Air Quality Screening Report:

Diesel Power Generation Facility, Whaley Road, Barnsley

September 2016

Experts in air quality
management & assessment

Document Control

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Contents

1 Introduction

1.1 This screening report considers the potential for human health-related air quality impacts associated with the proposed diesel power-generation facility at Whaley Road, Barnsley. The screening assessment has been carried out by Air Quality Consultants Ltd on behalf of Peak Power Connections Ltd.

1.2 The proposed development will involve the installation of eleven diesel generators housed within individual containers. There will also be some associated infrastructure, such as diesel storage tanks, transformers etc. The facility will provide up to 20 MW of reserve electricity to the national grid and will operate for up to 500 hours per year.

1.3 Emissions from the diesel generators could impact on local air quality. The main air pollutants of concern are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.4 Each generator will be a dual-fuel generator; startup and shutdown will be on diesel oil, switching, where a gas connection is available, to gas for the main operation of the generator. Where available, the gas usage will account for 60-70% of the operation of the generator. Where a gas connection is not available, the generators will run exclusively on diesel oil. Operation on diesel fuel will generate greater emissions than operation on gas and therefore for this assessment it has been assumed that the generators operate exclusively on diesel oil.

1.5 Diesel oil will be delivered to the site via tanker lorry. The guidance from the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) (EPUK & IAQM, 2015) suggests that a road would need to experience an increase of more than 9,000 Heavy Duty Vehicle (HDV) movements per year[1] before there is a risk of significant air quality impacts. While the precise number of tanker movements has not yet been defined, it will be significantly less than 9,000 per year. As such the impacts of traffic generated by the proposed development can be screened out as *insignificant* and are not considered further.

1.6 This screening report has been prepared taking into account relevant local and national guidance and regulations. In line with accepted practice for a screening assessment, it has followed a worst-case, and thus conservative, approach. It is thus likely to have over-predicted the impacts of the proposed facility.

1.7 The assessment takes no account of cumulative impacts with other local existing or proposed sources.

[1] Which is defined as 25 HDV movements per day as an annual average daily flow within an Air Quality Management Area. 25 movements per day over 365 days is 9,125 movements per year.

2 Policy Context and Assessment Criteria

Air Quality Strategy

2.1 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Medium Combustion Plant (MCP) Directive

2.2 The European Union regulates pollutant emissions from combustion plant with a rated input between 1 and 50 megawatts (MW_{th}) in its Medium Combustion Plant (MCP) Directive (Directive 2015/2193/EU of the European Parliament and of the Council, 2015). The MCP Directive must be transposed into UK law by December 2017.

2.3 The MCP Directive sets emission limits depending on plant size, to be applied from December 2018 for new plant and by 2025 or 2030 for existing plant. Member States may choose to exempt existing plant that operate for fewer than 500 hours per year, but current indications are that the UK Government will not apply this exemption (Department of Energy and Climate Change, 2016).

Clean Air Act 1993 & Environmental Protection Act

2.4 Small combustion plant of less than 20 MW net rated thermal input are controlled under the Clean Air Act 1993 (HMSO, 1993a). This requires the local authority to approve the chimney height. Plant which are smaller than 366 kW have no such requirement. The local authority’s approval will, therefore, be required for the plant to be installed in this scheme.

2.5 Measures to ensure adequate dispersion of emissions from discharging stacks and vents are included in Technical Guidance Note D1 (Dispersion) (HMSO, 1993b), issued in support of the Environmental Protection Act (HMSO, 1990).

Planning Policy

National Policies

2.6 The National Planning Policy Framework (NPPF) (2012) sets out planning policy for England in one place. It places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should *"contribute to…reducing pollution"*. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that the effects of pollution on health and the sensitivity of the area and the development should be taken into account.

2.7 More specifically the NPPF makes clear that:

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

2.8 The NPPF is now supported by Planning Practice Guidance (PPG) (DCLG, 2014), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that *"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values"* and *"It is important that the potential impact of new development on air quality is taken into account … where the national assessment indicates that relevant limits have been exceeded or are near the limit".* The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*".

2.9 The PPG states that:

"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)".

2.10 The PPG sets out the information that may be required in an air quality assessment, making clear that *"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality"*. It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that

"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact".

Local Policies

2.11 The Core Strategy for Barnsley Metropolitan Borough Council was adopted on 8 September 2011 and covers the period up to 2026. The following policies are of relevance to this application:

CSP29 Design; this policy sets out criteria that development must adhere to, such as to be at a scale, character, layout and building style similar to surrounding areas, as well as be integrated, sustainable, make efficient use of resources, flexible to future needs and have no adverse impacts on the surrounding area.

CSP40 Pollution Control and Protection; this policy will not allow development which will negatively affect or cause a nuisance to the natural environment or people from noise, smell, dust, vibration or air pollution. Developers must take action to reduce the effects of possible pollution and provide mitigation measures.

2.12 Barnsley MBC adopted in September 2014 its Air Quality and Emissions Good Practice Planning Guidance (Barnsley MBC, 2014). This document provides guidance for the consideration of air quality in the planning process, and details three stages to follow when carrying out an air quality assessment. The type of mitigation to be applied in order to reduce or off-set identified impacts is described in the third stage of the guidance, and will depend on the classification of the development and the predicted impacts on air quality. The proposed development is not of residential nature, this guidance does not require the application of any of the specific mitigation or off-setting measures listed in the document.

Air Quality Action Plans

National Air Quality Plans

2.13 Defra has produced Air Quality Plans to reduce nitrogen dioxide concentrations in major cities throughout the UK (Defra, 2015). Along with a suite of national measures, the Air Quality Plans identify the need to establish Clean Air Zones within five Zones (Birmingham, Leeds, Southampton, Nottingham and Derby) where exceedences of the EU limit values for nitrogen dioxide have been forecast in 2020 and beyond. Within these Zones, lower-emission vehicles will be encouraged. The precise nature of these Clean Air Zones is still to be decided. In Greater London, Defra will continue to support and monitor the delivery of the Mayor's plans for improving air quality to meet the EU limit value for nitrogen dioxide by 2025. The proposed development is not located in any of these zones.

2.14 There is currently no practical way to take account of the effects of these Air Quality Plans on the modelling presented in this report, which is for assessment against the air quality objectives rather than the EU limit values.

Local Air Quality Action Plan

2.15 Barnsley MBC has declared eight AQMAs for exceedences of the nitrogen dioxide objective. The AQMAs cover a section of the M1 between Junctions 35a and 38, the junction of the A61 Wakefield Road and Burton Road, two sections of the A628 from Junction 37 of the M1 to Dodworth Level Crossing and to Town End roundabout, the junction of Rotherham Road and Burton Road, a section of the southbound carriageway of the A61 Harborough Hill Road, the southbound carriageway of the A61 Sheffield Road adjacent to the junction with the A6133 Cemetery Road and the A616 road through Langsett. Public consultation is currently being undertaken to revoke the AQMA No.3 (at the junction between Wakefield Road and Burton Road) following a Detailed Assessment showing a sufficient reduction in nitrogen dioxide concentrations in the area. The Council has developed an Air Quality Action Plan (Barnsley MBC, 2012) that sets out a number of measures to improve air quality within the Borough's AQMAs, as well as generally within the entire Borough. The Action Plan includes measures to: reduce vehicle emissions, reduce traffic volumes and improve traffic management, develop planning measures, improve public transport, promote and publicise air quality issues, reduce industrial and commercial emissions, and improve air quality monitoring and modelling. The 2015 Action Plan Progress Report (Barnsley MBC, 2015) outlines the progress and measures that have been completed since the initial plan was introduced.

Assessment Criteria

2.16 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations, 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

2.17 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 $\mu g/m^3$

(Defra, 2016). Measurements have also shown that the 24-hour PM_{10} objective could be exceeded where the annual mean concentration is above 32 $\mu g/m^3$ (Defra, 2016).

2.18 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2016). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations, gardens and fishing areas.

2.19 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one (Directive 2008/50/EC of the European Parliament and of the Council, 2008). In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded.

2.20 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 $\mu g/m^3$ not to be exceeded more than 18 times a year
	Annual Mean	40 $\mu g/m^3$
Fine Particles (PM_{10})	24-hour Mean	50 $\mu g/m^3$ not to be exceeded more than 35 times a year
	Annual Mean	40 $\mu g/m^3$
Fine Particles ($PM_{2.5}$) [a]	Annual Mean	25 $\mu g/m^3$

[a] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Point Source Assessment Criteria

2.21 The approach developed jointly by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[2] (EPUK & IAQM, 2015) is that any change in concentration smaller than 0.5% of the long-term environmental standard will be *negligible*, regardless of the existing air quality conditions. Any change smaller than 1.5% of the long-term environmental standard will be *negligible* so long as the total concentration is less than 94% of the standard and any change smaller than 5.5% of the long-term environmental standard will be *negligible* so long as the total concentration is less than 75% of the standard. The guidance also explains that:

"Where peak short term concentrations (those averaged over periods of an hour or less) from an elevated source are in the range 10-20% of the relevant Air Quality Assessment Level (AQAL), then their magnitude can be described as small, those in the range 20-50% medium and those above 50% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. In most cases, the assessment of impact severity for a proposed development will be governed by the long-term exposure experienced by receptors and it will not be a necessity to define the significance of effects by reference to short-term impacts. The severity of the impact will be substantial when there is a risk that the relevant AQAL for short-term concentrations is approached through the presence of the new source, taking into account the contribution of other local sources".

2.22 As a first step, the assessment of the emissions from the proposed facility has considered the predicted process contributions using the following criteria:

- is the long-term (annual mean) process contribution less than 0.5% of the long-term environmental standard? and
- is the short-term (24-hour mean or shorter) process contribution less than 10% of the short-term environmental standard?

2.23 Where both of these criteria are met, then the impacts are *negligible* and thus 'not significant'. Where these criteria are breached then a more detailed assessment may be required.

[2] The IAQM is the professional body for air quality practitioners in the UK.

3 Assessment Approach

Existing Conditions

3.1 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. Background concentrations have been defined using the national pollution maps published by Defra (2016b). These cover the whole country on a 1x1 km grid.

3.2 Exceedences of the annual mean EU limit value for nitrogen dioxide in the study area have been identified using the maps of roadside concentrations published by Defra for 2014 (Defra, 2016c) and for 2020 (Defra, 2016d). These are the maps used by the UK Government, together with the results from national AURN monitoring sites that operate to EU data quality standards, to report exceedences of the limit value to the EU. The maps are currently available for the past years 2001 to 2014 and the future years 2020, 2025 and 2030. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations, which are available for the years 2009 to 2014, show no exceedences of the limit values anywhere in the UK in 2014.

Modelling Methodology

3.3 The impacts of emissions from the proposed facility have been modelled using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The model input parameters are set out in Appendix A2.

Operating Hours

3.4 Operation of the proposed generators is expected to be limited to 2 hours per day on 50 occasions per year; meaning that they would only operate for a total of 100 hours per year. There will, however, be some flexibility around this, and the plant could conceivably operate for up to 500 hours per year.

3.5 Operation would typically be between the peak demand hours of 1600 – 1900, within the months of November to March, and during the working week (Monday to Friday). The generators will not run after 11 pm at night until 6am in the morning except when there is a 'national emergency' due to a failure of a major power station or part of the national grid network being stressed. In such a situation, they would only run for a maximum of 30 minutes before the generators would automatically shut down

3.6 Since the precise hours when the plant will operate are not known, and in order to provide a worst-case assessment, it has been assumed that all eleven generators will run constantly for 3 hours (16.00 until 19.00) every day of the year. This makes a total of 1,095 operating hours per year, which is more than 10 times the most likely scenario of 100 hours of operation per year, and twice the worst-case maximum of 500 hours that would be permitted. The impacts of the plant will thus be significantly over-predicted.

Receptor Grid

3.7 Concentrations have been predicted across nested Cartesian grids. These grids have a spacing of 10 m x 10 m within 250 m of the facility, 50 m x 50 m within 1,000 m of the facility,100 m x 100 m within 2,000 m of the facility and 250 m x 250 m within 5,000 m of the facility. The receptor grid has been modelled at a height of 1.5 m above ground level.

Meteorological Data

3.8 In order to allow for uncertainties in local and future-year meteorological conditions, the dispersion model has been run 30 times, with each run using a different full year of hour-by-hour meteorological data. For each individual receptor point on the nested Cartesian grid, the maximum predicted concentration across any of the 30 meteorological datasets has then been determined. It is these maxima which are presented. This approach provides a high degree of conservatism and will tend to over-predict the impacts of the facility. Further details of this approach, as well as the meteorological datasets used, are provided in Appendix A2.

Additional Sources of Uncertainty

3.9 The point source dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which in reality are variable. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs. Where these parameters have been estimated the approach has been to use reasonable worst-case assumptions.

3.10 On balance, when taking into account the assumed number of operating hours, and the approach taken to meteorological conditions, the assessment will over-predict the impacts of the facility. It thus provides a robust screening assessment.

4 Site Description and Baseline Conditions

4.1 The proposed development site is an area currently used for parking near to a number of industrial and commercial premises and is effectively surrounded by industrial and commercial activity. It is located to the northwest of Barnsley.

Air Quality Review and Assessment

4.2 Barnsley MBC investigated air quality within its area as part of its responsibilities under the LAQM regime. In 2001, an AQMA was declared along a section of the M1. Three further AQMA's were declared in 2005; two along the A628 Dodworth Road and one at the junction of the A61 Wakefield Road and Burton Road (which may soon be revoked following public consultation). In 2008, another two AQMA's were declared, along the A61 Harborough Hill Road and at the Junction between the A633 Rotherham Road and Burton Road. A section of the A616 passing through Langsett and the junction of the A61 Sheffield and A6133 cemetery Road were declared as AQMA's in 2012. All AQMA's have been declared for exceedences of the annual mean nitrogen dioxide objective. The nearest AQMA is located 1.3 km south of the proposed development site and is shown in Figure 1.

4.3 In terms of PM_{10}, the Council's latest Annual Status Report confirmed that the objectives are still being met in the borough, as it has been the case for the past five years. It is therefore reasonable to assume that existing PM_{10} levels will not exceed the objectives within the study area (Barnsley MBC, 2016).

Local Air Quality Monitoring

4.4 Barnsley MBC operates two automatic air quality monitoring stations which monitor NO_2 within its area, both of which are within the study area for this assessment. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by South Yorkshire Air Quality Samplers (using the 50% TEA in acetone method). The monitoring locations within the assessment study area are shown in Figure 2, along with the measured annual mean nitrogen dioxide concentrations in 2015.

Figure 1: AQMAs in the Study Area

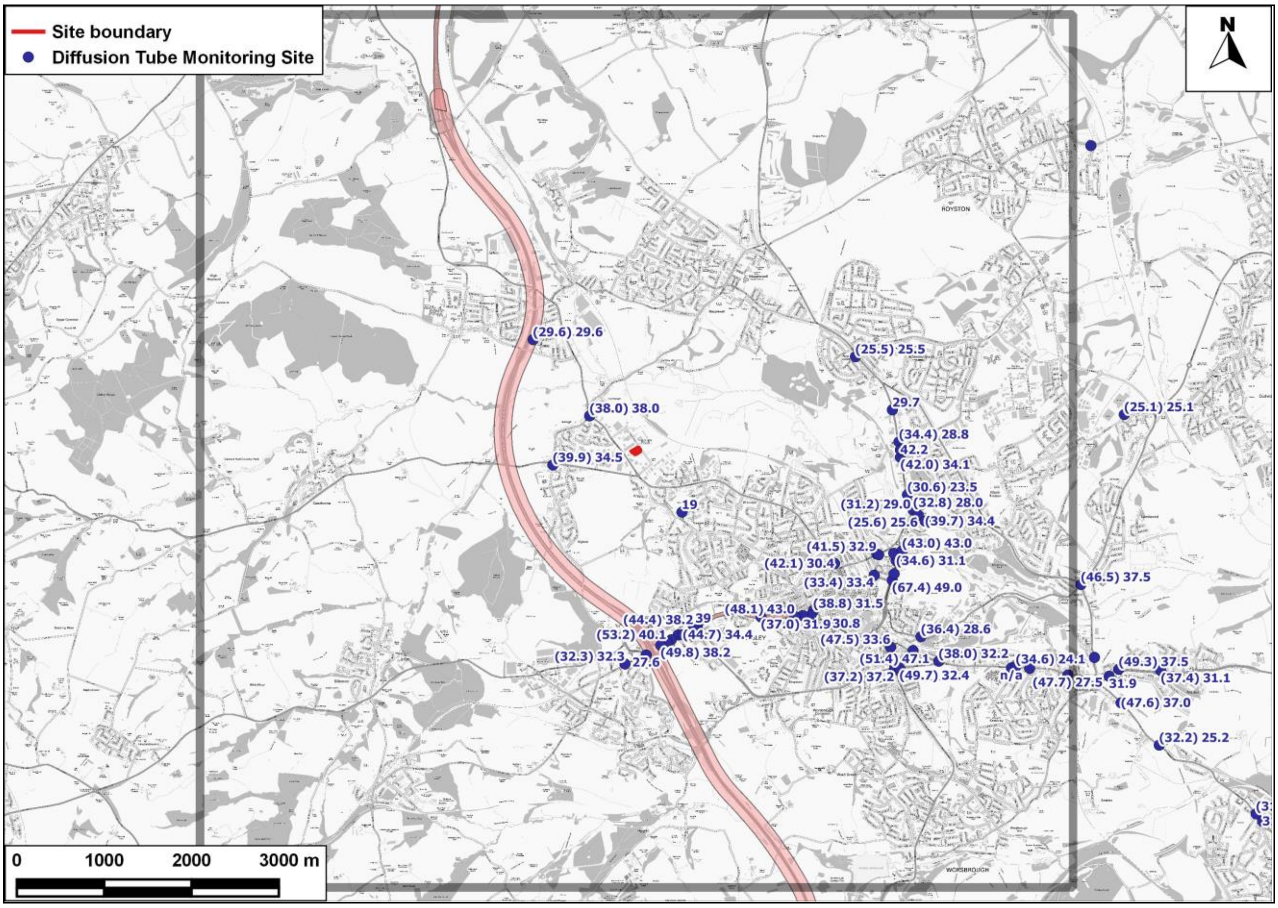

Figure 2: Measured Annual Mean Nitrogen Dioxide Concentrations in 2015 (µg/m^3)

4.5 The Barnsley A635 roadside automatic monitor, located outside the Kendray Hospital in Measborough Dike, measures PM_{10} concentrations. In 2015 the annual mean PM_{10} concentration measured here was 21 µg/m^3. There are no monitors measuring $PM_{2.5}$ concentrations in Barnsley.

Exceedences of EU Limit Value

4.6 The Barnsley Gawber urban background AURN monitoring site is located within 1 km of the development site, and measured an annual mean nitrogen dioxide concentration well below the limit value in 2015 (Barnsley MBC, 2016). The national maps of roadside annual mean nitrogen dioxide concentrations in 2014 (Defra, 2016c), used to report exceedences of the limit value to the EU, do not identify any exceedences within 1 km of the development site. Defra's mapping for 2020, which takes account of the measures contained in its 2015 Air Quality Plan (Defra, 2015), also does not identify any exceedences within 1 km of the development site.

Background Concentrations

4.7 In addition to these locally measured concentrations, estimated background concentrations in the study area have been determined for 2015 (Table 2) using Defra's background maps (Defra, 2016b). The background concentrations have been derived as described in Appendix A2. The background concentrations are all below the objectives.

Table 2: Estimated Annual Mean Background Pollutant Concentrations in 2015 (μg/m^3) [a]

Year	NO_2	PM_{10}	$PM_{2.5}$
2015	13.2-33.4	13.1-17.2	9.4-12.8
Objectives	**40**	**40**	**25** [b]

[a] The range covers all the 1 km x 1 km grid squares within the study area.

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

5 Impact Assessment

Nitrogen Dioxide

Annual Mean

5.1 Figure 3 shows concentration contours which define the area over which, if the generators were to run for 1,095 hours per year, their emissions might add more than 0.2, 0.6 and 2.2 µg/m^3 to annual mean nitrogen dioxide concentrations.

5.2 Using the descriptive terminology developed jointly by EPUK and the IAQM, as described in Paragraph 2.21, outside the area defined by the 0.2 µg/m^3 contour the impacts will be negligible, regardless of the receptor-specific total concentrations (process contribution plus existing concentration). The impacts will also be negligible between the 0.2 and 0.6 µg/m^3 contours, as long as the total baseline concentration is below 37.2 µg/m^3. Between the 0.6 and 2.2 µg/m^3 contours, the impacts will be negligible with a baseline concentration below 28.0 µg/m^3. Non-negligible impacts cannot be discounted inside the 2.2 µg/m^3 contour wherever there are locations with relevant exposure to the annual mean objective as described in Paragraph 2.18.

5.3 As shown in Figure 3, there are AQMAs within the 0.2 µg/m^3 and 0.6 µg/m^3 contours, but none within the 2.2 µg/m^3 contour.

5.4 A number of worst-case assumptions have been made in deriving these contours. It has been assumed that the generators will operate exclusively on diesel oil and for a period that is significantly greater than will occur in practice. Furthermore, where a gas connection can be made to the grid, the generators will operate in dual fuel mode. The combustion of gas within the generators is far cleaner than the combustion of diesel oil and therefore the emissions would be significantly lower than has been modelled. In addition, the plant have been assumed to operate for 10 times longer than the expected 100 hours, and over twice the likely worst-case of 500 hours. Due to these factors the above bands will, in reality, be much smaller, thereby reducing the area over which adverse impacts cannot be discounted.

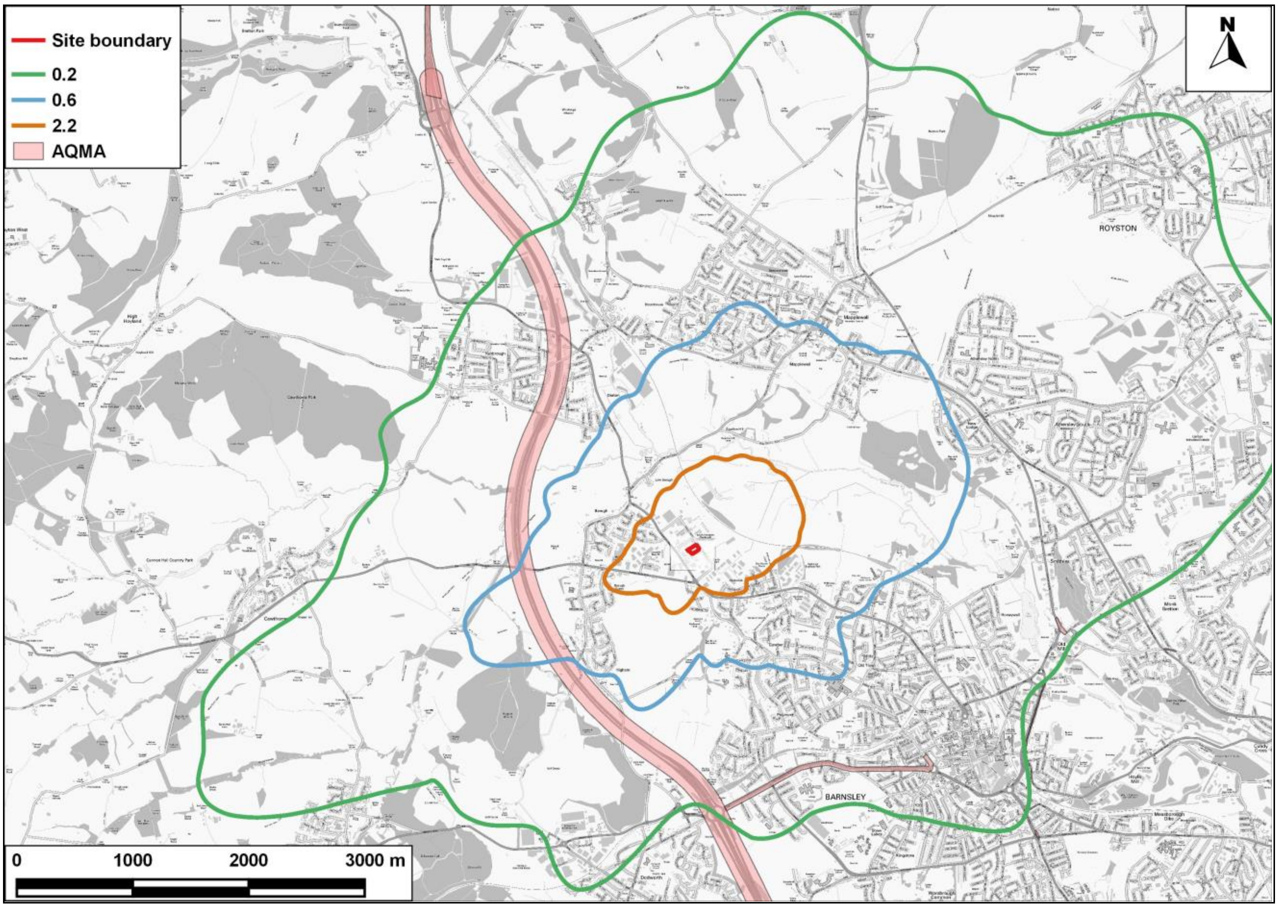

Figure 3: Area over which the Process Contribution to the Annual Mean Nitrogen Dioxide Concentrations could Exceed 0.2, 0.6 and 2.2 µg/m^3

99.79th Percentiles of 1-hour Means

5.5 Figure 3 shows the area over which the generators have the potential to add more than 20 µg/m^3 to the 99.79th percentiles of 1-hour mean nitrogen dioxide concentrations. Outside the area defined by the 20 µg/m^3 band the impact will be negligible regardless of the baseline concentration.

5.6 Within the 20 µg/m^3 contour in Figure 4, non-negligible impacts cannot be discounted, but it should be recognised that the modelling will significantly over-state these potential impacts. The model has assumed that the plant will run each and every time meteorological conditions will be worst. For any receptor, this is highly unlikely, while across all of the receptor points which make up the isopleth in Figure 4, it would be impossible. Figure 4 will thus over-predict the impacts of the scheme.

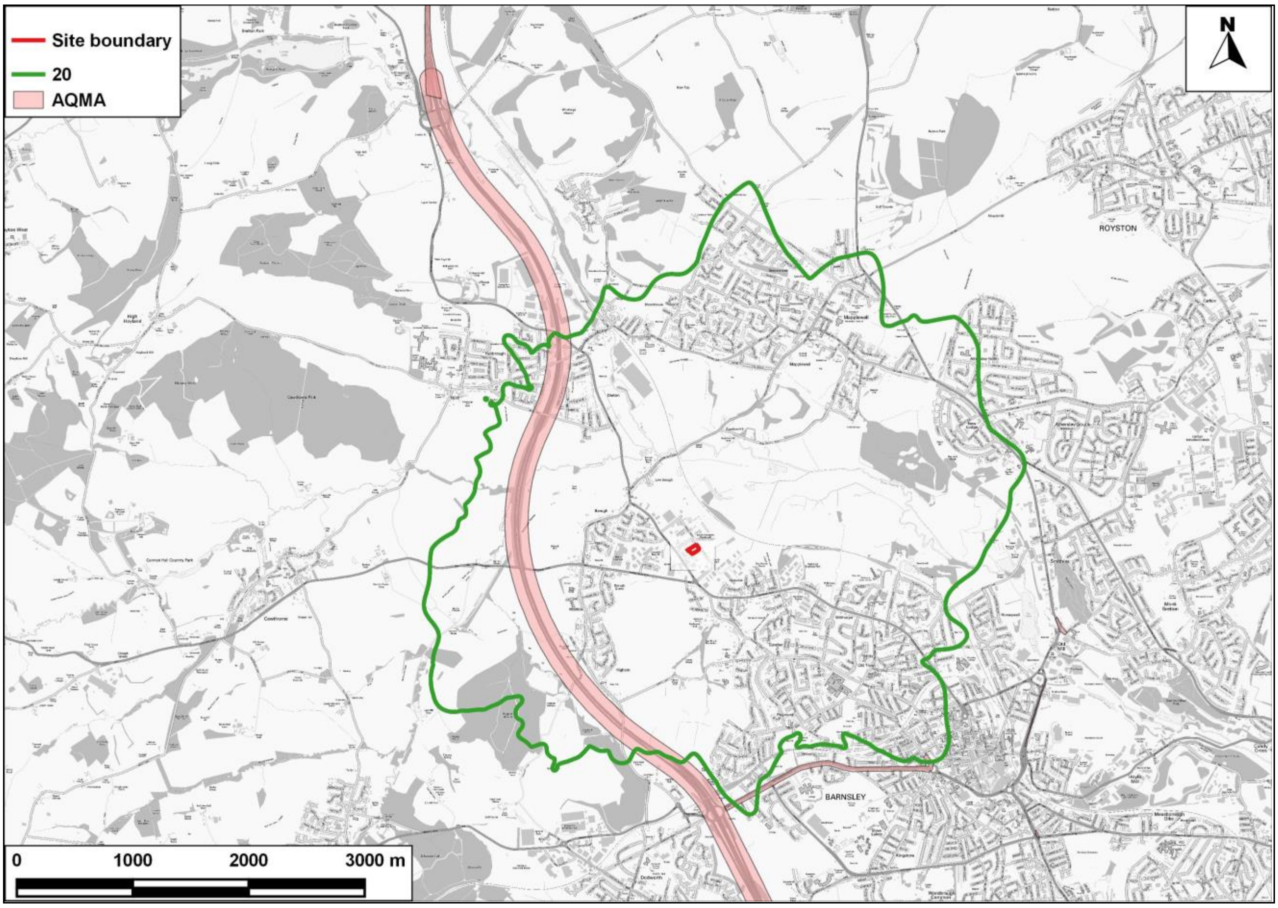

Figure 4: Area over which the Process Contribution to the 99.79th Percentiles of 1-hour Mean Nitrogen Dioxide Concentrations could Exceed 20 µg/m³ (10% of the Objective)

PM_{10}

Annual Mean

5.7 Figure 5 shows concentration contours which define the area over which, if the generators were to run for 1,095 hours per year, their emissions might add more than 0.2 and 0.6 µg/m^3 to annual mean PM_{10} concentrations. There are no areas which could experience impacts greater than 2.2 µg/m^3.

5.8 Outside the area defined by the 0.2 µg/m^3 contour, the impacts will be negligible, regardless of the receptor-specific total concentrations (process contribution plus existing concentration). There is no relevant exposure to the annual mean PM_{10} objective within the 0.2 µg/m^3 contour and any impacts will thus be negligible.

Figure 5: Area over which the Process Contribution to the Annual PM_{10} Concentrations could Exceed 0.2 and 0.6 µg/m^3

90.4th Percentiles of 24-hour Means

5.9 The maximum predicted process contribution of PM_{10} due to the generators, at any location across the modelled 10km by 10km grid, is 3.34 µg/m^3, as a 90.4th percentile of 24-hour means. This is well below the screening criterion of 5 µg/m^3 (10% of the short-term objective). Thus short-term impacts across the entire study area will be negligible.

$PM_{2.5}$

Annual Mean

5.10 Figure 6 shows concentration contours which define the area over which, if the generators were to run for 1,095 hours per year, their emissions might add more than 0.125 and 0.375 µg/m^3 to annual mean $PM_{2.5}$ concentrations. There are no areas which could experience impacts greater than 1.125 µg/m^3.

5.11 Outside the area defined by the 0.125 µg/m^3 contour, the impacts will be negligible, regardless of the receptor-specific total concentrations (process contribution plus existing concentration). There is no relevant exposure to the annual mean $PM_{2.5}$ objective within the 0.125 µg/m^3 contour and any impacts will thus be negligible.

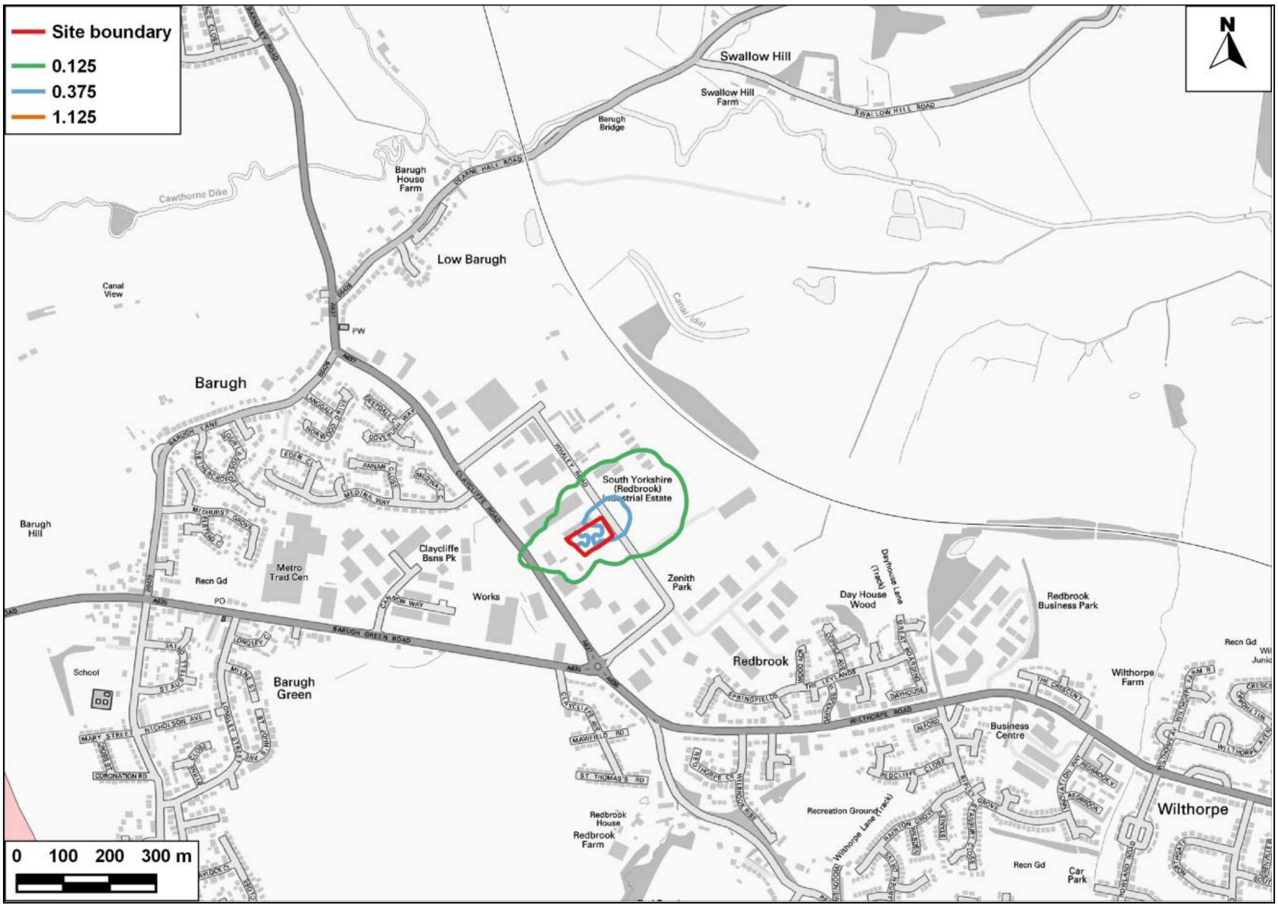

Figure 6: Area over which the Process Contribution to the Annual $PM_{2.5}$ Concentrations could Exceed 0.125 and 0.375 µg/m^3

6 Summary and Conclusions

6.1 The impacts associated with the proposed diesel power generation facility at Whaley Road, Barnsley have been assessed in relation to the objectives set to protect human health. The generators are expected to operate for up to 100 hours per year but, in order to provide a worst-case assessment, it has been assumed that they would operate for more than 1,000 hours per year.

6.2 The impacts have been assessed using the ADMS-5 dispersion model, and considered using criteria provided by Environmental Protection UK and the Institute of Air Quality Management.

6.3 Even based on the worst-case assumptions regarding how long the facility will operate, any impacts in relation to PM_{10} and $PM_{2.5}$ will be negligible. There will thus be no significant effects in relation to these pollutants.

6.4 In terms of nitrogen dioxide, there will be no significant effects outside of the isopleths shown in Figure 3 and Figure 4. Within these isopleths, potentially significant effects cannot be discounted, but it should be recognised that this is based on extremely worst-case assumptions regarding how the facility will operate. The potential for significant effects will thus have been exaggerated.

7 References

Barnsley MBC. (2012). *Air Quality Action Plan.*

Barnsley MBC. (2014). *Air Quality and Emissions Good Practice Planning Guidance.*

Barnsley MBC. (2015). *2015 Air Quality Action Plan Progress Report for Barnsley Metropolitan Borough Council.*

Barnsley MBC. (2016). *Annual Status Report.*

DCLG. (2014). *Planning Practice Guidance*. Retrieved from http://planningguidance.planningportal.gov.uk/blog/guidance/

Defra. (2007). *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.* Defra.

Defra. (2015). *Air quality in the UK: plan to reduce nitrogen dioxide emissions*. Retrieved from https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions

Defra. (2016). *Review & Assessment: Technical Guidance LAQM.TG16.* Defra.

Defra. (2016b). *Defra Air Quality Website*. Retrieved from http://laqm.defra.gov.uk/

Defra. (2016c). *UK Ambient Air Quality Interactive Map*. Retrieved from http://uk-air.defra.gov.uk/data/gis-mapping

Defra. (2016d). *2015 NO2 projections data (2013 reference year)*. Retrieved from http://uk-air.defra.gov.uk/library/no2ten/2015-no2-projections-from-2013-data

Department of Energy and Climate Change. (2016). *Consultation on further reforms to the Capacity Market .*

Directive 2008/50/EC of the European Parliament and of the Council. (2008).

Directive 2015/2193/EU of the European Parliament and of the Council. (2015).

Environment Agency. (2005). *Conversion ratios for NOx and NO2*. Retrieved from http://persona.uk.com/kings_lynn/Core_docs/Q/Q11.pdf

EPUK & IAQM. (2015, Novemeber). *Land-Use Planning & Development Control: Planning For Air Quality.* IAQM.

HMSO. (1990). *Environmental Protection Act 1990.*

HMSO. (1993a). *Clean Air Act 1993.*

HMSO. (1993b). *Technical Guidance Note D1 (Dispersion).*

National Planning Policy Framework. (2012). DCLG.

The Air Quality (England) (Amendment) Regulations, 2002, Statutory Instrument 3043. (2002). HMSO.

The Air Quality (England) Regulations, 2000, Statutory Instrument 928. (2000). HMSO.

8 Glossary

ADMS-5	Atmospheric Dispersion Modelling System model for point sources
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
$\mu g/m^3$	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PC	Process Contribution
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter

PPG	Planning Practice Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide

9 Appendices

A1 Professional Experience

Prof. Duncan Laxen, BSc (Hons) MSc PhD MIEnvSc FIAQM

Prof Laxen is the Managing Director of Air Quality Consultants, a company which he founded in 1993. He has over forty years' experience in environmental sciences and has been a member of Defra's Air Quality Expert Group and the Department of Health's Committee on the Medical Effects of Air Pollution. He has been involved in major studies of air quality, including nitrogen dioxide, lead, dust, acid rain, PM_{10}, $PM_{2.5}$ and ozone and was responsible for setting up the UK's urban air quality monitoring network. Prof Laxen has been responsible for appraisals of all local authorities' air quality Review & Assessment reports and for providing guidance and support to local authorities carrying out their local air quality management duties. He has carried out air quality assessments for power stations; road schemes; ports; airports; railways; mineral and landfill sites; and residential/commercial developments. He has also been involved in numerous investigations into industrial emissions; ambient air quality; indoor air quality; nuisance dust and transport emissions. Prof Laxen has prepared specialist reviews on air quality topics and contributed to the development of air quality management in the UK. He has been an expert witness at numerous Public Inquiries, published over 70 scientific papers and given numerous presentations at conferences. He is a Fellow of the Institute of Air Quality Management.

Dr Ben Marner, BSc (Hons) PhD CSci MIEnvSc MIAQM

Dr Marner is a Technical Director with AQC and has seventeen years' experience in the field of air quality. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has been an expert witness at several public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has extensive experience of using detailed dispersion models, as well as contributing to the development of modelling best practices. Dr Marner has arranged and overseen air quality monitoring surveys, as well as contributing to Defra guidance on harmonising monitoring methods. He has been responsible for air quality review and assessments on behalf of numerous local authorities. He has also developed methods to predict nitrogen deposition fluxes on behalf of the Environment Agency, provided support and advice to the UK Government's air quality review and assessment helpdesk, Transport Scotland, Transport for London, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist.

Kieran Laxen, MEng (Hons) AMIEnvSc MIAQM

Mr Laxen is a Senior Consultant with AQC with over seven years' experience in the field of air quality management and assessment. Previously having two years' experience in scientific research on internal combustion engines, he now works in the field of air quality. He is involved in a wide range of development projects, most of which have involved use of ADMS modelling methodologies for biomass boilers, CHP plant and roads, and is also competent in the assessment of construction dust. He has pioneered the use of OpenAir software within the Company, which is used to analyse air quality monitoring data, and is responsible for routine calibration of air quality monitoring stations, together with data ratification. He is a Member of the Institute of Air Quality Management.

Pauline Jezequel, MSc MIEnvSc AMIAQM

Miss Jezequel is a Consultant with AQC with seven years' relevant experience. Prior to joining AQC she worked as an air quality consultant at AECOM. She has also worked as an air quality controller at Bureau Veritas in France, undertaking a wide range of ambient and indoor air quality measurements for audit purposes. She now works in the field of air quality assessment, undertaking air quality impact assessments for a wide range of development projects in the UK and abroad, including for residential and commercial developments, transport schemes (rail, road and airport), waste facilities and industrial sites. Miss Jezequel has also undertaken a number of odour surveys and assessments in the context of planning applications. She has experience in monitoring construction dust, as well as indoor pollutant levels for BREEAM purposes.

Full CVs are available at www.aqconsultants.co.uk.

A2 Modelling Methodology

A2.1 The impacts of emissions from the proposed facility have been predicted using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the art understanding of the dispersion processes within the atmospheric boundary layer.

Model Inputs

Emissions and Release Conditions

A2.2 The model input parameters for the proposed generators have been derived from the generator datasheets provided by Ocktcom (James Beck):

- *Product_16V4000G63 3D NEA.pdf – Pages 1, 5, 8 and 12; and*
- *Machine Emissions Info.pdf (Ref: EDS 4000 0623. Date@ 29 June 2012).*

A2.3 The emissions parameters employed in the modelling are given in Table A2.1 and Table A2.2. These are based on use of diesel fuel for 100% of the operations.

A2.4 In order to simulate the combined buoyancy of plumes from each of the generator flues, emissions from ten of the generators have been combined in pairs within the model. The configuration of the generators will mean that one generator flue will not be close to any others and so it has been assumed that it will discharge from its own flue. The modelling has thus assumed that there will be six discharge flues for the eleven generators. Table A2.2 thus includes the emission parameter for the single unit and the paired units.

Table A2.1: Plant Specifications, Emissions and Release Conditions per Generator

Parameter	Value
Power output (kW_{out})	2,185
Power output (kVA) [a]	2,730
Gross Fuel Consumption (g/kWh_{out})	200
Gross Fuel Consumption (kg/hr)	437
Gross Fuel Consumption (Litres/hr) [b]	523
Net Input Fuel Rate (kW_{in})	5,197.5
Gross Input Fuel Rate (kW_{in})	5,547.1
Exhaust Temperature (degC)	492
Combustion air (m/s) [c]	2.7
Combustion air (kg/h) [d]	11,260
Excess air [d]	77%
Flue Internal Diameter (m)	0.5
Exhaust flow (kg/h)	11,695
Exhaust flow (Nm^3/s) [e]	1.3
Exhaust flow (Am^3/s) [f]	7.1
Exhaust velocity (Nm/s) [e]	6.5
Exhaust velocity (Am^3/s) [f]	35.9
Molecular Mass (g/mol)	28.92
NOx Emission rate (g/kWh_{out})	6.4
PM Emission rate (g/kWh_{out})	0.03

[a] Power factor of 0.8.

[b] Liquid density at 15 degC is 835 kg/m^3.

[c] Assumed conditions of 25degC, 30% relative humidity, 101.325kPa, wet.

[d] Derived from combustion air m^3/s.

[e] Normalised to 0degC, 101.325kPa, 0% O2, dry.

[f] Actual flow conditions assumed to be 492degC, 8.7% O2, wet.

Table A2.2: Modelled Plant Specifications, Emissions and Release Conditions

Parameter	Value
Single Diesel Generator	
Flue Internal Diameter (m)	0.5
Exhaust flow (Am^3/s) [a]	7.1
Exhaust velocity (Am^3/s) [a]	35.9
Molecular Mass (g/mol)	28.92
NOx Emission rate (g/s)	3.8844
PM Emission rate (g/s)	0.0182
Combined Diesel Generators – 2 generators	
Flue Internal Diameter (m)	0.71
Exhaust flow (Am^3/s) [a]	14.1
Exhaust velocity (Am^3/s) [a]	35.9
Molecular Mass (g/mol)	28.92
NOx Emission rate (g/s)	7.7689
PM Emission rate (g/s)	0.0364

[a] Actual flow conditions assumed to be 492degC, 8.7% O2, wet.

Spatial Configuration

A2.5 Within the model, the eleven generators have been positioned across the site in a nominal configuration as shown in Figure A2.1. The precise positions of the generators within the site may, in practice, differ from those that have been modelled, but in the context of the high level of conservatism built in to other parts of the assessment, any differences between the configuration modelled and the configuration which is ultimately used will have no material effect on the outcomes.

A2.6 The flues have been modelled at a height of 3.8 m (0.4 m above the tops of the generators).

A2.7 Entrainment of the plume into the wake of the generators (the so-called building downwash effect) has been taken into account by including the generators themselves as buildings within the model.

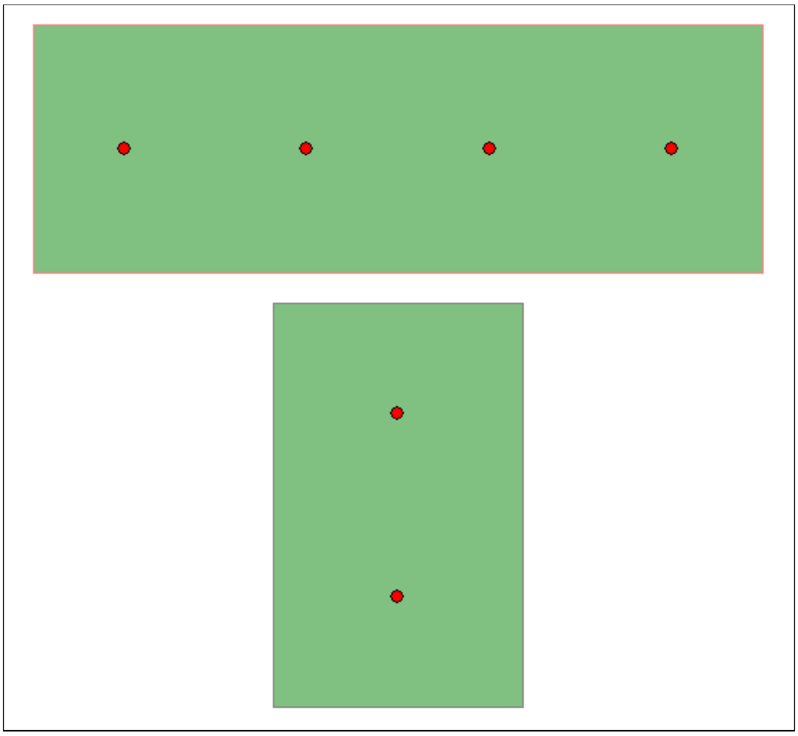

Figure A2.1: Modelled Generator Flue Outlet Layout (Red circles) and Modelled Building Area (Green rectangles)

Meteorological Inputs

A2.8 Thirty separate sets of hourly sequential meteorological data have been used in the model. This includes five years' worth of data from six Meteorological Office sites spread across the UK. One of the sites, Waddington, is the site used by Defra for the UK-wide modelling that it carries out for reporting to the European Union. The meteorological datasets used are set out in Table A2.3 and the locations of the sites are shown in Figure A2.2.

A2.9 Once the dispersion model had been run 30 times, for each receptor, the maximum value across all 30 datasets was selected and used to generate the contour isopleths.

Table A2.3: Meteorological Datasets used in the Model

Monitoring Site	Datasets
Coleshill	5 x 1 year datasets (2011 – 2015 inc)
Glasgow Airport	5 x 1 year datasets (2011 – 2015 inc)
Linton on Ouse	5 x 1 year datasets (2011 – 2015 inc)
Luton	5 x 1 year datasets (2011 – 2015 inc)
Southend	5 x 1 year datasets (2011 – 2015 inc)
Waddington	5 x 1 year datasets (2011 – 2015 inc)

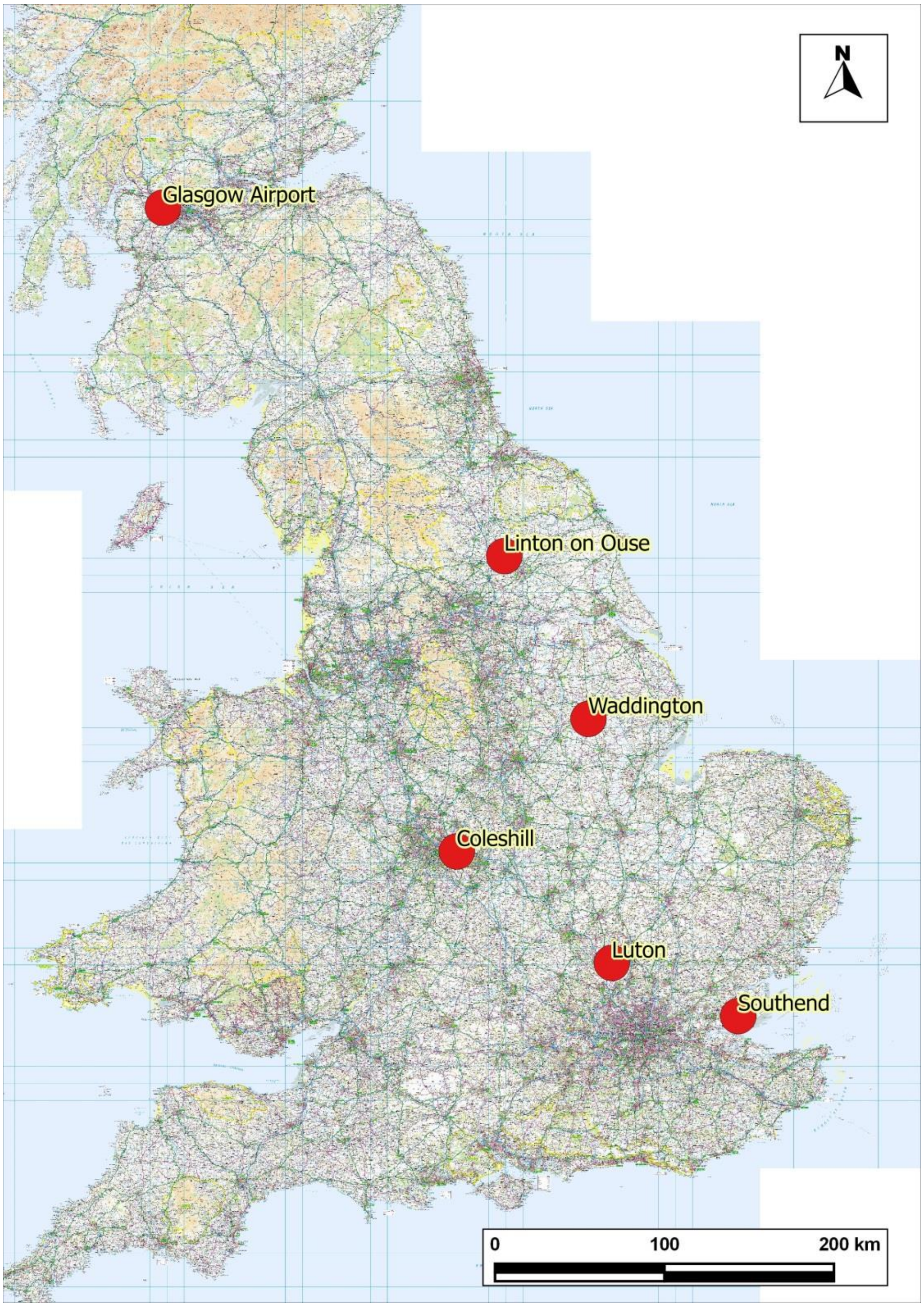

Figure A2.2: Meteorological Office Monitoring Sites

Temporal Inputs

A2.10 The model has been run using a 'fac' file to simulate the generators operating for three hours, between 16.00 and 17.00 each day of the year.

Model Post-processing for Nitrogen Dioxide

A2.11 Emissions from the generators will be predominantly in the form of nitrogen oxides (NOx). ADMS-5 has been run to predict the contribution of the generators to annual mean concentrations of nitrogen oxides and to the 99.79th percentiles of 1-hour mean nitrogen oxides. The approach recommended by the Environment Agency (Environment Agency, 2005) has been used to predict annual mean nitrogen dioxide concentrations and 99.79th percentiles of 1-hour mean nitrogen dioxide concentrations. This assumes that:

- Annual mean nitrogen dioxide concentrations = Annual mean nitrogen oxides x 0.7; and
- 99.79th percentiles of 1-hour mean nitrogen dioxide concentrations = 99.79th percentiles of 1-hour mean nitrogen oxides x 0.35.

Background Concentrations

A2.12 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2016b). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030.