those predicted at the point of maximum concentration and on the track, where it has been shown there is no relevant exposure for long term concentrations, which are of most concern. At the residential receptors the difference in process contribution and the resulting PEC between those predicted with a 20 m stack and those with a 22.5 m stack are minimal. Therefore, it is concluded with regard to the protection of human health, there is only a marginal benefit from raising the stack height from 20 to 22.5 m.

1 Introduction

1.1 Introduction

ENVIRON UK Ltd was commissioned by Hargreaves Services Plc and Rocpower Ltd to carry out an air quality assessment of a proposed biofuel power generation plant to be located at a former sub-station on Whaley Road, Barnsley. The site is located within the Metropolitan Borough of Barnsley. This assessment is provided in support of the planning application for the proposals, which are to be submitted to the local authority, Barnsley Metropolitan Borough Council (BMBC).

The proposed site will incorporate five 1.6MWe second-hand engines, which will be run on biofuel, to generate electricity, which will be fed into the national grid. A review of the Environmental Permitting (England and Wales) Regulations 2007 indicates that the trigger threshold for permitting (under part B of the regulations) is an aggregate rated thermal capacity in excess of 20MW. As the aggregated thermal capacity of the proposed site is 19 MW, an environmental permit application is not required. However, as a result of objections to the site by Biofuel Watch, BMBC has requested an air quality assessment of the proposed installation.

The proposed site is located on the outskirts of Barnsley, approximately 2.5 km northwest of the city centre. The site was previously an electricity sub station and forms part of an existing industrial estate. The location of the site is shown in Figure 1.1.



Figure 1.1: Site Location

1.2 Scope and Methodology

The aim of the assessment is to determine the impact of pollutant emissions arising from the proposed site on ambient air quality with regard to human health.

The scope and methodology of the assessment has been discussed and agreed with BMBC.

1.2.1 Air dispersion modelling

The ADMS air dispersion model has been used to predict the likely ground level concentrations of pollutants arising from the proposed installation. The engines will be fired using biofuels (tall oil and vegetable oils) and therefore the main emissions of concern arising from the proposed engines are oxides of nitrogen (NO_x) and fine particulates (PM_{10} and $PM_{2.5}$) .

Emissions data has been obtained from a stack emissions monitoring exercise carried out in May 2011 at the Rocpower/Hargreaves plant in Featherstone, which operates a similar process.

The model has been used to predict ground level concentrations of both pollutants in the vicinity of the site. Predicted concentrations of oxides of nitrogen have been used to calculate ground level concentrations of nitrogen dioxide, to allow comparison with UK air quality objectives. Emissions of other pollutants normally associated with combustion activities i.e. sulphur dioxide, are expected to be negligible and have therefore not been assessed.

2 The Proposed Development

2.1 Installation Details

The proposed site, a former sub station, is located at Whaley Road, Barnsley, to the north of the South Yorkshire (Redbrook) Industrial Site (OS 431960, 408530).

It is proposed to install five 1.6MWe second-hand diesel engines at the site, all of which will run on biofuels. The site will make use of various types of fuel sources e.g. tall oil, a by-product of the wood pulp manufacturing process, vegetable oils etc. that are commercially available on the market. The choice of fuel will be largely dependent on the availability and prevailing financial conditions.

All five diesel engines will be housed within a single building, with emissions released via a stack located on the southern façade of the building. The location of the engines and the associated stack are shown in Figure 2.1.

The thermal efficiency of the site is envisaged to be approximately 41%. Excess heat generated by the engines will be released via five external radiators located to the south of the proposed building, two to the west of the emission stack and three to the east. Each radiator will include fans to help disperse the heat. The location of the radiators is shown in Figure 2.1.

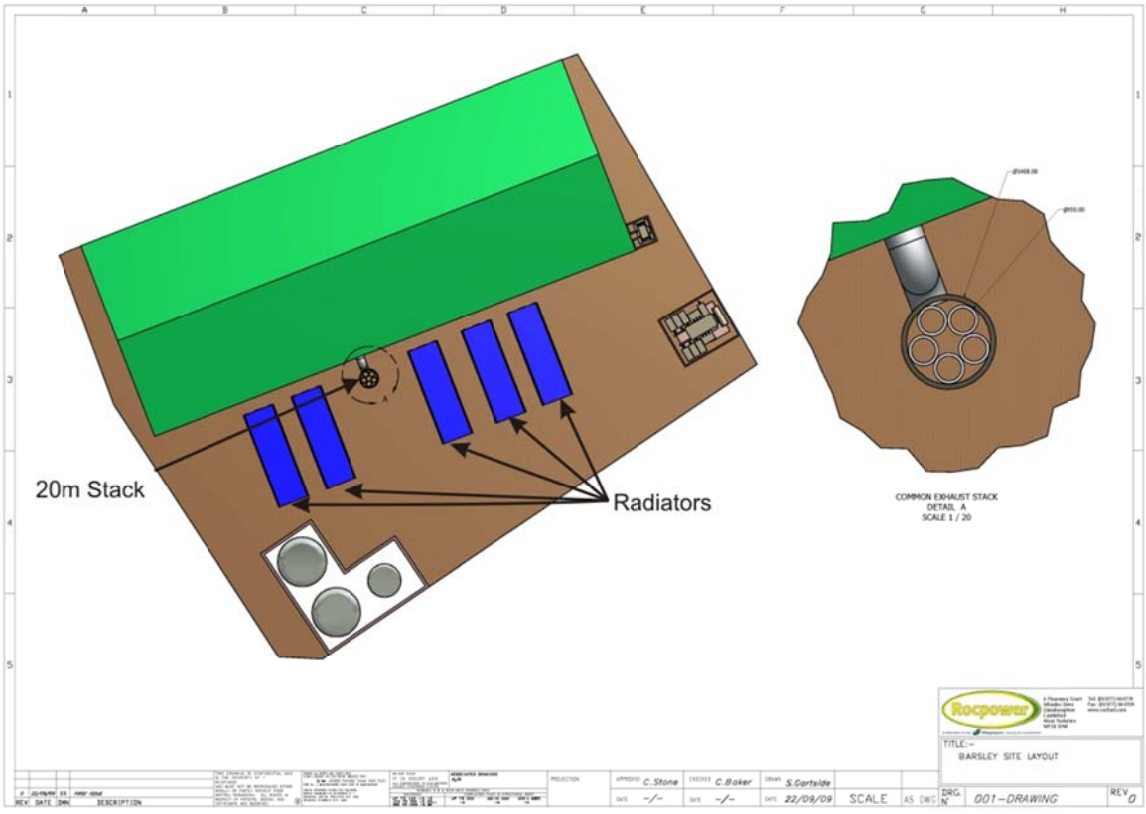


Figure 2.1: Layout of Proposed Energy Generation Plant

2.2 Proposed Fuel Use

The facility proposes to utilise a range of biofuels at the Barnsley site. The exact choice of fuel will depend on market forces. Under the current market conditions tall oil is one of the most favoured options and is considered to be the worst case option in terms of pollutant emissions. As there will be a range of fuels used at the Barnsley site, it is not practical to measure the emissions arising from every type and blend of fuel. Therefore to ensure a conservative approach to the assessment, the predictions contained within this assessment have been based on tall oil use.

The fuel used during the emissions test at Featherstone is considered to be typical of that which will be used at Barnsley and therefore the most appropriate source of emissions data. Hargreaves can confirm that it will use the same fuels at both the Featherstone and Barnsley sites and therefore this is considered to be the most reliable source of emissions data.

All the fuels/blends of fuels that will be used on the site will be OFGEM approved and comply with the requirements of the Renewables Obligations Certificates. Palm oil will not be used.

2.3 Start-up

During the start-up of the generators it is proposed to use a blended fuel to reduce its viscosity in order to run the generators until they reach a temperature of 60 ºC. Hargreaves is currently pursuing a number of options with regard to the lighter fraction oil required for this; possibilities include used cooking oil or biodiesel. Once the generators have reached the required temperature it will be possible to switch to the more viscous tall oil or similar fuel. It is estimated that it will take approximately 20 minutes for the generators to reach 60 ºC from a cold start.

The impact of the start-up emissions has not been considered within the air quality assessment as they will only arise for short periods. It is anticipated that the generators will run continuously except for routine maintenance checks which will occur each month. Averaged over all five generators this equates to approximately one start-up period per week.

The modelling assumes continuous operation of all 5 generators for 24 hours a day 365 days per year. This will be an overestimate, as each generator will need to cool down for several hours before maintenance activities can take place and there may be other longer periods when the generators are inactive. Thus it is considered that even in the event that slightly higher emissions arise during the start-up period when the engines are cold, they have been more than compensated for within the modelling predictions, by the periods of inactivity which have also not been included.

The requirement not to consider emissions during start-up within the assessment was agreed with BMBC.

Hargreaves/Rocpower is also considering the possibility of using a small amount of lighter fraction oil within the fuel mix on a continuous basis to improve the performance of the plant. It is considered that this will not have a significant impact on overall emissions.

As stated above, all fuels and blends of fuels used on a long term basis i.e. not just for start-up, will be OFGEM approved.

3 Methodology

3.1 Choice of Model

Air dispersion modelling is a method whereby computer models are used to estimate the ground level concentration of pollutants derived from emission sources, which in this case arise from an elevated stack.

There is a wide range of dispersion models available and the choice of model depends on the situation under assessment. The models range from simple spreadsheet sets of nomograms to highly complex multi-source programmes. The model used for this assessment is the ADMS 4 model.

ADMS 4 is a 'new generation' dispersion model, which uses Gaussian based equations to predict the dispersion of pollutants within the atmosphere. It is primarily designed for the assessment of industrial emissions from point, line, volume or area sources.

Meteorological data are used to characterise the boundary layer within which the dispersion takes place. Instead of using the old single parameter of the Pasquill Class, stability conditions within the boundary layer are determined by use of the Monin-Obukhov length and the depth of the boundary layer. A further modification from older models is the use of a skewed Gaussian concentration distribution under convective meteorological conditions.

The ADMS 4 model is extensively used within the UK to model industrial sources and is widely used by the Environment Agency, Scottish Environment Protection Agency (SEPA) and other regulatory authorities. The model has been validated against field data sets. The most recent version of the model, version 4.2, has been used in this assessment.

3.2 Meteorological Data

The modelling has utilised hourly sequential meteorological data for 5 complete years (2004 to 2008) obtained from the Emley Moor meteorological station. This is the closest site to the power generation plant, providing appropriate data for use within ADMS 4.

3.3 Scenarios Assessed

The model has been run to predict concentrations arising from the proposed five engines assuming continuous operation on a 24/7 basis. Model runs were carried out for all meteorological years. Initially BMBC requested that the assessment considered 3 stack heights of 12 m, 15 m and 20 m. However, the initial screening runs indicated that the predicted concentrations from a 12m or 15m stack would be well in excess of the objective concentrations and therefore the use of these stacks were discounted. Instead the assessment has considered emissions from a 17.5, 20m and 22.5m stack.

3.4 Input Parameters

The data used in the modelling is provided below in Tables 3.1 to 3.2. The emissions data has been supplied by Rocpower Ltd and has been obtained from a monitoring exercise carried out in May 2011, following the installation of particulate filters at the Rocpower plant at Featherstone when operating using tall oil. The Featherstone plant houses similar engines to those that will be utilised at Barnsley. However, at Featherstone the exhaust gases from each engine are emitted through individual stacks, whilst at Barnsley the emissions will be combined and emitted through a central stack. Thus the emissions data,

which was collected from the operation of a single engine at Featherstone has been multiplied by 5 to calculate the total emissions expected at Barnsley.

Buildings can have a significant effect on the dispersion of pollutants from sources and can increase the maximum predicted ground level concentrations. The main impact from buildings is to entrain pollutants emitted via stacks rapidly down to ground level in the immediate leeward side of the most prominent building. This results in higher concentrations adjacent to buildings, with pollution levels decreasing further away.

ADMS 4 is designed to account for building wash effects, taking into consideration both the building dimensions and heights of the main buildings in close proximity to the stacks being modelled. The proposed building which will house the five diesel engines and the adjacent large storage tanks have been included within the model assessment, details of which are provided in Table 3.3 and their locations shown in Figure 3.1.

Table 3.1: Stack Data

Parameter	Data used
Stack Location	Proposed Engine Building
Stack Height (m)	17.5, 20, 22.5
Stack Diameter (m)	1.01
Volume Flowrate (m^3s^{-1})	30.4
Efflux Velocity (ms^{-1})	36.8
Stack Temperature (°C)	410

Table 3.2: Emissions Data

Parameter	Data Used in Modelling	
Surface Roughness (m)	0.5	
Fuel	Tall Oil	
	Single Engine	5 Engines
Oxides of Nitrogen (gs^{-1})	3.03	15.15
PM_{10} (gs^{-1})	0.023	0.117
$PM_{2.5}$ (gs^{-1})	0.018	0.088

Table 3.3: Building Dimensions

Building	National Grid Reference	Height (m)	Length/diameter (m)	Width (m)
Proposed Engine Building	431997,408549	8.6	38	15
Cylinders	431993,408524	8.5	10	N/A

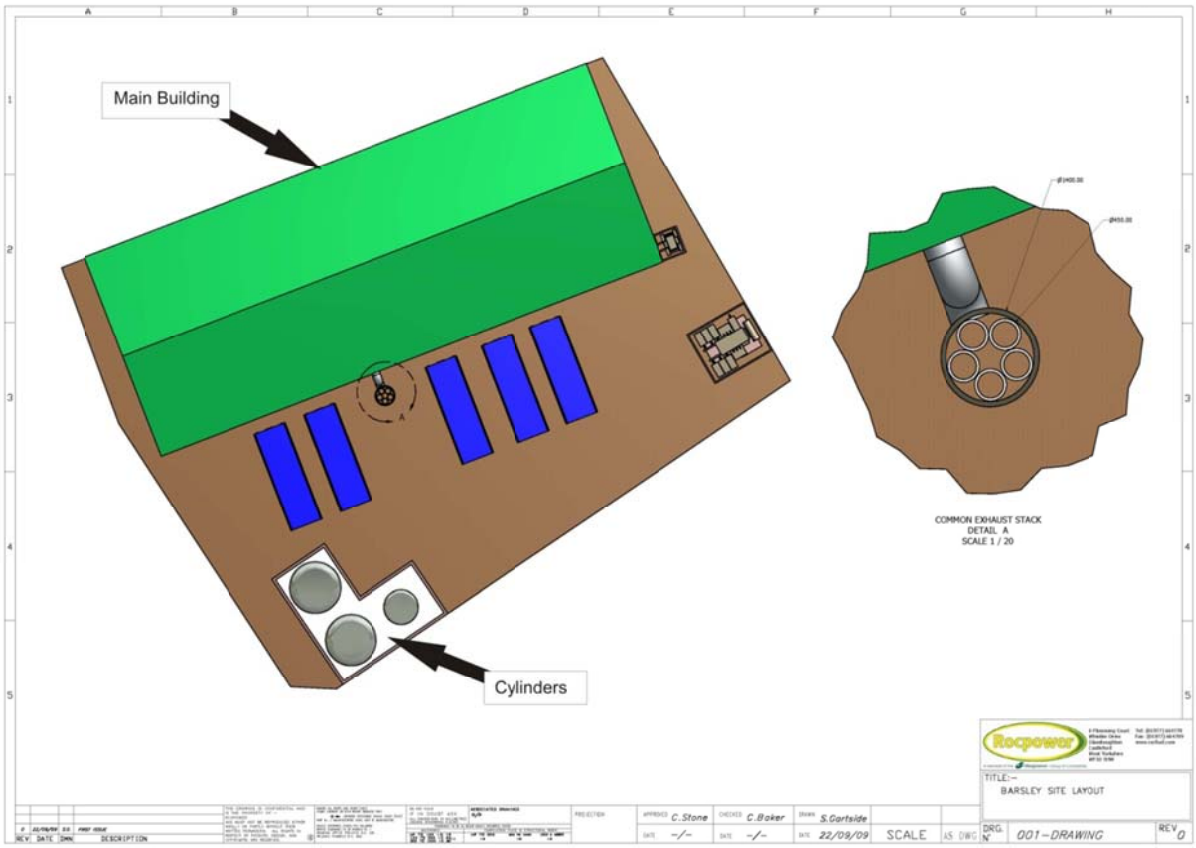


Figure 3.1: Location of Buildings included within ADMS 4

3.5 Output Parameters and Air Quality Objectives

The model has been run for a number of averaging periods to correspond with those used by the objectives set by the Air Quality England Regulations 2000 (as amended), which implement the limit values prescribed by the relevant EU Directives and Daughter Directives within England. The objectives for nitrogen dioxide, PM_{10} and $PM_{2.5}$ are provided below in Table 3.4.

Table 3.4: Relevant Air Quality Objectives and Environmental Assessment Levels

Pollutant	Averaging Period	Objective	Not to be exceeded more than
Nitrogen Dioxide	Annual	40 μgm^{-3}	NA
	1 hour	200 μgm^{-3}	18 times per year
PM_{10}	Annual	40 μgm^{-3}	NA
	24 hour	50 μgm^{-3}	35 times per year
$PM_{2.5}$	Annual	25 μgm^{-3}	NA
	Annual	Target of 15% reduction in concentrations at background locations by 2020	NA

The UK AQOs and EU limits relate to external ambient air where members of the public are regularly present and may be exposed over the averaging period of the objective. Guidance is provided in LAQM.TG (09)[1] on the typical locations where the objectives should and should not apply. A summary of this current guidance is provided below in Table 3.5.

Table 3.5: Typical Locations Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:-
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, libraries etc.	Building facades of offices or other places of work where members of the public do not have regular access. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24 hour mean	All locations where the annual mean objective would apply. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1 hour mean	All locations where the annual mean and 24 hour mean objectives apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably expected to spend 1-hour or more. Any outdoor locations to which the public might reasonably expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

The ADMS model has been used to predict concentrations of oxides of nitrogen, however the existing air quality objectives are for concentrations of nitrogen dioxide. Nitrogen dioxide is primarily a secondary pollutant, i.e. it is formed in the atmosphere rather than emitted directly. From all combustion sources the majority of oxides of nitrogen are emitted as nitrous oxide (between 90-95%), which is then converted to nitrogen dioxide in the atmosphere. The rate of conversion is governed by the availability of other pollutants, most importantly ozone.

Nitrogen dioxide concentrations have been calculated from the predicted concentrations of oxides of nitrogen using the worst case conversion ratios advised by the Air Quality Modelling and Assessment Unit of the Environment Agency. To calculate the annual average nitrogen dioxide contribution, 70% of the predicted oxides of nitrogen concentration

1 DEFRA, Local Air Quality Management, technical Guidance LAQM.TG(09), February 2009

have been used, with 35% of the short term predicted concentration used to calculate the 1 hour concentration.

3.6 Receptors

The model has been run to predict ground level concentrations both over a receptor grid and at a number of identified receptor locations.

3.6.1 Receptor Grids

Initially the model was run over a coarse grid covering an area of 10 km by 10 km with receptors placed every 100 m to identify the approximate location of the point of maximum concentration. The grid area was then refined to predict concentrations every 20 m over a 2 km by 2 km grid which included the area of maximum concentration. Contour plots indicating the ground level concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$, over the small receptor grid area, have been provided in Annex B.

3.6.2 Sensitive Receptors

The identified sensitive receptor locations are provided Table 3.6. and shown in Figure 3.2.

Table 3.6: Identified Sensitive Receptors

Receptor	Grid Coordinates	
2 Dovebush Way	431592	408448
1 Dovebush Way	431616	408427
24 Dearne Hall Fold	431650	408728
104 Dearne Hall Road Garden	431710	408845
Public Track A	432088	408591
Public Track B	432036	408654
Public Track C	432152	408539
2 Medway Close	431709	408271
Snow Hall Farm	432394	409130
Gawber Background Monitoring Site	432550	407550

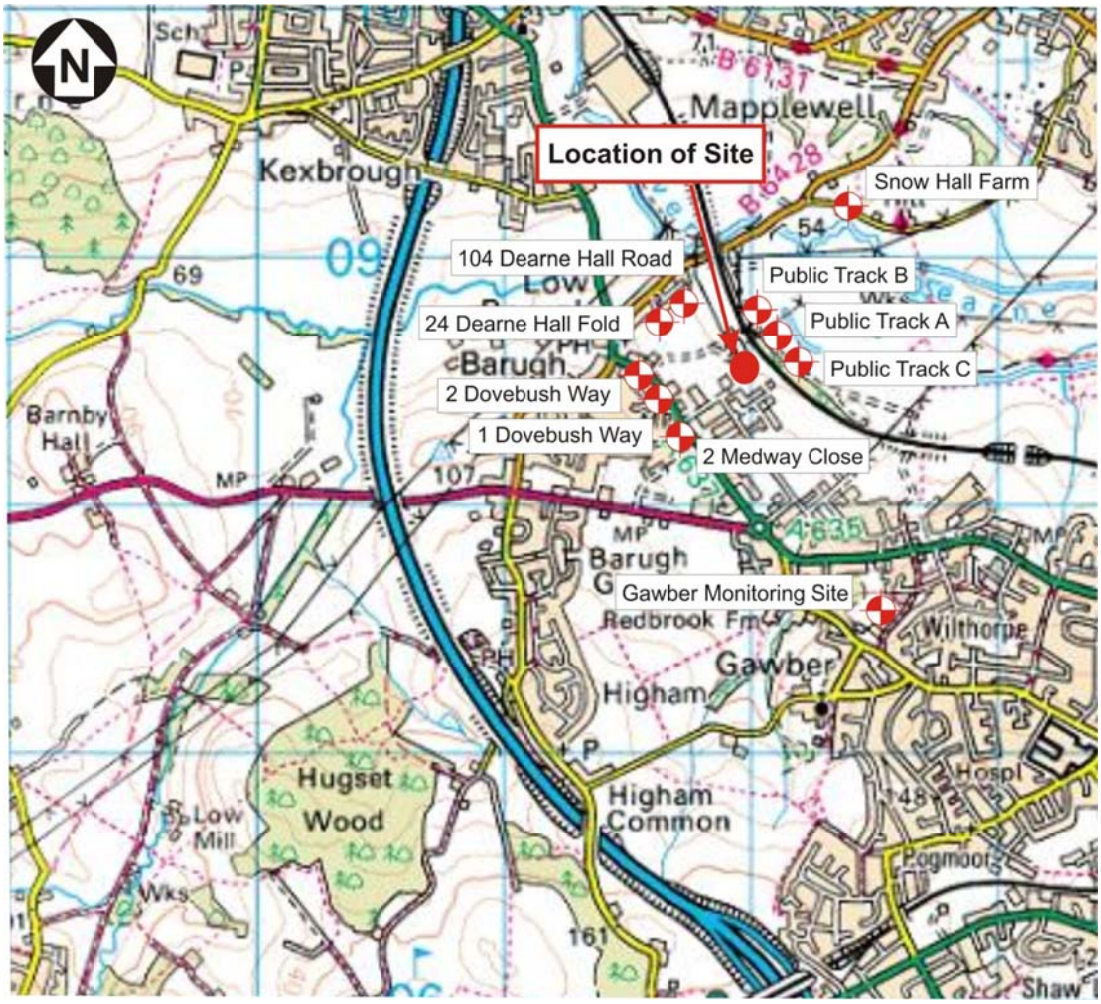


Figure 3.2: Receptor Locations

4 Air Dispersion Modelling Results

4.1 Predicted Concentrations

The results of the assessment for each receptor point are provided below in Tables 4.1 to 4.5. The data provided is the maximum concentration from the 5 meteorological years assessed. The data for each meteorological year is provided in Annex A.

Contour plots depicting the process contributions to ground level concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ for the worst meteorological year are provided in Annex B for a 20 m & 22.5 m stack. PM_{10} & $PM_{2.5}$ plots have not been produced for the 22.5 m stack as there is minimal difference between the 20 and 22.5 m stacks. It has been found that the meteorological conditions during 2008 resulted in the highest concentrations of oxides of nitrogen and PM.

Table 4.1: Predicted annual mean nitrogen dioxide concentrations (µgm^{-3})

	17 m Stack		20 m Stack		22.5 m Stack	
	Value	**% AQO**	**Value**	**% AQO**	**Value**	**% AQO**
Point of Maximum concentration	24.8	62	17.8	44.5	13.8	34.5
Receptors						
2 Dovebush Way	1.9	4.6	1.7	4.2	1.5	3.8
1 Dovebush Way	2.0	5.0	1.8	4.5	1.6	4.1
24 Deane Hall Fold	2.2	5.4	2.0	4.9	1.8	4.4
104 Deane Hall Road	2.6	6.5	2.3	5.8	2.1	5.3
Public Track A	21.5	53.7	11.2	28.1	5.4	13.5
Public Track B	10.8	27.1	6.3	15.7	3.2	7.9
Public Track C	22.8	56.9	15.2	38.0	9.8	24.4
2 Medway Close	1.7	4.3	1.5	3.9	1.4	3.5
Snow Hall Farm	2.9	7.3	2.8	6.9	2.6	6.6
Gawber BG Site	0.9	2.4	0.9	2.3	0.9	2.2
Objective below which concentrations can be considered insignificant	40	1	40	1	40	1

AQO – Air Quality Objective

Table 4.2: Predicted 99.8th percentile value of 1 hour mean nitrogen dioxide concentrations (µgm-3)						
	17 m Stack		20 m Stack		22.5 m Stack	
	Value	% AQO	Value	% AQO	Value	% AQO
Point of Maximum concentration	138.9	69.4	97.0	48.5	56.2	28.1
Receptors						
2 Dovebush Way	32.4	16.2	30.0	15.0	27.9	14.0
1 Dovebush Way	32.8	16.4	30.7	15.4	28.3	14.1
24 Deane Hall Fold	36.2	18.1	33.4	16.7	30.9	15.4
104 Deane Hall Road	32.9	16.4	30.1	15.0	27.8	13.9
Public Track A	85.3	42.6	54.6	27.3	31.5	15.7
Public Track B	125.9	63.0	89.4	44.7	49.1	24.6
Public Track C	102.7	51.3	78.4	39.2	53.4	26.7
2 Medway Close	33.6	16.8	30.8	15.4	28.6	14.3
Snow Hall Farm	17.2	8.6	16.6	8.3	16.0	8.0
Gawber BG Site	11.9	6.0	11.4	5.7	11.0	5.5
Objective below which concentrations can be considered insignificant	200	10	200	10	200	10
AQO – Air Quality Objective						

Table 4.3: Predicted annual mean PM_{10} concentrations (μgm^{-3})						
	17 m Stack		20 m Stack		22.5 m Stack	
	Value	% AQO	Value	% AQO	Value	% AQO
Point of Maximum concentration	0.28	0.7	0.20	0.5	0.16	0.4
Receptors						
2 Dovebush Way	0.02	0.1	0.02	0.0	0.02	0.0
1 Dovebush Way	0.02	0.1	0.02	0.0	0.02	0.0
24 Deane Hall Fold	0.02	0.1	0.02	0.1	0.02	0.1
104 Deane Hall Road	0.03	0.1	0.03	0.1	0.02	0.1
Public Track A	0.24	0.6	0.13	0.3	0.06	0.2
Public Track B	0.12	0.3	0.07	0.2	0.04	0.1
Public Track C	0.25	0.6	0.17	0.4	0.11	0.3
2 Medway Close	0.02	0.0	0.02	0.0	0.02	0.0
Snow Hall Farm	0.03	0.1	0.03	0.1	0.03	0.1
Gawber BG Site	0.01	0.0	0.01	0.0	0.01	0.0
Objective below which concentrations can be considered insignificant	40	1	40	1	40	1
AQO – Air Quality Objective						

Table 4.4: Predicted 90.4 percentile value of 24 hour mean PM_{10} concentrations (μgm^{-3})						
	17 m Stack		20 m Stack		22.5 m Stack	
	Value	% AQO	Value	% AQO	Value	% AQO
Point of Maximum concentration	0.91	1.8	0.62	1.2	0.46	0.9
Receptors						
2 Dovebush Way	0.06	0.1	0.06	0.1	0.05	0.1
1 Dovebush Way	0.07	0.1	0.06	0.1	0.05	0.1
24 Deane Hall Fold	0.10	0.2	0.09	0.2	0.08	0.2
104 Deane Hall Road	0.12	0.2	0.11	0.2	0.11	0.2
Public Track A	0.80	1.6	0.43	0.9	0.20	0.4
Public Track B	0.53	1.1	0.28	0.6	0.14	0.3
Public Track C	0.83	1.7	0.53	1.1	0.33	0.7
2 Medway Close	0.06	0.1	0.05	0.1	0.05	0.1
Snow Hall Farm	0.11	0.2	0.11	0.2	0.10	0.2
Gawber BG Site	0.04	0.1	0.04	0.1	0.04	0.1
Objective below which concentrations can be considered insignificant	50	10	50	10	50	10
AQO – Air Quality Objective						

Table 4.5: Predicted annual mean $PM_{2.5}$ concentrations (μgm^{-3})						
	17 m Stack		20 m Stack		22.5 m Stack	
	Value	% AQO	Value	% AQO	Value	% AQO
Point of Maximum concentration	0.21	0.8	0.15	0.6	0.12	0.5
Receptors						
2 Dovebush Way	0.02	0.1	0.01	0.1	0.01	0.1
1 Dovebush Way	0.02	0.1	0.02	0.1	0.01	0.1
24 Deane Hall Fold	0.02	0.1	0.02	0.1	0.02	0.1
104 Deane Hall Road	0.02	0.1	0.02	0.1	0.02	0.1
Public Track A	0.18	0.7	0.10	0.4	0.05	0.2
Public Track B	0.09	0.4	0.05	0.2	0.03	0.1
Public Track C	0.19	0.8	0.13	0.5	0.08	0.3
2 Medway Close	0.01	0.1	0.01	0.1	0.01	0.0
Snow Hall Farm	0.02	0.1	0.02	0.1	0.02	0.1
Gawber BG Site	0.01	0.0	0.01	0.0	0.01	0.0
Objective below which concentrations can be considered insignificant	25	1	25	1	25	1
AQO – Air Quality Objective						

4.2 Comparison of Process Contributions with Air Quality Objectives

The predicted concentrations at both the point of maximum concentration and at each of the receptor locations have been compared with the relevant air quality objectives.

To determine the significance of the releases from the other stack heights, the results have been assessed using the criteria given in H1. Releases can be considered to be insignificant if:-

Process Contribution long term <= 1 % of the long term environmental benchmark; and

Process Contribution short term <= 10 % of the short term environmental benchmark.

The predicted annual mean nitrogen dioxide concentrations emitted by the proposed electricity generation plant are greater than 1% of the annual mean objective at all the selected receptor locations for all stack heights (Table 4.1). The short-term concentrations are over 10% of the short term objective at the majority of locations for all stack heights (Table 4.2). Emissions of nitrogen dioxide cannot, therefore, be considered as insignificant.

Predicted PM_{10} concentrations are just under 1% of the annual mean objective at the point of maximum concentration for all stack heights (Table 4.3). Similarly the 24 hour mean concentrations are less than 10 % of the short term objective at all locations, including the

point of maximum concentration, for all stack heights (Table 4.4). Therefore impacts on PM_{10} concentrations can be considered as insignificant.

Emissions of $PM_{2.5}$ are predicted to be under 1% of the annual mean objective at all locations for all stack heights (Table 4.5), therefore emissions of this pollutant can be considered as insignificant.

4.3 Predicted Environmental Concentrations

Where the process concentrations cannot be considered as insignificant, the next stage in the assessment process is to consider the process contribution together with the existing background concentration, to calculate the Predicted Environmental Concentration (PEC) to determine the overall impact on air quality. Through discussions with BMBC it has been agreed that this stage of the assessment would be carried out for all predicted results, regardless of whether they could be deemed as insignificant at stage 1 (detailed in section 4.2).

This is relatively straight forward with regard to annual impacts as the background concentration and process contribution can be easily combined. For the 1 hour nitrogen dioxide objective guidance recommends that the PEC is calculated by adding the short-term PC to twice the annual average ambient background concentrations, whilst for the 24 hour PM_{10} objective the PEC should be calculated by adding the annual average to the 90.4 percentile value.

Background nitrogen dioxide concentrations have been taken from the Barnsley Gawber background continuous monitoring site. Data recorded between 2004 and 2008 has indicated a gradual decline in concentrations. Thus for the purposes of this assessment it is considered appropriate to use an average concentration calculated from annual results recorded between 2004 and 2008 to provide a conservative background concentration.

PM_{10} and $PM_{2.5}$ concentrations are not monitored at the Gawber site, therefore background data for both these pollutants have been taken from the Defra 2008 background maps. Data has been extracted for the OS grid square, 431500,408500, which covers the proposed installation site.

Calculation of the PEC for nitrogen dioxide, PM_{10} and $PM_{2.5}$ at each of the receptor locations and the point of maximum concentration and comparison with the relevant environmental benchmarks is provided in Tables 4.6 to 4.10 below.

Table 4.6: Calculation of the PEC for Annual Mean Nitrogen Dioxide (µgm^{-3})									
	17 m Stack			20 m Stack			22.5 m Stack		
	PC	PEC	% AQO	PC	PEC	% AQO	PC	PEC	% AQO
Point of Maximum concentration	24.8	44.8	112	17.8	37.8	94.5	13.8	33.8	84.5
Receptors									
2 Dovebush Way	1.9	21.9	54.6	1.7	21.7	54.2	1.5	21.5	53.8
1 Dovebush Way	2.0	22.0	55.0	1.8	21.8	54.5	1.6	21.6	54.1
24 Deane Hall Fold	2.2	22.2	55.4	2.0	22.0	54.9	1.8	21.8	54.4
104 Deane Hall Road	2.6	22.6	56.5	2.3	22.3	55.8	2.1	22.1	55.3
Public Track A	21.5	41.5	103.7	11.2	31.2	78.1	5.4	25.4	63.5
Public Track B	10.8	30.8	77.1	6.3	26.3	65.7	3.2	23.2	57.9
Public Track C	22.8	42.8	106.9	15.2	35.2	88.0	9.8	29.8	74.4
2 Medway Close	1.7	21.7	54.3	1.5	21.5	53.9	1.4	21.4	53.5
Snow Hall Farm	2.9	22.9	57.3	2.8	22.8	56.9	2.6	22.6	56.6
Gawber BG Site	0.9	20.9	52.4	0.9	20.9	52.3	0.9	20.9	52.2
Background concentration = 20 µgm^{-3} taken from the Gawber monitoring site									

Table 4.7: Calculation of the PEC for 99.8 percentile value of 1 hour mean Nitrogen Dioxide (μgm^{-3})

	17 m Stack			20 m Stack			22.5 m Stack		
	PC	PEC	% AQO	PC	PEC	% AQO	PC	PEC	% AQO
Point of Maximum concentration	138.9	178.9	89.45	97.0	137	68.5	56.2	96.2	48.1
Receptors									
2 Dovebush Way	32.4	72.4	36.2	30.0	70.0	35.0	27.9	67.9	34.0
1 Dovebush Way	32.8	72.8	36.4	30.7	70.7	35.4	28.3	68.3	34.1
24 Deane Hall Fold	36.2	76.2	38.1	33.4	73.4	36.7	30.9	70.9	35.4
104 Deane Hall Road	32.9	72.9	36.4	30.1	70.1	35.0	27.8	67.8	33.9
Public Track A	85.3	125.3	62.6	54.6	94.6	47.3	31.5	71.5	35.7
Public Track B	125.9	165.9	83.0	89.4	129.4	64.7	49.1	89.1	44.6
Public Track C	102.7	142.7	71.3	78.4	118.4	59.2	53.4	93.4	46.7
2 Medway Close	33.6	73.6	36.8	30.8	70.8	35.4	28.6	68.6	34.3
Snow Hall Farm	17.2	57.2	28.6	16.6	56.6	28.3	16.0	56.0	28.0
Gawber BG Site	11.9	51.9	26.0	11.4	51.4	25.7	11.0	51.0	25.5

Background concentration = 20 μgm^{-3} taken from the Gawber monitoring site

Table 4.8: Calculation of the PEC for annual mean PM_{10} (μgm^{-3})									
	17 m Stack			20 m Stack			22.5 m Stack		
	PC	PEC	% AQO	PC	PEC	% AQO	PC	PEC	% AQO
Point of Maximum concentration	0.28	16.78	42.0	0.2	16.70	41.8	0.16	16.66	41.7
Receptors									
2 Dovebush Way	0.02	16.52	41.3	0.02	16.52	41.3	0.02	16.52	41.3
1 Dovebush Way	0.02	16.52	41.3	0.02	16.52	41.3	0.02	16.52	41.3
24 Deane Hall Fold	0.02	16.52	41.3	0.02	16.52	41.3	0.02	16.52	41.3
104 Deane Hall Road	0.03	16.53	41.3	0.03	16.53	41.3	0.02	16.52	41.3
Public Track A	0.24	16.74	41.9	0.13	16.63	41.6	0.06	16.56	41.4
Public Track B	0.12	16.62	41.6	0.07	16.57	41.4	0.04	16.54	41.3
Public Track C	0.25	16.75	41.9	0.17	16.67	41.7	0.11	16.61	41.5
2 Medway Close	0.02	16.52	41.3	0.02	16.52	41.3	0.02	16.52	41.3
Snow Hall Farm	0.03	16.53	41.3	0.03	16.53	41.3	0.03	16.53	41.3
Gawber BG Site	0.01	16.51	41.3	0.01	16.51	41.3	0.01	16.51	41.3
Background concentration = 16.5 μgm^{-3} taken from the Defra Background maps									

Table 4.9: Calculation of the PEC for 90.4 percentile value of 24 hour mean PM_{10} (μgm^{-3})									
	17 m Stack			20 m Stack			22.5 m Stack		
	PC	PEC	% AQO	PC	PEC	% AQO	PC	PEC	% AQO
Point of Maximum concentration	0.91	17.41	34.8	0.62	17.12	34.2	0.46	16.96	33.9
Receptors									
2 Dovebush Way	0.06	16.56	33.1	0.06	16.56	33.1	0.05	16.55	33.1
1 Dovebush Way	0.07	16.57	33.1	0.06	16.56	33.1	0.05	16.55	33.1
24 Deane Hall Fold	0.10	16.60	33.2	0.09	16.59	33.2	0.08	16.58	33.2
104 Deane Hall Road	0.12	16.62	33.2	0.11	16.61	33.2	0.11	16.61	33.2
Public Track A	0.80	17.30	34.6	0.43	16.93	33.9	0.20	16.70	33.4
Public Track B	0.53	17.03	34.1	0.28	16.78	33.6	0.14	16.64	33.3
Public Track C	0.83	17.33	34.7	0.53	17.03	34.1	0.33	16.83	33.7
2 Medway Close	0.06	16.56	33.1	0.05	16.55	33.1	0.05	16.55	33.1
Snow Hall Farm	0.11	16.61	33.2	0.11	16.61	33.2	0.10	16.60	33.2
Gawber BG Site	0.04	16.54	33.1	0.04	16.54	33.1	0.04	16.54	33.1
Background concentration = 16.5 μgm^{-3} taken from the Defra Background maps									

Table 4.10: Calculation of the PEC for annual mean $PM_{2.5}$ (μgm^{-3})									
	17 m Stack			20 m Stack			22.5 m Stack		
	PC	PEC	% AQO	PC	PEC	% AQO	PC	PEC	% AQO
Point of Maximum concentration	0.21	10.71	42.8	0.15	10.65	42.6	0.12	10.62	42.5
Receptors									
2 Dovebush Way	0.02	10.52	42.1	0.01	10.51	42.1	0.01	10.51	42.1
1 Dovebush Way	0.02	10.52	42.1	0.02	10.52	42.1	0.01	10.51	42.1
24 Deane Hall Fold	0.02	10.52	42.1	0.02	10.52	42.1	0.02	10.52	42.1
104 Deane Hall Road	0.02	10.52	42.1	0.02	10.52	42.1	0.02	10.52	42.1
Public Track A	0.18	10.68	42.7	0.10	10.60	42.4	0.05	10.55	42.2
Public Track B	0.09	10.59	42.4	0.05	10.55	42.2	0.03	10.53	42.1
Public Track C	0.19	10.69	42.8	0.13	10.63	42.5	0.08	10.58	42.3
2 Medway Close	0.01	10.51	42.1	0.01	10.51	42.1	0.01	10.51	42.0
Snow Hall Farm	0.02	10.52	42.1	0.02	10.52	42.1	0.02	10.52	42.1
Gawber BG Site	0.01	10.51	42.0	0.01	10.51	42.0	0.01	10.51	42.0
Background concentration = 10.5 μgm^{-3} taken from the Defra Background maps									

4.4 Assessment of Predicted Environmental Concentrations

4.4.1 17.5 m Stack

The calculated PEC for annual mean nitrogen dioxide concentrations using a 17.5 m stack indicates that the PEC is predicted to exceed the 40 μgm^{-3} at the point of maximum concentration. Given that the cumulative impact of the process contribution and background concentrations are resulting in an exceedance of the objective, it is considered that this stack height results in an unacceptable impact and therefore has been discounted. No further assessment of the results from this stack height has been undertaken.

4.4.2 20 m Stack

Calculation of the annual mean PEC for nitrogen dioxide is less than 70% of the annual mean objective at each of the residential receptors (Table 4.6). It is therefore considered that there is no risk of the contribution from the facility causing a breach of the air quality objective at residential receptors, given the existing background concentrations in the vicinity of the facility. However, the PEC calculated at the point of maximum concentration and at point A and C along the public track, located to the east of the railway track, is over 70% of the annual mean objective. A concentration of 37.8 μgm^{-3} is predicted at the point of maximum concentration, which is predicted to arise to the north east of the track within an arable area; this equates to 94.5% of the objective.

However, as detailed in Table 3.5, the annual mean objective only applies at locations where the public might be regularly exposed such as building facades of residential properties, schools and hospitals. The objective does not apply at locations where public exposure is expected to be short-term. Public exposure along the public track, to the east of the railway, and at the point of maximum concentration is considered to be short-term, therefore the annual mean objective does not apply.

The short-term PEC for nitrogen dioxide (Table 4.7) are below 70% of the objective limit of 200 μgm^{-3} at all receptor locations and at the point of maximum concentration, therefore there is minimal risk of the short term objective being exceeded in these locations.

The annual mean PM_{10} and annual mean $PM_{2.5}$ PEC calculated at each receptor, including the point of maximum concentration, is less than 50% of the objective limit. Therefore, there is negligible risk of the facility resulting in an exceedance of the annual mean objective at any location.

The PEC calculated for short-term PM_{10} is less than 40% of the objective at each receptor, including the point of maximum concentration. Therefore, there is negligible risk of the facility resulting in an exceedance of the annual mean objective at any location.

4.4.3 22.5 m Stack

Calculation of the annual mean PEC for nitrogen dioxide is less than 60% of the annual mean objective at each of the residential receptors (Table 4.6). It is therefore considered that there is no risk of the contribution from the facility causing a breach of the air quality objective at residential receptors, given the existing background concentrations in the vicinity of the facility. It is only at the point of maximum concentration and at point C on the public track where the PECs are predicted to exceed 70% of the objective. At the point of

maximum concentration a concentration of 33.8 μgm^{-3} is predicted which is some 84.5% of the objective.

However, as detailed in Section 4.4.2, the annual mean objective does not apply at these locations.

The short-term PEC for nitrogen dioxide (Table 4.7) are below 50% of the objective limit of 200 μgm^{-3} at all receptor locations and at the point of maximum concentration, therefore there is minimal risk of the short term objective being exceeded in these locations.

The annual mean PM_{10} and annual mean $PM_{2.5}$ PEC calculated at each receptor, including the point of maximum concentration, is less than 50% of the objective limit. Therefore, there is negligible risk of the facility resulting in an exceedance of the annual mean objective at any location.

The PEC calculated for short-term PM_{10} is less than 40% of the objective at each receptor, including the point of maximum concentration. Therefore, there is negligible risk of the facility resulting in an exceedance of the annual mean objective at any location.

4.4.4 Residential Receptors on Dovebush Way

BMBC has raised concerns regarding residential receptors located on Dovebush Way, southwest of the installation site. As shown on Figure 3.2, properties 1 and 2 are located directly adjacent to A637 Claycliffe Road, which can experience congestion at peak period. The combined impact from traffic emissions and emissions from the proposed installation are therefore a concern with regard to nitrogen dioxide concentrations. It has been agreed with BMBC that to assess the combined impact from traffic emissions and emissions from the proposed diesel engines, the PC from the site will be added to nitrogen dioxide concentrations recorded along the A637. BMBC operate a number of diffusion tubes (DT) within the borough to record nitrogen dioxide concentrations. The closest DT site to Dovebush Way is DT 46, which is located adjacent to the A637, close to the junction with the A635. The site is a roadside site and is considered a worst case representation of concentration at Dovebush Way, therefore the predicted PEC detailed in Table 4.11 and 4.12 below is likely to be an overestimate of actual concentrations.

Table 4.11: Calculation of Worst Case PEC for Annual Mean Nitrogen Dioxide at Residential Receptors on Dovebush Way, 20 m Stack

Receptors	PC μgm^{-3}	NO_2 Roadside Concentrations [1] μgm^{-3}	PEC μgm^{-3}	% EAL/AQO
2 Dovebush Way	1.7	34.9	36.6	91.5
1 Dovebush Way	1.8		36.7	91.8

[1] recorded at Diffusion Tube site 46

Table 4.12: Calculation of Worst Case PEC for Annual Mean Nitrogen Dioxide at Residential Receptors on Dovebush Way, 22.5 m Stack

Receptors	PC µgm^{-3}	NO_2 Roadside Concentrations [1] µgm^{-3}	PEC µgm^{-3}	% EAL/AQO
2 Dovebush Way	1.5	34.9	36.4	91.0
1 Dovebush Way	1.6		36.5	91.3

[1] recorded at Diffusion Tube site 46

Annual mean nitrogen dioxide concentrations predicted at Dovebush Way, after traffic related emissions have been taken into consideration, are below the annual mean objective, with either a 20 or 22.5 m stack. The proposed installation is predicted to increase annual mean nitrogen dioxide concentrations at both 1 and 2 Dovebush Way by less than 2 µgm^{-3}, compared to existing annual mean concentrations recorded at the Claycliffe Road diffusion tube site. Using guidance published by Environmental Protection UK (EPUK) for Development Control[2] this increase equates to a 'small' change in air quality. Where existing air quality is 'just below' the objective i.e. between 36 and 40 µgm^{-3}, this equates to a 'slight adverse' impact on air quality.

2 EPUK (2010) Development Control: Planning for Air Quality 2010 Update

5 Conclusions

The assessment has considered the emissions from the proposed new power generation site, which will operate five 1.6 MWe engines fuelled with biofuels, to generate electricity to feed into the national grid. Ground level concentrations of pollutants have been predicted assuming a stack height of 17.5, 20 and 22.5 m and compared with the relevant air quality objectives.

Emissions from the installation have been provided by Rocpower Ltd, and have been obtained from a monitoring exercise carried out in May 2011 at a similar facility in Featherstone, operated by Rocpower located. The monitoring was carried out with engines running on tall oil.

The predicted process contribution (PC) at both the point of maximum concentration and at each of the receptor locations have been compared with the relevant air quality objectives. To determine the significance of the releases, the results have been assessed using the criteria given in the Environment Agency's H1 Guidance.

The predicted process concentrations from all stack heights, whilst below the objective concentrations, were above the level at which they could be considered as insignificant for nitrogen dioxide. However, process contributions of particulates, both PM_{10} and $PM_{2.5}$ were less than 1% of the annual objective and less than 10% of the short term objective and can therefore be considered as insignificant.

Where the process concentrations cannot be considered as insignificant, the next stage in the assessment process is to consider the PC together with the existing background concentration, to calculate the Predicted Environmental Concentration (PEC) to determine the overall impact on air quality.

Consideration of the PEC from emissions arising from a 17.5 m stack indicated that there was potential that the combined impact would result in an exceedance of the annual mean at the point of maximum concentration. Therefore this stack height has been discounted.

Calculation of the annual mean PEC for nitrogen dioxide from either a 20 or 22.5 m stack is less than 70% of the annual mean objective at each of the residential receptors. It is therefore considered that there is no risk of the contribution from the facility causing a breach of the air quality objective at residential receptors, given the existing background concentrations in the vicinity of the facility.

The PEC calculated at the point of maximum concentration and at point A and C along the public track, located to the east of the railway track, is over 70% of the annual mean objective, although concentrations are not predicted to exceed the objective. The maximum PEC with a 20 m stack is 38 μgm^{-3}, some 95% of the objective, whilst raising the stack height to 22.5m the maximum PEC is 34 μgm^{-3}, 85% of the objective. However, the annual mean objective only applies at locations where the public might be regularly exposed such as building facades of residential properties, schools and hospitals. The objective does not apply at locations where public exposure is expected to be short-term. Public exposure along the public track, to the east of the railway, and at the point of maximum concentration which occurs further to the north east on agricultural land, is considered to be short-term, therefore the annual mean objective does not apply.

The short-term PEC for nitrogen dioxide are below 70% of the objective limit of 200 μgm^{-3} at all receptor locations and at the point of maximum concentration with a 20m stack and below

60% of the objective with a 22.5 m stack. Therefore there is minimal risk of the short term objective being exceeded with either stack height.

In summary, although emissions of nitrogen dioxide arising from the proposed energy generation plant from either a 20 or 22.5 m stack cannot be considered as insignificant based on the criteria given in the H1 guidance, subsequent analysis of the data, in conjunction with local background concentrations, indicates that the there is negligible risk of emissions from the facility resulting in a breach of the air quality objectives at the identified residential receptor locations. Whilst higher concentrations are predicted at the point of maximum concentration and on a public track, located adjacent to the railway line to the east, in these locations concentrations of pollutants are predicted to meet the relevant air quality objectives.

Raising the stack from 20 to 22.5 m has the greatest impact on peak concentrations, i.e. those predicted at the point of maximum concentration and on the track, where it has been shown there is no relevant exposure for long term concentrations. At the residential receptors the difference in process contribution and the resulting PEC between those predicted with a 20 m stack and those with a 22.5 m stack are minimal. Therefore, it is concluded with regard to the protection of human health, there is only a marginal benefit from raising the stack height from 20 to 22.5 m.

Annex A: Predicted Concentrations for all years

2004 V1 17.5 m stack

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr I	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.84	1.29	90.41	31.64	0.01	0.02	0.01
1 Dovebush Way	431616.3	408427.2	0	1.95	1.36	93.61	32.76	0.01	0.02	0.01
24 DHF	431650.7	408728.2	0	3.10	2.17	103.50	36.22	0.02	0.05	0.02
24 DHF Garden	431657.4	408727.9	0	3.16	2.21	106.05	37.12	0.03	0.05	0.02
DT 46	432007	407940	0	1.60	1.12	65.31	22.86	0.01	0.02	0.01
DT 47	432056	407850	0	1.45	1.02	48.62	17.02	0.01	0.02	0.01
DT 48	432116	407796	0	1.40	0.98	50.61	17.71	0.01	0.03	0.01
104 DHR	431690.7	408860	0	2.56	1.79	83.53	29.24	0.02	0.06	0.02
104 DHR Garden	431710.4	408845.7	0	2.69	1.88	89.44	31.31	0.02	0.07	0.02
142 DHR	431735.4	408906.7	0	2.39	1.67	80.59	28.20	0.02	0.07	0.01
Public Track A	432088.8	408591	0	23.29	16.30	240.46	84.16	0.19	0.72	0.14
Public Track B	432036.5	408654.9	0	9.55	6.69	351.78	123.12	0.08	0.26	0.06
Public Track C	432152	408539.4	0	26.70	18.69	293.31	102.66	0.22	0.71	0.16
2 Medway Close	431709.7	408271.1	0	1.43	1.00	81.64	28.57	0.01	0.02	0.01
Snow Hall Farm	432394.5	409130.4	0	2.98	2.09	48.70	17.04	0.02	0.09	0.02
Gawber BG Site	432550	407550	0	1.21	0.85	32.82	11.49	0.01	0.03	0.01

2005

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr I	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.57	1.10	82.60	28.91	0.01	0.04	0.01
1 Dovebush Way	431616.3	408427.2	0	1.78	1.25	89.79	31.43	0.01	0.03	0.01
24 DHF	431650.7	408728.2	0	1.94	1.36	98.92	34.62	0.02	0.06	0.01
24 DHF Garden	431657.4	408727.9	0	1.97	1.38	101.08	35.38	0.02	0.06	0.01
DT 46	432007	407940	0	1.79	1.25	64.89	22.71	0.01	0.05	0.01
DT 47	432056	407850	0	1.58	1.10	47.91	16.77	0.01	0.05	0.01
DT 48	432116	407796	0	1.47	1.03	48.50	16.97	0.01	0.04	0.01
104 DHR	431690.7	408860	0	2.66	1.86	85.61	29.96	0.02	0.10	0.02
104 DHR Garden	431710.4	408845.7	0	2.90	2.03	92.28	32.30	0.03	0.11	0.02
142 DHR	431735.4	408906.7	0	3.45	2.41	80.73	28.25	0.03	0.13	0.02
Public Track A	432088.8	408591	0	26.27	18.39	241.53	84.54	0.21	0.80	0.16
Public Track B	432036.5	408654.9	0	12.83	8.98	352.64	123.42	0.10	0.47	0.08
Public Track C	432152	408539.4	0	21.97	15.38	283.06	99.07	0.17	0.52	0.13
2 Medway Close	431709.7	408271.1	0	2.36	1.66	93.08	32.58	0.02	0.06	0.01
Snow Hall Farm	432394.5	409130.4	0	3.62	2.53	49.27	17.24	0.03	0.11	0.02
Gawber BG Site	432550	407550	0	1.36	0.95	32.95	11.53	0.01	0.04	0.01

2006

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr I	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.98	1.39	92.48	32.37	0.02	0.05	0.01
1 Dovebush Way	431616.3	408427.2	0	2.31	1.62	92.85	32.50	0.02	0.05	0.01
24 DHF	431650.7	408728.2	0	2.80	1.96	102.78	35.97	0.02	0.09	0.02
24 DHF Garden	431657.4	408727.9	0	2.86	2.00	104.77	36.67	0.03	0.10	0.02
DT 46	432007	407940	0	1.17	0.82	63.16	22.11	0.01	0.03	0.01
DT 47	432056	407850	0	0.99	0.69	47.12	16.49	0.01	0.03	0.01
DT 48	432116	407796	0	0.90	0.63	46.29	16.20	0.01	0.02	0.01
104 DHR	431690.7	408860	0	3.41	2.39	86.36	30.22	0.03	0.11	0.02
104 DHR Garden	431710.4	408845.7	0	3.69	2.58	93.51	32.73	0.03	0.11	0.02
142 DHR	431735.4	408906.7	0	4.20	2.94	81.34	28.47	0.03	0.11	0.02
Public Track A	432088.8	408591	0	25.00	17.50	241.91	84.67	0.20	0.70	0.15
Public Track B	432036.5	408654.9	0	15.49	10.84	352.53	123.39	0.12	0.50	0.09
Public Track C	432152	408539.4	0	23.61	16.53	284.28	99.50	0.18	0.59	0.14
2 Medway Close	431709.7	408271.1	0	2.45	1.71	95.90	33.57	0.02	0.04	0.01
Snow Hall Farm	432394.5	409130.4	0	3.75	2.62	49.03	17.16	0.03	0.10	0.02
Gawber BG Site	432550	407550	0	0.75	0.52	30.48	10.67	0.01	0.02	0.00

2007

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr I	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.23	0.86	82.25	28.79	0.01	0.03	0.01
1 Dovebush Way	431616.3	408427.2	0	1.33	0.93	81.75	28.61	0.01	0.04	0.01
24 DHF	431650.7	408728.2	0	1.98	1.39	100.37	35.13	0.02	0.04	0.01
24 DHF Garden	431657.4	408727.9	0	2.02	1.41	102.69	35.94	0.02	0.04	0.01
DT 46	432007	407940	0	1.23	0.86	62.82	21.99	0.01	0.03	0.01
DT 47	432056	407850	0	1.05	0.73	48.20	16.87	0.01	0.03	0.01
DT 48	432116	407796	0	0.97	0.68	48.72	17.05	0.01	0.02	0.01
104 DHR	431690.7	408860	0	2.49	1.74	84.44	29.55	0.02	0.08	0.01
104 DHR Garden	431710.4	408845.7	0	2.67	1.87	90.56	31.70	0.02	0.09	0.02
142 DHR	431735.4	408906.7	0	3.03	2.12	79.92	27.97	0.03	0.11	0.02
Public Track A	432088.8	408591	0	28.65	20.06	243.38	85.18	0.23	0.79	0.17
Public Track B	432036.5	408654.9	0	9.66	6.76	347.56	121.65	0.08	0.28	0.06
Public Track C	432152	408539.4	0	32.54	22.78	287.65	100.68	0.25	0.83	0.19
2 Medway Close	431709.7	408271.1	0	1.88	1.31	91.22	31.93	0.02	0.04	0.01
Snow Hall Farm	432394.5	409130.4	0	3.35	2.34	48.96	17.14	0.03	0.09	0.02
Gawber BG Site	432550	407550	0	1.02	0.72	34.03	11.91	0.01	0.03	0.01

2008

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr I	Annual PM2.5

2 Dovebush Way	431592.2	408448.1	0	2.66	1.86	90.81	31.78	0.02	0.06	0.02
1 Dovebush Way	431616.3	408427.2	0	2.86	2.00	92.72	32.45	0.02	0.07	0.02
24 DHF	431650.7	408728.2	0	2.63	1.84	100.12	35.04	0.02	0.10	0.02
24 DHF Garden	431657.4	408727.9	0	2.67	1.87	101.78	35.62	0.02	0.11	0.02
DT 46	432007	407940	0	0.84	0.58	63.82	22.34	0.00	0.01	0.00
DT 47	432056	407850	0	0.73	0.51	47.56	16.65	0.00	0.01	0.00
DT 48	432116	407796	0	0.69	0.48	44.58	15.60	0.00	0.01	0.00
104 DHR	431690.7	408860	0	3.23	2.26	86.62	30.32	0.03	0.12	0.02
104 DHR Garden	431710.4	408845.7	0	3.49	2.45	93.91	32.87	0.03	0.12	0.02
142 DHR	431735.4	408906.7	0	3.83	2.68	81.89	28.66	0.03	0.13	0.02
Public Track A	432088.8	408591	0	30.67	21.47	243.69	85.29	0.24	0.74	0.18
Public Track B	432036.5	408654.9	0	14.60	10.22	359.76	125.92	0.12	0.53	0.09
Public Track C	432152	408539.4	0	25.48	17.83	289.82	101.44	0.20	0.66	0.15
2 Medway Close	431709.7	408271.1	0	2.25	1.57	94.03	32.91	0.01	0.03	0.01
Snow Hall Farm	432394.5	409130.4	0	4.16	2.91	49.14	17.20	0.03	0.11	0.02
Gawber BG Site	432550	407550	0	0.87	0.61	32.57	11.40	0.01	0.02	0.01

max all years

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr I	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	2.66	1.86	92.48	32.37	0.02	0.06	0.02
1 Dovebush Way	431616.3	408427.2	0	2.86	2.00	93.61	32.76	0.02	0.07	0.02
24 DHF	431650.7	408728.2	0	3.10	2.17	103.50	36.22	0.02	0.10	0.02
24 DHF Garden	431657.4	408727.9	0	3.16	2.21	106.05	37.12	0.03	0.11	0.02
DT 46	432007	407940	0	1.79	1.25	65.31	22.86	0.01	0.05	0.01
DT 47	432056	407850	0	1.58	1.10	48.62	17.02	0.01	0.05	0.01
DT 48	432116	407796	0	1.47	1.03	50.61	17.71	0.01	0.04	0.01
104 DHR	431690.7	408860	0	3.41	2.39	86.62	30.32	0.03	0.12	0.02
104 DHR Garden	431710.4	408845.7	0	3.69	2.58	93.91	32.87	0.03	0.12	0.02
142 DHR	431735.4	408906.7	0	4.20	2.94	81.89	28.66	0.03	0.13	0.02
Public Track A	432088.8	408591	0	30.67	21.47	243.69	85.29	0.24	0.80	0.18
Public Track B	432036.5	408654.9	0	15.49	10.84	359.76	125.92	0.12	0.53	0.09
Public Track C	432152	408539.4	0	32.54	22.78	293.31	102.66	0.25	0.83	0.19
2 Medway Close	431709.7	408271.1	0	2.45	1.71	95.90	33.57	0.02	0.06	0.01
Snow Hall Farm	432394.5	409130.4	0	4.16	2.91	49.27	17.24	0.03	0.11	0.02
Gawber BG Site	432550	407550	0	1.36	0.95	34.03	11.91	0.01	0.04	0.01

Objective				40.00	40.00		200.00	40.00	50.00	25.00

% of objective

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr I	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0		4.6		16.2	0.1	0.1	0.1
1 Dovebush Way	431616.3	408427.2	0		5.0		16.4	0.1	0.1	0.1
24 DHF	431650.7	408728.2	0		5.4		18.1	0.1	0.2	0.1
24 DHF Garden	431657.4	408727.9	0		5.5		18.6	0.1	0.2	0.1
DT 46	432007	407940	0		3.1		11.4	0.0	0.1	0.0
DT 47	432056	407850	0		2.8		8.5	0.0	0.1	0.0
DT 48	432116	407796	0		2.6		8.9	0.0	0.1	0.0
104 DHR	431690.7	408860	0		6.0		15.2	0.1	0.2	0.1
104 DHR Garden	431710.4	408845.7	0		6.5		16.4	0.1	0.2	0.1
142 DHR	431735.4	408906.7	0		7.4		14.3	0.1	0.3	0.1
Public Track A	432088.8	408591	0		53.7		42.6	0.6	1.6	0.7
Public Track B	432036.5	408654.9	0		27.1		63.0	0.3	1.1	0.4
Public Track C	432152	408539.4	0		56.9		51.3	0.6	1.7	0.8
2 Medway Close	431709.7	408271.1	0		4.3		16.8	0.0	0.1	0.1
Snow Hall Farm	432394.5	409130.4	0		7.3		8.6	0.1	0.2	0.1
Gawber BG Site	432550	407550	0		2.4		6.0	0.0	0.1	0.0

V1 17.5m

Maximum percentile concentrations								2004	2005	2006	2007	2008	max all years		% obj
Group	Pollutant	Averaging t	Units	Percentile	X(m)	Y(m)	Z(m)	Maximum	Maximum	Maximum	Maximum	Maximum value		NO2	
All sources	NOx	1hr -	µg/m³	99.8	431974.2	408635.6	0	393.62	395.00	395.71	379.12	396.79	396.79	138.88	69.44
All sources	PM10	24hrs -	µg/m³	90.4	432114.2	408595.6	0	0.82	0.91	0.85	0.90	0.86	0.91		1.82

Maximum long term average concentrations													
Group	Pollutant	Averaging t	Units	X(m)	Y(m)	Z(m)	Maximum	Maximum	Maximum	Maximum	Maximum value		
All sources	NOx	1hr -	µg/m³	432134.2	408555.6	0	28.03	31.50	29.21	33.27	35.43	35.43	24.80	62.00
All sources	PM10	24hrs -	µg/m³	432134.2	408555.6	0	0.23	0.25	0.23	0.26	0.28	0.28		0.71
All sources	PM2.5	1hr -	µg/m³	432134.2	408555.6	0	0.17	0.19	0.17	0.20	0.21	0.21		0.84

2004 V1 june 11 20 m stack Barnsley

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.67	1.17	85.07	29.78	0.01	0.02	0.01
1 Dovebush Way	431616.3	408427.2	0	1.76	1.23	87.84	30.74	0.01	0.02	0.01
24 DHF	431650.7	408728.2	0	2.81	1.97	95.30	33.36	0.02	0.05	0.02
24 DHF Garden	431657.4	408727.9	0	2.86	2.00	97.34	34.07	0.02	0.04	0.02
DT 46	432007	407940	0	1.50	1.05	62.80	21.98	0.01	0.02	0.01
DT 47	432056	407850	0	1.38	0.97	46.70	16.35	0.01	0.02	0.01
DT 48	432116	407796	0	1.33	0.93	48.72	17.05	0.01	0.03	0.01
104 DHR	431690.7	408860	0	2.34	1.64	77.81	27.23	0.02	0.05	0.01
104 DHR Garden	431710.4	408845.7	0	2.45	1.71	82.85	29.00	0.02	0.06	0.01
142 DHR	431735.4	408906.7	0	2.19	1.53	75.68	26.49	0.02	0.06	0.01
Public Track A	432088.8	408591	0	12.02	8.42	151.67	53.09	0.10	0.38	0.07
Public Track B	432036.5	408654.9	0	5.32	3.73	255.26	89.34	0.04	0.15	0.03
Public Track C	432152	408539.4	0	17.83	12.48	224.01	78.40	0.14	0.46	0.11
2 Medway Close	431709.7	408271.1	0	1.29	0.90	76.55	26.79	0.01	0.02	0.01
Snow Hall Farm	432394.5	409130.4	0	2.84	1.99	46.94	16.43	0.02	0.09	0.02
Gawber BG Site	432550	407550	0	1.17	0.82	31.29	10.95	0.01	0.03	0.01

2005

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.45	1.01	77.33	27.07	0.01	0.03	0.01
1 Dovebush Way	431616.3	408427.2	0	1.63	1.14	83.12	29.09	0.01	0.03	0.01
24 DHF	431650.7	408728.2	0	1.75	1.22	91.26	31.94	0.02	0.05	0.01
24 DHF Garden	431657.4	408727.9	0	1.77	1.24	92.67	32.43	0.02	0.05	0.01
DT 46	432007	407940	0	1.68	1.18	62.10	21.73	0.01	0.05	0.01
DT 47	432056	407850	0	1.50	1.05	46.25	16.19	0.01	0.04	0.01
DT 48	432116	407796	0	1.40	0.98	47.03	16.46	0.01	0.04	0.01
104 DHR	431690.7	408860	0	2.42	1.69	79.54	27.84	0.02	0.09	0.01
104 DHR Garden	431710.4	408845.7	0	2.62	1.83	85.69	29.99	0.02	0.10	0.02
142 DHR	431735.4	408906.7	0	3.16	2.21	75.17	26.31	0.03	0.12	0.02
Public Track A	432088.8	408591	0	13.47	9.43	153.99	53.90	0.11	0.40	0.08
Public Track B	432036.5	408654.9	0	7.17	5.02	254.67	89.13	0.06	0.25	0.04
Public Track C	432152	408539.4	0	14.46	10.12	217.07	75.97	0.11	0.35	0.09
2 Medway Close	431709.7	408271.1	0	2.14	1.50	86.03	30.11	0.02	0.05	0.01
Snow Hall Farm	432394.5	409130.4	0	3.45	2.41	47.53	16.64	0.03	0.10	0.02
Gawber BG Site	432550	407550	0	1.31	0.92	31.96	11.19	0.01	0.04	0.01

2006

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.81	1.27	85.53	29.94	0.02	0.05	0.01
1 Dovebush Way	431616.3	408427.2	0	2.09	1.47	85.56	29.95	0.02	0.05	0.01
24 DHF	431650.7	408728.2	0	2.53	1.77	94.36	33.03	0.02	0.08	0.02
24 DHF Garden	431657.4	408727.9	0	2.57	1.80	96.01	33.60	0.02	0.09	0.02
DT 46	432007	407940	0	1.11	0.78	60.39	21.14	0.01	0.03	0.01
DT 47	432056	407850	0	0.95	0.66	45.71	16.00	0.01	0.02	0.01
DT 48	432116	407796	0	0.87	0.61	44.58	15.60	0.01	0.02	0.01
104 DHR	431690.7	408860	0	3.11	2.18	79.88	27.96	0.03	0.10	0.02
104 DHR Garden	431710.4	408845.7	0	3.34	2.34	85.94	30.08	0.03	0.10	0.02
142 DHR	431735.4	408906.7	0	3.85	2.69	76.29	26.70	0.03	0.10	0.02
Public Track A	432088.8	408591	0	13.04	9.13	153.07	53.57	0.10	0.37	0.08
Public Track B	432036.5	408654.9	0	8.97	6.28	255.33	89.36	0.07	0.25	0.05
Public Track C	432152	408539.4	0	15.64	10.95	220.68	77.24	0.12	0.39	0.09
2 Medway Close	431709.7	408271.1	0	2.21	1.55	88.13	30.84	0.02	0.04	0.01
Snow Hall Farm	432394.5	409130.4	0	3.58	2.50	47.35	16.57	0.03	0.10	0.02
Gawber BG Site	432550	407550	0	0.72	0.51	29.79	10.43	0.01	0.02	0.00

2007

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.12	0.79	77.68	27.19	0.01	0.03	0.01
1 Dovebush Way	431616.3	408427.2	0	1.21	0.84	76.57	26.80	0.01	0.03	0.01
24 DHF	431650.7	408728.2	0	1.77	1.24	92.13	32.25	0.01	0.04	0.01
24 DHF Garden	431657.4	408727.9	0	1.80	1.26	94.04	32.91	0.01	0.04	0.01
DT 46	432007	407940	0	1.16	0.81	59.13	20.69	0.01	0.03	0.01
DT 47	432056	407850	0	1.00	0.70	46.68	16.34	0.01	0.02	0.01
DT 48	432116	407796	0	0.92	0.65	47.45	16.61	0.01	0.02	0.01
104 DHR	431690.7	408860	0	2.26	1.58	78.85	27.60	0.02	0.07	0.01
104 DHR Garden	431710.4	408845.7	0	2.42	1.69	84.31	29.51	0.02	0.08	0.01
142 DHR	431735.4	408906.7	0	2.78	1.94	74.52	26.08	0.02	0.10	0.02
Public Track A	432088.8	408591	0	15.02	10.51	155.18	54.31	0.12	0.43	0.09
Public Track B	432036.5	408654.9	0	5.45	3.81	219.28	76.75	0.04	0.14	0.03
Public Track C	432152	408539.4	0	21.74	15.22	222.66	77.93	0.17	0.53	0.13
2 Medway Close	431709.7	408271.1	0	1.69	1.18	86.44	30.25	0.01	0.04	0.01
Snow Hall Farm	432394.5	409130.4	0	3.19	2.23	47.45	16.61	0.03	0.09	0.02
Gawber BG Site	432550	407550	0	0.99	0.69	32.69	11.44	0.01	0.03	0.01

2008

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	2.41	1.69	85.69	29.99	0.02	0.06	0.01
1 Dovebush Way	431616.3	408427.2	0	2.59	1.81	87.51	30.63	0.02	0.06	0.02
24 DHF	431650.7	408728.2	0	2.37	1.66	92.25	32.29	0.02	0.09	0.01
24 DHF Garden	431657.4	408727.9	0	2.40	1.68	93.67	32.78	0.02	0.09	0.01

DT 46	432007	407940	0	0.79	0.55	61.52	21.53	0.00	0.01	0.00
DT 47	432056	407850	0	0.69	0.49	45.89	16.06	0.00	0.01	0.00
DT 48	432116	407796	0	0.66	0.46	43.12	15.09	0.00	0.01	0.00
104 DHR	431690.7	408860	0	2.97	2.08	80.01	28.00	0.02	0.11	0.02
104 DHR Garden	431710.4	408845.7	0	3.18	2.23	85.97	30.09	0.03	0.11	0.02
142 DHR	431735.4	408906.7	0	3.53	2.47	76.33	26.72	0.03	0.12	0.02
Public Track A	432088.8	408591	0	16.06	11.24	156.03	54.61	0.13	0.40	0.10
Public Track B	432036.5	408654.9	0	8.58	6.00	255.04	89.26	0.07	0.28	0.05
Public Track C	432152	408539.4	0	17.37	12.16	222.02	77.71	0.14	0.44	0.10
2 Medway Close	431709.7	408271.1	0	2.04	1.42	86.86	30.40	0.01	0.03	0.01
Snow Hall Farm	432394.5	409130.4	0	3.97	2.78	47.43	16.60	0.03	0.11	0.02
Gawber BG Site	432550	407550	0	0.84	0.59	31.30	10.95	0.01	0.02	0.00

max all years

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	2.41	1.69	85.69	29.99	0.02	0.06	0.01
1 Dovebush Way	431616.3	408427.2	0	2.59	1.81	87.84	30.74	0.02	0.06	0.02
24 DHF	431650.7	408728.2	0	2.81	1.97	95.30	33.36	0.02	0.09	0.02
24 DHF Garden	431657.4	408727.9	0	2.86	2.00	97.34	34.07	0.02	0.09	0.02
DT 46	432007	407940	0	1.68	1.18	62.80	21.98	0.01	0.05	0.01
DT 47	432056	407850	0	1.50	1.05	46.70	16.35	0.01	0.04	0.01
DT 48	432116	407796	0	1.40	0.98	48.72	17.05	0.01	0.04	0.01
104 DHR	431690.7	408860	0	3.11	2.18	80.01	28.00	0.03	0.11	0.02
104 DHR Garden	431710.4	408845.7	0	3.34	2.34	85.97	30.09	0.03	0.11	0.02
142 DHR	431735.4	408906.7	0	3.85	2.69	76.33	26.72	0.03	0.12	0.02
Public Track A	432088.8	408591	0	16.06	11.24	156.03	54.61	0.13	0.43	0.10
Public Track B	432036.5	408654.9	0	8.97	6.28	255.33	89.36	0.07	0.28	0.05
Public Track C	432152	408539.4	0	21.74	15.22	224.01	78.40	0.17	0.53	0.13
2 Medway Close	431709.7	408271.1	0	2.21	1.55	88.13	30.84	0.02	0.05	0.01
Snow Hall Farm	432394.5	409130.4	0	3.97	2.78	47.53	16.64	0.03	0.11	0.02
Gawber BG Site	432550	407550	0	1.31	0.92	32.69	11.44	0.01	0.04	0.01

Objective				40.00	40.00		200.00	40.00	50.00	25.00

% of objective

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0		4.2		15.0	0.0	0.1	0.1
1 Dovebush Way	431616.3	408427.2	0		4.5		15.4	0.0	0.1	0.1
24 DHF	431650.7	408728.2	0		4.9		16.7	0.1	0.2	0.1
24 DHF Garden	431657.4	408727.9	0		5.0		17.0	0.1	0.2	0.1
DT 46	432007	407940	0		2.9		11.0	0.0	0.1	0.0
DT 47	432056	407850	0		2.6		8.2	0.0	0.1	0.0
DT 48	432116	407796	0		2.4		8.5	0.0	0.1	0.0
104 DHR	431690.7	408860	0		5.4		14.0	0.1	0.2	0.1
104 DHR Garden	431710.4	408845.7	0		5.8		15.0	0.1	0.2	0.1
142 DHR	431735.4	408906.7	0		6.7		13.4	0.1	0.2	0.1
Public Track A	432088.8	408591	0		28.1		27.3	0.3	0.9	0.4
Public Track B	432036.5	408654.9	0		15.7		44.7	0.2	0.6	0.2
Public Track C	432152	408539.4	0		38.0		39.2	0.4	1.1	0.5
2 Medway Close	431709.7	408271.1	0		3.9		15.4	0.0	0.1	0.1
Snow Hall Farm	432394.5	409130.4	0		6.9		8.3	0.1	0.2	0.1
Gawber BG Site	432550	407550	0		2.3		5.7	0.0	0.1	0.0

v1 June 11 20m stack Barnsley

Maximum percentile concentrations

Group	Pollutant	Averaging	Units	Percentile	X(m)	Y(m)	Z(m)	Maximum	Maximum	Maximum	Maximum	Maximum value	max all years NO2	% obj	
All sources	NOx	1hr -	µg/m³	99.8	431974.2	408655.6	0	275.02	271.46	277.25	261.05	277.18	277.25	97.04	48.52
All sources	PM10	24hrs -	µg/m³	90.4	432134.2	408615.6	0	0.54	0.62	0.57	0.62	0.59	0.62		1.24

Maximum long term average concentrations

Group	Pollutant	Averaging	Units	X(m)	Y(m)	Z(m)	Maximum	Maximum	Maximum	Maximum	Maximum value			
All sources	NOx	1hr -	µg/m³	432194.2	408575.6	0	19.46	22.58	20.71	23.08	25.45	25.45	17.82	44.54
All sources	PM10	24hrs -	µg/m³	432174.2	408575.6	0	0.16	0.18	0.16	0.18	0.20	0.20		0.51
All sources	PM2.5	1hr -	µg/m³	432194.2	408575.6	0	0.12	0.13	0.12	0.14	0.15	0.15		0.60

2004 Jun-11 22.5 m stack

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.52	1.06	78.71	27.55	0.01	0.02	0.01
1 Dovebush Way	431616.3	408427.2	0	1.59	1.11	80.85	28.30	0.01	0.02	0.01
24 DHF	431650.7	408728.2	0	2.54	1.78	88.21	30.87	0.02	0.04	0.02
24 DHF Garden	431657.4	408727.9	0	2.58	1.81	89.58	31.35	0.02	0.04	0.02
DT 46	432007	407940	0	1.42	0.99	60.28	21.10	0.01	0.02	0.01
DT 47	432056	407850	0	1.31	0.92	44.64	15.62	0.01	0.02	0.01
DT 48	432116	407796	0	1.27	0.89	46.12	16.14	0.01	0.03	0.01
104 DHR	431690.7	408860	0	2.15	1.50	72.83	25.49	0.02	0.05	0.01
104 DHR Garden	431710.4	408845.7	0	2.22	1.56	76.83	26.89	0.02	0.05	0.01
142 DHR	431735.4	408906.7	0	2.01	1.41	71.24	24.93	0.02	0.06	0.01
Public Track A	432088.8	408591	0	5.67	3.97	75.16	26.31	0.05	0.18	0.03
Public Track B	432036.5	408654.9	0	2.70	1.89	133.93	46.87	0.02	0.08	0.02
Public Track C	432152	408539.4	0	11.57	8.10	152.51	53.38	0.09	0.29	0.07
2 Medway Close	431709.7	408271.1	0	1.16	0.81	71.40	24.99	0.01	0.02	0.01
Snow Hall Farm	432394.5	409130.4	0	2.70	1.89	45.20	15.82	0.02	0.08	0.02
Gawber BG Site	432550	407550	0	1.13	0.79	30.39	10.64	0.01	0.03	0.01

2005 35%

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.33	0.93	72.98	25.54	0.01	0.03	0.01
1 Dovebush Way	431616.3	408427.2	0	1.49	1.05	78.97	27.64	0.01	0.03	0.01
24 DHF	431650.7	408728.2	0	1.57	1.10	83.67	29.28	0.01	0.04	0.01
24 DHF Garden	431657.4	408727.9	0	1.59	1.11	84.89	29.71	0.01	0.05	0.01
DT 46	432007	407940	0	1.59	1.11	59.25	20.74	0.01	0.05	0.01
DT 47	432056	407850	0	1.42	1.00	44.40	15.54	0.01	0.04	0.01
DT 48	432116	407796	0	1.33	0.93	45.54	15.94	0.01	0.03	0.01
104 DHR	431690.7	408860	0	2.20	1.54	73.35	25.67	0.02	0.08	0.01
104 DHR Garden	431710.4	408845.7	0	2.37	1.66	78.33	27.42	0.02	0.09	0.01
142 DHR	431735.4	408906.7	0	2.89	2.03	70.60	24.71	0.03	0.11	0.02
Public Track A	432088.8	408591	0	6.49	4.54	81.18	28.41	0.05	0.18	0.04
Public Track B	432036.5	408654.9	0	3.50	2.45	135.10	47.28	0.03	0.11	0.02
Public Track C	432152	408539.4	0	9.33	6.53	149.64	52.37	0.07	0.23	0.06
2 Medway Close	431709.7	408271.1	0	1.94	1.36	81.03	28.36	0.01	0.05	0.01
Snow Hall Farm	432394.5	409130.4	0	3.28	2.30	45.86	16.05	0.03	0.10	0.02
Gawber BG Site	432550	407550	0	1.27	0.89	30.49	10.67	0.01	0.04	0.01

2006 35%

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.65	1.16	79.09	27.68	0.01	0.04	0.01
1 Dovebush Way	431616.3	408427.2	0	1.90	1.33	78.37	27.43	0.02	0.04	0.01
24 DHF	431650.7	408728.2	0	2.29	1.60	87.47	30.61	0.02	0.07	0.01
24 DHF Garden	431657.4	408727.9	0	2.32	1.63	88.59	31.01	0.02	0.08	0.01
DT 46	432007	407940	0	1.06	0.74	57.52	20.13	0.01	0.02	0.01
DT 47	432056	407850	0	0.91	0.64	43.98	15.39	0.01	0.02	0.01
DT 48	432116	407796	0	0.83	0.58	43.37	15.18	0.01	0.02	0.00
104 DHR	431690.7	408860	0	2.83	1.98	74.42	26.05	0.02	0.09	0.02
104 DHR Garden	431710.4	408845.7	0	3.02	2.11	79.27	27.74	0.02	0.09	0.02
142 DHR	431735.4	408906.7	0	3.52	2.47	71.59	25.06	0.03	0.10	0.02
Public Track A	432088.8	408591	0	6.21	4.35	83.26	29.14	0.05	0.18	0.04
Public Track B	432036.5	408654.9	0	4.52	3.16	140.33	49.12	0.03	0.13	0.03
Public Track C	432152	408539.4	0	10.21	7.15	151.73	53.11	0.08	0.25	0.06
2 Medway Close	431709.7	408271.1	0	2.00	1.40	81.10	28.39	0.02	0.03	0.01
Snow Hall Farm	432394.5	409130.4	0	3.41	2.38	45.74	16.01	0.03	0.09	0.02
Gawber BG Site	432550	407550	0	0.70	0.49	29.18	10.21	0.01	0.02	0.00

2007 35%

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	1.02	0.72	72.50	25.37	0.01	0.02	0.01
1 Dovebush Way	431616.3	408427.2	0	1.09	0.77	72.08	25.23	0.01	0.03	0.01
24 DHF	431650.7	408728.2	0	1.59	1.11	84.29	29.50	0.01	0.04	0.01
24 DHF Garden	431657.4	408727.9	0	1.61	1.13	85.82	30.04	0.01	0.04	0.01
DT 46	432007	407940	0	1.09	0.77	56.54	19.79	0.01	0.03	0.01
DT 47	432056	407850	0	0.95	0.66	44.88	15.71	0.01	0.02	0.01
DT 48	432116	407796	0	0.88	0.62	46.10	16.13	0.01	0.02	0.01
104 DHR	431690.7	408860	0	2.06	1.44	73.69	25.79	0.02	0.06	0.01
104 DHR Garden	431710.4	408845.7	0	2.18	1.53	78.29	27.40	0.02	0.07	0.01
142 DHR	431735.4	408906.7	0	2.54	1.78	70.25	24.59	0.02	0.10	0.02
Public Track A	432088.8	408591	0	7.17	5.02	89.92	31.47	0.06	0.20	0.04
Public Track B	432036.5	408654.9	0	2.62	1.84	114.14	39.95	0.02	0.08	0.02
Public Track C	432152	408539.4	0	13.94	9.75	152.24	53.29	0.11	0.33	0.08
2 Medway Close	431709.7	408271.1	0	1.53	1.07	80.56	28.19	0.01	0.03	0.01
Snow Hall Farm	432394.5	409130.4	0	3.03	2.12	45.72	16.00	0.02	0.08	0.02
Gawber BG Site	432550	407550	0	0.96	0.67	31.53	11.03	0.01	0.03	0.01

2008 35%

Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	2.19	1.53	79.78	27.92	0.02	0.05	0.01
1 Dovebush Way	431616.3	408427.2	0	2.34	1.64	80.81	28.28	0.02	0.05	0.01

24 DHF	431650.7	408728.2	0	2.14	1.50	84.79	29.68	0.02	0.08	0.01
24 DHF Garden	431657.4	408727.9	0	2.16	1.51	86.03	30.11	0.02	0.08	0.01
DT 46	432007	407940	0	0.74	0.52	58.83	20.59	0.00	0.01	0.00
DT 47	432056	407850	0	0.66	0.46	44.14	15.45	0.00	0.01	0.00
DT 48	432116	407796	0	0.63	0.44	41.75	14.61	0.00	0.01	0.00
104 DHR	431690.7	408860	0	2.72	1.90	74.68	26.14	0.02	0.10	0.02
104 DHR Garden	431710.4	408845.7	0	2.89	2.03	79.48	27.82	0.02	0.11	0.02
142 DHR	431735.4	408906.7	0	3.25	2.27	72.05	25.22	0.03	0.11	0.02
Public Track A	432088.8	408591	0	7.70	5.39	85.97	30.09	0.06	0.19	0.05
Public Track B	432036.5	408654.9	0	4.23	2.96	134.08	46.93	0.04	0.14	0.03
Public Track C	432152	408539.4	0	11.48	8.03	152.21	53.27	0.09	0.28	0.07
2 Medway Close	431709.7	408271.1	0	1.84	1.29	81.71	28.60	0.01	0.03	0.01
Snow Hall Farm	432394.5	409130.4	0	3.78	2.65	45.49	15.92	0.03	0.10	0.02
Gawber BG Site	432550	407550	0	0.81	0.57	30.49	10.67	0.01	0.02	0.00

max all years							35%			
Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0	2.19	1.53	79.78	27.92	0.02	0.05	0.01
1 Dovebush Way	431616.3	408427.2	0	2.34	1.64	80.85	28.30	0.02	0.05	0.01
24 DHF	431650.7	408728.2	0	2.54	1.78	88.21	30.87	0.02	0.08	0.02
24 DHF Garden	431657.4	408727.9	0	2.58	1.81	89.58	31.35	0.02	0.08	0.02
DT 46	432007	407940	0	1.59	1.11	60.28	21.10	0.01	0.05	0.01
DT 47	432056	407850	0	1.42	1.00	44.88	15.71	0.01	0.04	0.01
DT 48	432116	407796	0	1.33	0.93	46.12	16.14	0.01	0.03	0.01
104 DHR	431690.7	408860	0	2.83	1.98	74.68	26.14	0.02	0.10	0.02
104 DHR Garden	431710.4	408845.7	0	3.02	2.11	79.48	27.82	0.02	0.11	0.02
142 DHR	431735.4	408906.7	0	3.52	2.47	72.05	25.22	0.03	0.11	0.02
Public Track A	432088.8	408591	0	7.70	5.39	89.92	31.47	0.06	0.20	0.05
Public Track B	432036.5	408654.9	0	4.52	3.16	140.33	49.12	0.04	0.14	0.03
Public Track C	432152	408539.4	0	13.94	9.75	152.51	53.38	0.11	0.33	0.08
2 Medway Close	431709.7	408271.1	0	2.00	1.40	81.71	28.60	0.02	0.05	0.01
Snow Hall Farm	432394.5	409130.4	0	3.78	2.65	45.86	16.05	0.03	0.10	0.02
Gawber BG Site	432550	407550	0	1.27	0.89	31.53	11.03	0.01	0.04	0.01

Objective				40.00	40.00		200.00	40.00	50.00	25.00
% of objective				1.00	0.70		0.35			
Receptor name	X(m)	Y(m)	Z(m)	Annual Nox	Annual NO2	99.8% 1 hr Nox	99.8% 1 hr NO2	Annual PM10	90.4% 24 hr PM10	Annual PM2.5
2 Dovebush Way	431592.2	408448.1	0		3.8		14.0	0.0	0.1	0.1
1 Dovebush Way	431616.3	408427.2	0		4.1		14.1	0.0	0.1	0.1
24 DHF	431650.7	408728.2	0		4.4		15.4	0.1	0.2	0.1
24 DHF Garden	431657.4	408727.9	0		4.5		15.7	0.1	0.2	0.1
DT 46	432007	407940	0		2.8		10.5	0.0	0.1	0.0
DT 47	432056	407850	0		2.5		7.9	0.0	0.1	0.0
DT 48	432116	407796	0		2.3		8.1	0.0	0.1	0.0
104 DHR	431690.7	408860	0		5.0		13.1	0.1	0.2	0.1
104 DHR Garden	431710.4	408845.7	0		5.3		13.9	0.1	0.2	0.1
142 DHR	431735.4	408906.7	0		6.2		12.6	0.1	0.2	0.1
Public Track A	432088.8	408591	0		13.5		15.7	0.2	0.4	0.2
Public Track B	432036.5	408654.9	0		7.9		24.6	0.1	0.3	0.1
Public Track C	432152	408539.4	0		24.4		26.7	0.3	0.7	0.3
2 Medway Close	431709.7	408271.1	0		3.5		14.3	0.0	0.1	0.0
Snow Hall Farm	432394.5	409130.4	0		6.6		8.0	0.1	0.2	0.1
Gawber BG Site	432550	407550	0		2.2		5.5	0.0	0.1	0.0

V1 june 2011 22.5m stack Barnsley

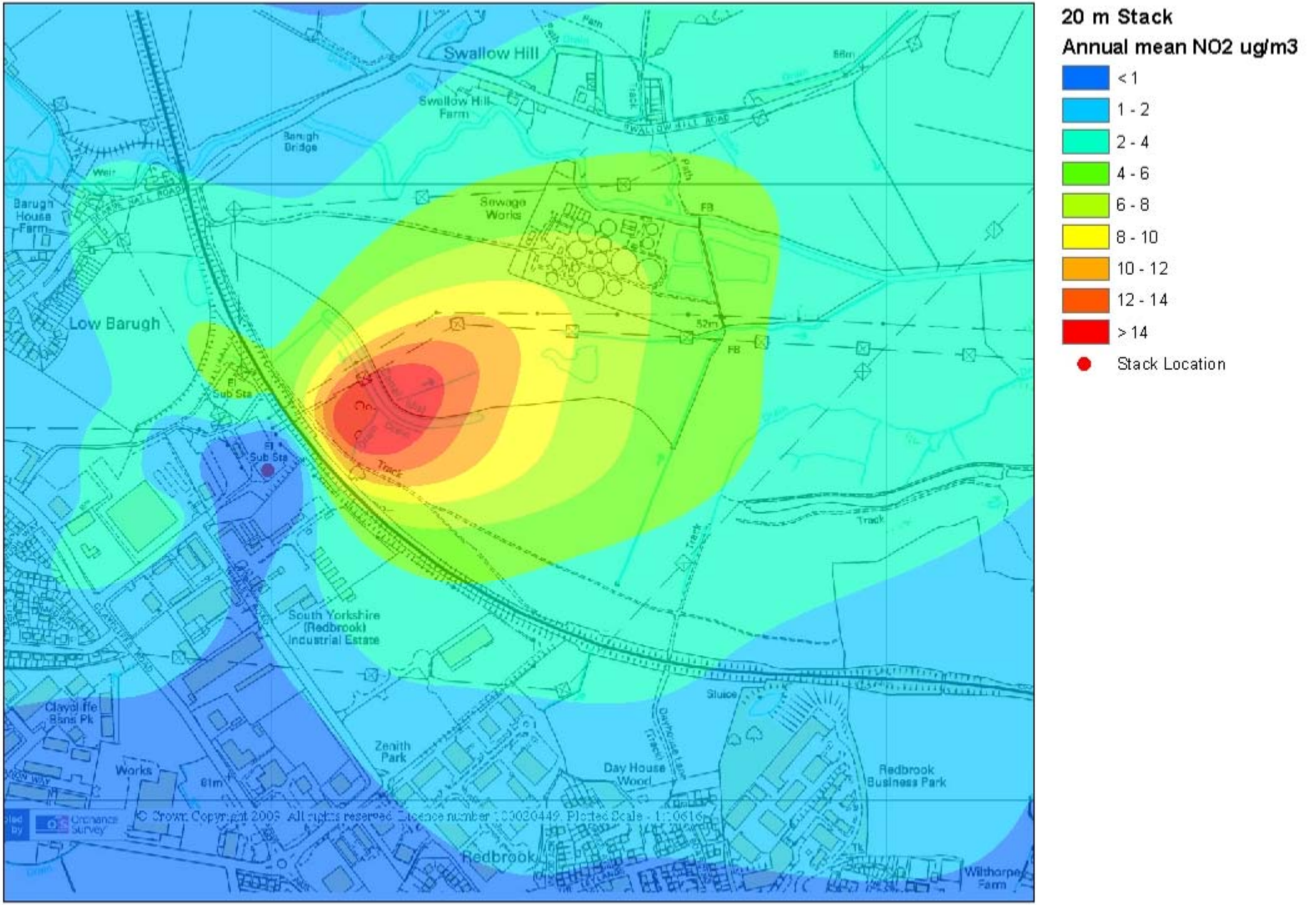
Maximum percentile concentrations

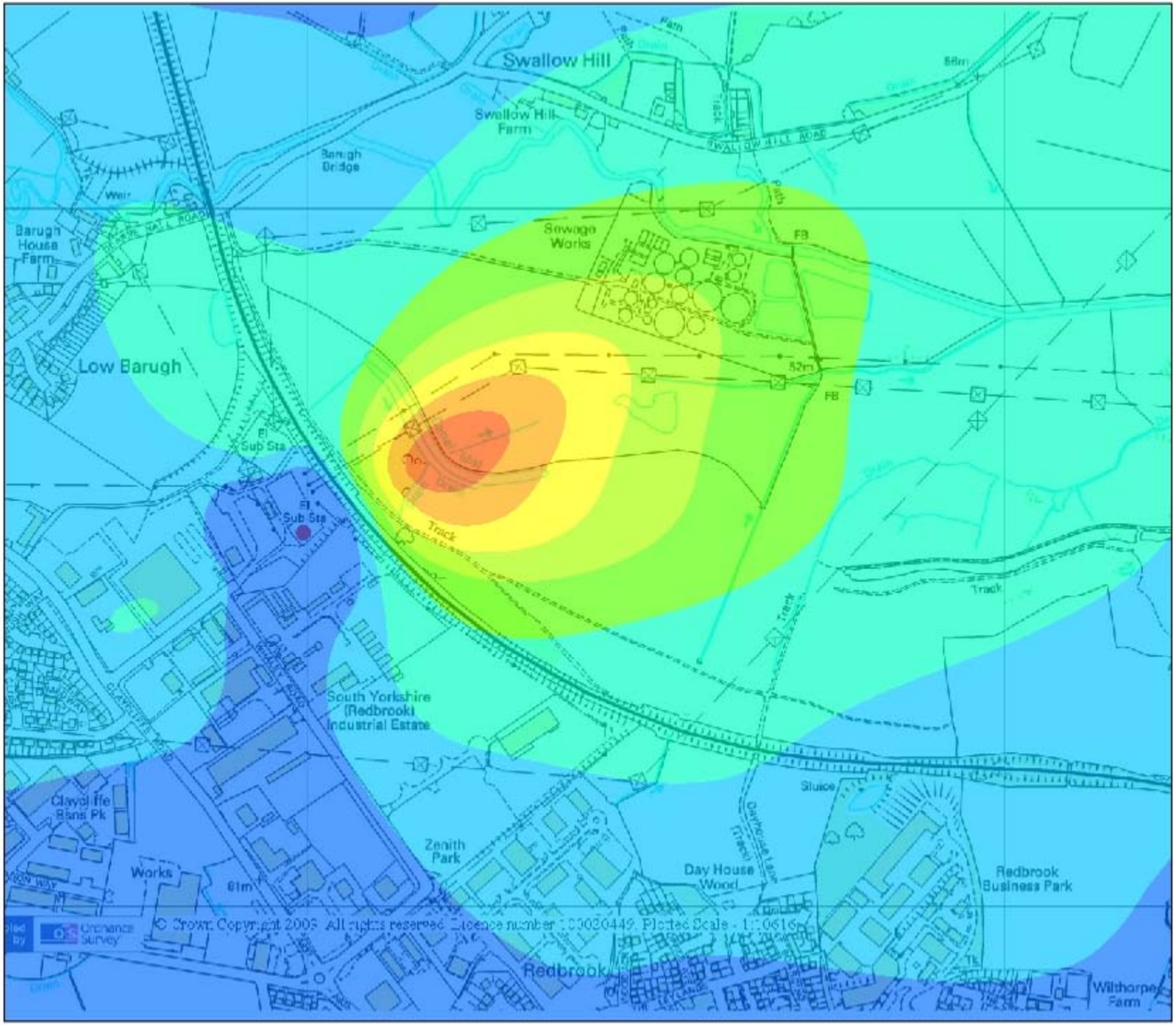
								2004	2005	2006	2007	2008	max all years		% obj
Group	Pollutant	Averaging t	Units	Percentile	X(m)	Y(m)	Z(m)	Maximum	Maximum	Maximum	Maximum	Maximum value		NO2	
All sources	NOx	1hr -	µg/m³	99.8	431854.2	408615.6	0	158.24	158.24	160.43	156.83	160.30	160.43	56.15	28.08
All sources	PM10	24hrs -	µg/m³	90.4	432234.2	408575.6	0	0.41	0.46	0.42	0.45	0.44	0.46		0.92

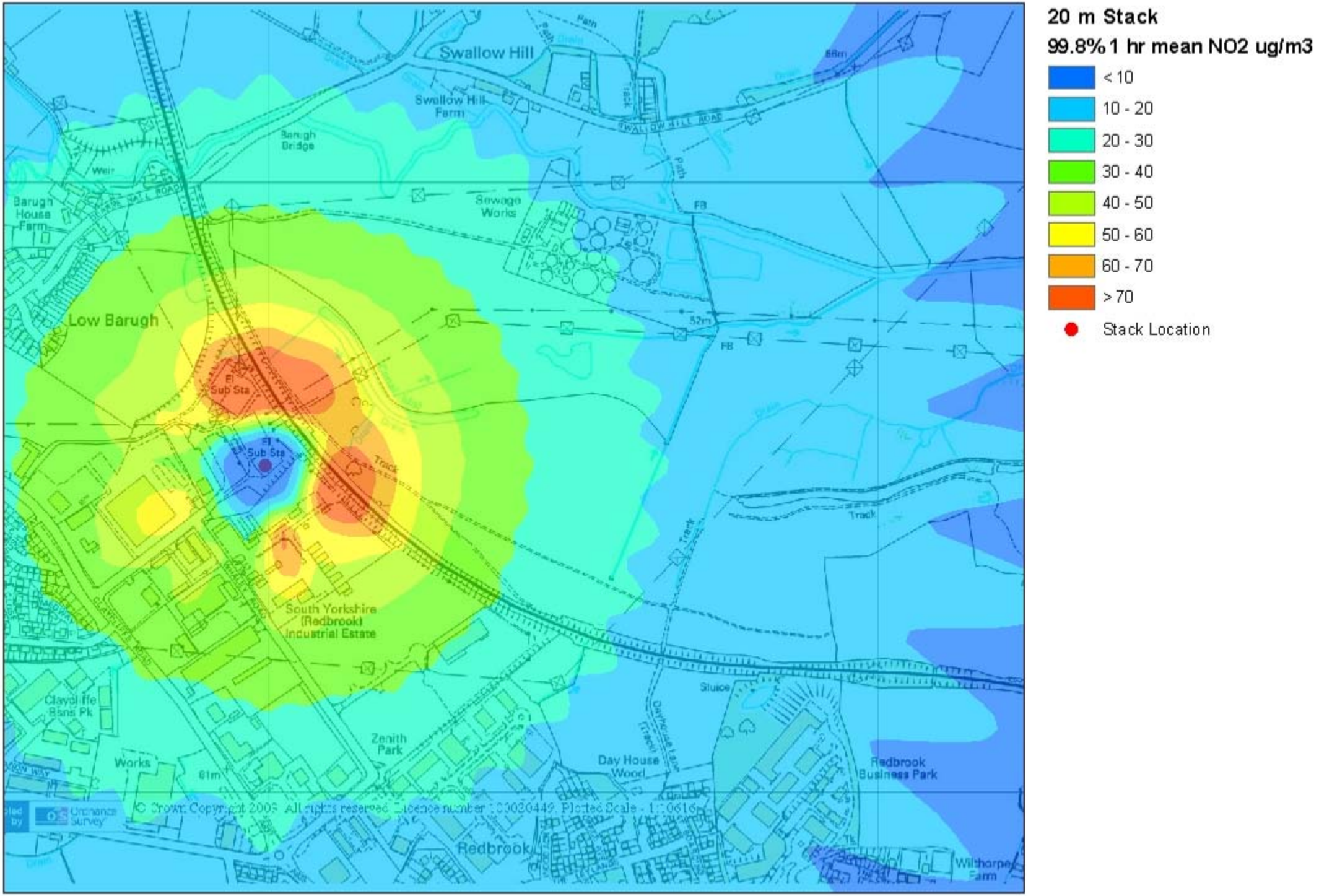
Maximum long term average concentrations

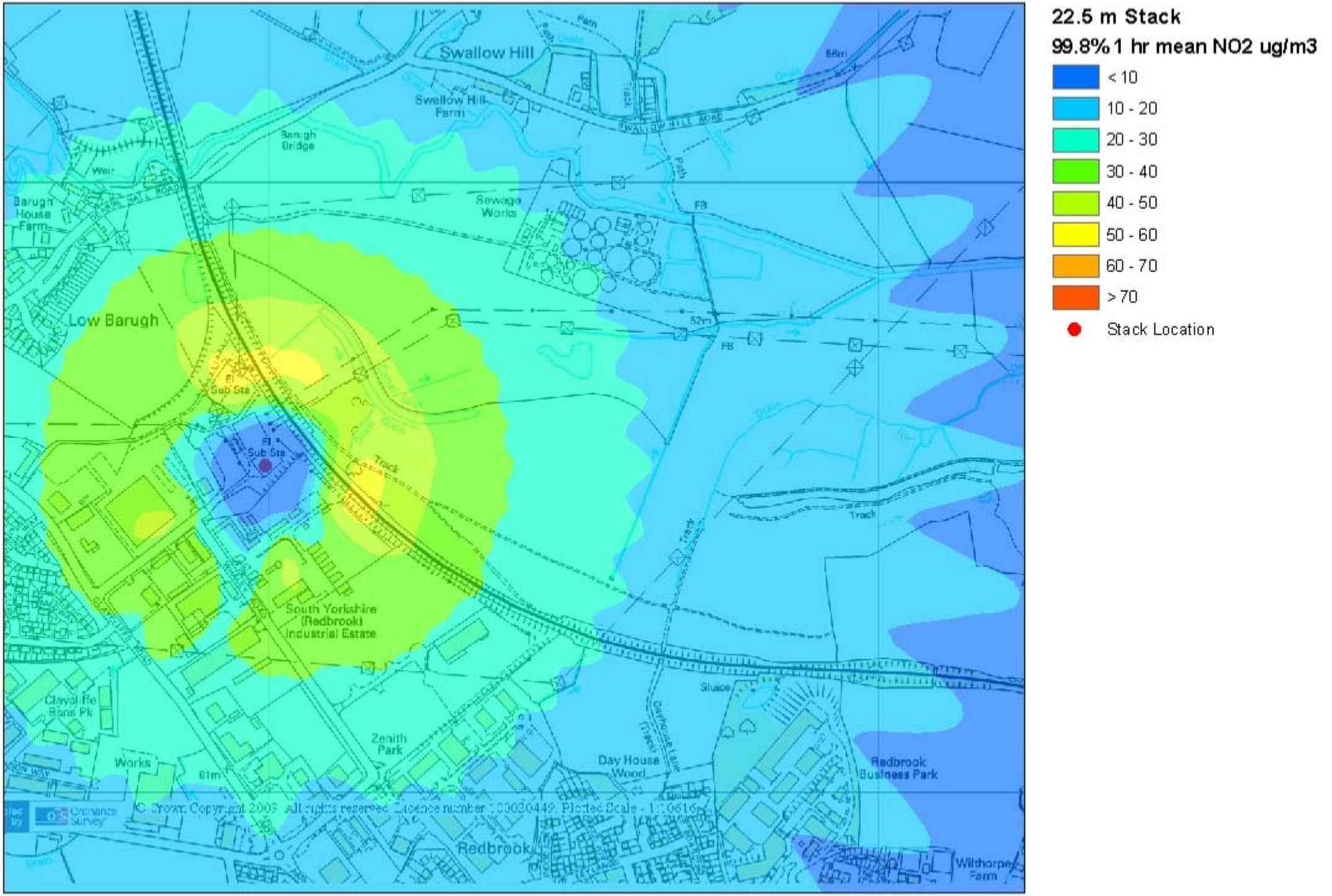
Group	Pollutant	Averaging t	Units	X(m)	Y(m)	Z(m)	Maximum	Maximum	Maximum	Maximum	Maximum value			
All sources	NOx	1hr -	µg/m³	432234.2	408575.6	0	14.99	17.42	15.79	17.72	19.71	19.71	13.80	34.49
All sources	PM10	24hrs -	µg/m³	432234.2	408575.6	0	0.12	0.14	0.12	0.14	0.16	0.16		0.39
All sources	PM2.5	1hr -	µg/m³	432234.2	408575.6	0	0.09	0.10	0.09	0.11	0.12	0.12		0.47

Annex B: Contour Plots for Stack Height 20 m & 22.5 m


20 m Stack
Annual mean NO2 ug/m3
< 1
1 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
> 14
Stack Location
Swallow Hill
Swallow Hill Farm
Barugh Bridge
Barugh House Farm
Sewage Works
Low Barugh
El Sub Sta
South Yorkshire (Redbrook) Industrial Estate
Claylife Bsns Pk
Works
Zenith Park
Day House Wood
Sluice
Redbrook Business Park
Redbrook
Wilthorpe Farm
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22.5 m Stack
Annual mean NO2 ug/m3
< 1
1 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
> 17
Stack Location
Swallow Hill
Swallow Hill Farm
Barugh Bridge
Barugh House Farm
Sewage Works
Low Barugh
El Sub Sta
Track
South Yorkshire (Redbrook) Industrial Estate
Clayoliffe Bsns Pk
Works
Zenith Park
Day House Wood
Sluice
Redbrook Business Park
Redbrook
Wilthorpe Farm
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20 m Stack
99.8% 1 hr mean NO2 ug/m3
< 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
> 70
Stack Location
Swallow Hill
Swallow Hill Farm
Barugh Bridge
Barugh House Farm
Sewage Works
Low Barugh
El Sub Sta
Track
South Yorkshire (Redbrook) Industrial Estate
Claylife Bsns Pk
Works
Zenith Park
Day House Wood
Sluice
Redbrook Business Park
Redbrook
Wilthorpe Farm
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22.5 m Stack
99.8%1 hr mean NO2 ug/m3
< 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
> 70
Stack Location
Swallow Hill
Swallow Hill Farm
Barugh Bridge
Barugh House Farm
Sewage Works
Low Barugh
El Sub Sta
Track
South Yorkshire (Redbrook) Industrial Estate
Claylliffe Bsns Pk
Works
Zenith Park
Day House Wood
Sluice
Redbrook Business Park
Redbrook
Wilthorpe Farm
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