
Aerquality
Better Air Quality, Better Lives

AIR QUALITY DISPERSION MODELLING

PROJECT: RESERVE PEAKING ENERGY GENERATION FACILITY,CHEADLE, STAFFORDSHIRE

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Appendix 1 Human Receptors

1 INTRODUCTION

1.1 This air quality assessment has been undertaken on behalf of MEB Total Ltd, in support of a planning application for reserve peaking energy generation facility at Cheadle, Staffordshire, ST10 4QS. The facility would be located on a plot of agricultural land, approximately 1.5 km north east of centre of Cheadle. Approximate grid reference of the site is 401850, 344440.

1.2 This reports the detailed atmospheric dispersion modelling undertaken in relation to the key pollutants associated with exhaust emissions of the diesel ignition engines at the facility.

1.3 The key pollutants associated with operation of the engines considered are oxides of nitrogen (NO_x as NO_2), and carbon monoxide (CO). Other pollutants, such as Total Hydrocarbons(THC), and Particulate Matter(PM) sometimes associated with the operation of diesel engines, are generated in negligible levels when using this fuel type.

1.4 Predicted ground level concentrations of these pollutants are compared with relevant air quality standards and guidelines for the protection of human health and sensitive habitats.

1.5 The proposed Cheadle Peaking Plant facility will consist of several modular diesel generator units, along with ancillary equipment such as transformers and fuel storage tanks. The purpose of the project will be to provide electricity to the regional grid at times of peak demand, to supplement base load provided by larger sources.

1.6 The facility will have a total generation capacity of 2.0 megawatts electrical output (Mwe), on a five engine configuration. It would operate for no more than 500 hours per year[1].

1.7 The facility will comprise five separate diesel generator units, most likely, each with an electrical output of 401KW. Existing access tracks would be upgraded and extended on to the site to accommodate deliveries of fuel. Construction is anticipated to take approximately three months, including testing and commissioning, and plans are to have 2019 be the first full year of operation. The generators themselves will require minimal on site works as they will be manufactured elsewhere, and brought to site as pre-fabricated units that would be craned into position and connected with the other site infrastructure.

1.8 The Industrial Emissions Directive (2010/75/EU) covers combustion plant with a capacity of greater than 50MWth. As such, the plant would not be regulated under Industrial Emissions Directive.

[1] Telephone conversation MEB Ltd to Aerquality Ltd, 26th August 2016

Scope / Initial Consultation

1.9 It were not possible to undertake initial consultation with Council[2], and the further to consultation with MEB Ltd the following scope was adopted:

- The stack emission and the resultant release and impact on the surrounding locality would be quantified, using dispersion modelling techniques to determine exposure to key pollutants associated with operation of the diesel engines considered are oxides of nitrogen (NO_x as NO_2), and carbon monoxide (CO);
- 5 years of meteorological data was applied to account for inter year variability;
- The predicted concentrations would be predicted across a 2km x 2km assessment area and receptors of ecological value;
- The stack emission were to be modelled and not process limit values;
- Test data and process conditions supplied, and subsequently modelled, are contained in Table 3-5.

[2] e.g. Email communication Aerquality to Staffordshire Moorlands District Council, 16th June 2016

2 ASSESSMENT CRITERIA

This section provides a summary of the primary regulatory controls, planning policy and other guidance relating to air quality in the UK to enable the assessment to be viewed in context.

International Legislation And Policy

2.1 The European Directive 2008/50/EC of the European Parliament and of the Council of 21st May 2008, sets legally-binding Europe-wide limit values for the protection of public health and sensitive habitats.

2.2 The pollutants included are particulate matter of less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}), particulate matter of less than 2.5µm in aerodynamic diameter lead ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), ozone (O_3) , benzene (C_6H_6), polycyclic aromatic hydrocarbons (PAHs), arsenic (As), cadmium (Cd), lead (Pb) , and mercury (Hg), and nickel (Ni).

2.3 The ambient air quality standards contained in Directive 2008/50/EC are not enforceable where there is not regular public access, or fixed habitation:

"*Compliance with the limit values directed at the protection of human health shall not be assessed at the following locations:*
(a) any locations situated within areas where members of the public do not have access and there is no fixed habitation;
(b) in accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply;
(c) on the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access to the central reservation.'"

2.4 The Industrial Emissions Directive (2010/75/EU) covers combustion plant with a capacity of greater than 50MWth. As such, the plant will not be regulated under IED.

2.5 The medium combustion plant Directive (MCPD) is currently in draft form, having been put in front of the Commission on 5th May: Proposal for a Directive of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from medium combustion plants Brussels. Of relevance is Article 5(2) second sub paragraph of the Draft Directive, which states that an exemption may be adopted by member states where the plant is not operational on a continuous basis (fewer than 500 hours per year).

UK Air Quality Strategy (AQS)

2.6 The Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (most recently updated in July 2007[3]) sets out a framework for reducing hazards to health from air pollution in the UK.

[3] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Department for Environment, Food and Rural Affairs (DEFRA), July 2007

2.7 The AQS sets out a strategic framework of air quality policies that Government, industry, the Environment Agency, local government, business, individuals and transport sectors should adopt in protecting and improving air quality.

Environment Act

2.8 Section 82 of the Environment Act (1995) (Part IV) requires local authorities to periodically review and assess, present and likely future air quality within their area of jurisdiction, under the system of Local Air Quality Management (LAQM). If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, the local authority is required under Section 83 (1) to declare an Air Quality Management Area (AQMA). For each AQMA the local authority is required under Section 84 of the Environment act to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutants levels in pursuit of the air quality objective levels. The Environment Act 1995 does not prescribe any time scale for preparing an Action Plan. However, the Government expect them to be completed between 12-18 months following the designation of any air quality management areas. The prime responsibility for preparing and submitting the Action Plan rests with district councils. However, there is a requirement on other relevant authorities to identify proposals in pursuit of the AQS objectives within their respective responsibilities and functions.

2.9 Whilst compliance with the AQS is regulated at the Local Authority as above, the Environment Agency's role in relation to Local Air Quality Management is as follows[4]:

> *"The Environment Agency is committed to ensuring that any industrial installation or waste operation we regulate will not contribute significantly to breaches of an AQS objective. It is a mandatory requirement of EPR legislation that we ensure that no single industrial installation or waste operation we regulate will be the sole cause of a breach of an EU air quality limit value. Additionally we have committed that no installation or waste operation will contribute significantly to a breach of an EU air quality limit value."*

Planning Policy & Guidance

National Planning Policy Framework

2.10 The NPPF[5] provides a list of matters to be considered in determining planning applications. Under the NPPF due considerations need to be given within the planning system to contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.

2.11 Furthermore, planning policies are required to 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

[4] Regulating to Improve Air Quality. AQPG3, version 1, Environment Agency, 14 July 2008
[5] National Planning Policy Framework, Department for Communities and Local Government, March 2012

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.

2.12 To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account.

2.13 National Policy Statements National Policy Statement for Energy NPS EN-1 states "*In England and Wales this NPS is likely to be a material consideration in decision making on applications that fall under the Town and Country Planning Act 1990 (as amended). Whether, and to what extent, this NPS is a material consideration will be judged on a case by case basis*."

2.14 The proposed project is below 50 MWe in generating capacity, and therefore not a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008. Nonetheless as explained above the project will contribute to the regional need for secure supplies of electricity and is of a type that, if of greater capacity, would be a NSIP, and therefore it is considered that the energy National Policy Statements are a material consideration in the determination of this proposal.

2.15 NPS EN-1 Overarching National Policy Statement for Energy and NPS EN-2 National Policy Statement for Fossil Fuel Electricity Generating Infrastructure are of relevance.

2.16 NPS EN-1 confirms that a diverse energy mix is required and that there is a significant need for new energy generation infrastructure to replace capacity that will be lost through the closure of existing large coal plants. Paragraph 3.6.1 of NPS EN-1 states "Fossil fuel power stations play a vital role in providing reliable electricity supplies: they can be operated flexibly in response to changes in supply and demand, and provide diversity in our energy mix. They will continue to play an important role in our energy mix as the UK makes the transition to a low carbon economy...". Similarly Paragraph 1.1.1 of NPS EN-2 states "Fossil fuel generating stations play a vital role in providing reliable electricity supplies and a secure and diverse energy mix as the UK makes the transition to a low carbon economy." A range of planning and environmental considerations are set out in the NPSs, such as air quality and landscape and visual impacts, which have been used to inform the scope of this Environmental Report.

2.17 NPS EN-2 does not repeat or add to the needs case set out in NPS EN-1, but provides additional policy criteria and assessment principles relevant to fossil fuel generating stations. Notably, it states that "the Government does not seek to direct applicants to particular sites for fossil fuel generating stations". The NPSs have been informed by and followed by other government policy and evidence as to the need for viable proposals to contribute towards greater reliability of electricity supply in Wales and the UK. These are covered in chronological order, followed by a discussion.

2.18 The 'Electricity Market Reform White Paper – Planning our electric future: a White Paper for secure, affordable and low-carbon electricity' (DECC, 2011) "sets out the Government's commitment to transform the UK's electricity system to ensure that our future electricity supply is secure, low-carbon and affordable". A key part of this wide ranging reform is the introduction of a 'Capacity Mechanism' in order "to guarantee future security of electricity supply as a quarter of ageing plant closes during this decade and the proportion of intermittent or less flexible low-carbon generation rises" (paragraph 1.35). The White Paper sets out, at page 24, a vision for the Electricity System following reform, in which it is stated "The electricity grid has evolved to accommodate more localised and intermittent sources of generation, as well as being smarter and more responsive".

2.19 With the increasing amount of intermittent renewable energy sources (e.g. wind turbines and solar farms) providing power to the National Grid, there is significant consideration being given to the need for more reactive/peaking power on the network.

2.20 To ensure that there is reliability of supply, it is government policy that the electricity generation mix needs to incorporate a balance of technologies that continuously and reliably produce stable and controllable power. Thus in the second Annual Energy Statement (AES) (November, 2011), the Department of Energy and Climate Change (DECC) directed the need to build new power generation infrastructure.

2.21 In October 2012, Ofgem (the electricity and gas regulatory body) prepared a report entitled 'Electricity Capacity Assessment' which was submitted to the Secretary of State and estimates a set of plausible electricity capacity margins that could be delivered by the market over the next four years and the associated risks to security of supply.

2.22 One of the key findings of the Ofgem report is that electricity de-rated capacity margins will decrease significantly from the current historically high levels (i.e. supply will drop as demand continues to increase). In parallel, the risk of electricity customer disconnections will appreciably increase from near zero levels due to insufficient supply. This is primarily because of a significant reduction in electricity supplies from coal and oil plants, which are due to close under European environmental legislation.

2.23 Given the above there is therefore a clear need for further capacity to meet the projected need for peaking generation. A dedicated peaking plant at the Cheadle site could allow for start-up and connection to the grid within minutes of being called up, thus helping stabilise the national and regional grid and providing some of this necessary additional capacity.

2.24 In addition to the above, peaking plant of the size proposed, represent embedded generation and are an ideal compliment to wind and other renewable power sources. Peaking plant represents the most flexible type of generation as they can be turned on exactly when needed (e.g. when the wind stops blowing) something which few other forms of power generation offer.

2.25 The plant would also supply power directly into the regional grid, and could be distributed within minimal losses. The close proximity to the Cheadle substation also removed the need for extensive electrical cabling and complex connections often associated with power generation facilities.

Planning for Air Quality Guidance

2.26 Guidance issued by the Environmental Protection UK (EPUK)) relates to Air Quality considerations within the planning process for use by local planning authorities and developers[6]. In this guidance, criteria are detailed that identify the need for an Air Quality Assessment, the type of Air Quality assessment required, and the significance of any predicted impact, presented in Table 2-1 and Table 2-2.

Table 2-1 Significance Criteria for Changes Annual Mean

Magnitude of Change	Description
Large	Increase/decrease >10% AQO/EAL
Medium	Increase/decrease 5 – 10% AQO/EAL
Small	Increase/decrease 1 - 5% AQO/EAL
Imperceptible	Increase/decrease <1% AQO/EAL

Table 2-2 Criteria For Annual Mean Impact Significance

Increase with Scheme	Magnitude of Change in Concentration[7]		
	Small	Medium	Large
Above Objective *With* Scheme	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective *With* Scheme (90-100%)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective *With* Scheme (75-90%)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective *With* Scheme (<75%)	Negligible	Negligible	Slight Adverse

Environmental Permitting Regulation

2.27 Industrial processes are regulated by the Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No.675) by the Environment Agency.

Environmental Assessment Levels (EALs)

2.28 The EALs used in this assessment have been reproduced from EPR Guidance H1, which are based upon the air quality standards and occupational exposure limits (OEL) and maximum exposure levels (MEL) presented in HSE EH40 (2005) as amended in October 2007. A summary of the appropriate EALs for potential pollutants emitted by the facility are included in Table 3-5. EALs have been applied in this assessment where no air quality standard exists, or where the EAL is lower than the corresponding air quality standard. Supplementary to the critical levels

[6] Development Control: Planning of Air Quality, April 2010

[7] An imperceptible change would be described as '*negligible*'

defined in the AQS the EALs for the protection of ecosystems and vegetation, also defined in H1 as critical levels are contained in Table 3-6.

Table 2-3 Applied Environmental Assessment Level Concentrations

Species	Averaging Period	Air Quality Objectives (AQO) (µg/m^3)	Data Source[8,9,10]
CO	8-hr (max. daily running av.)	10,000	UK/EU AQS
CO	1 hour	30000	H1
NO_2	Annual	40	UK/EU AQS
NO_2	1-hr (99.79th percentile)	200	UK/EU AQS

Table 2-4 Critical Levels For The Protection of Ecosystems and Vegetation

Species	Averaging Period	Air Quality Objectives (AQO) (µg/m^3)	Notes
Nitrogen oxides (as NO_2)	Daily	75	All Ecosystems
	Annual	30	All Ecosystems

2.29 The critical levels are based on monitoring criteria and only apply in the following areas:

- more than 20 km from agglomerations; and
- more than 5 km away from other built up areas, industrial installations motorways and major roads with a traffic count of more than 50,000 vehicles per day.

2.30 Notwithstanding criteria above, the critical levels are applied at all locations as a matter of policy, as they represent a standard against which to judge ecological harm.

Assessment Of Air Quality Impacts On Sensitive Ecosystems

2.31 In accordance with EPR H1, for all European sites within 10km and other designated ecological sites of Special Scientific Interest (SSSIs) with 5km, National and Local Nature Reserves (NNR and LNR), Areas of Ancient Wood Land (AWL), and Local Wildlife Sites (LWS) within 2km; process contributions (and predicted environmental concentrations where required) of NOx and SO_2 have been calculated in accordance with AQTAG06 for comparison against the relevant critical levels and loads.

Air Quality Assessment under the Habitats Regulations

2.32 The Conservation of Habitats and Species Regulations 2010 transpose Council Directive 79/409/EEC on the conservation of wild birds ('Birds Directive') and Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('Habitats Directive') into national law (in conjunction with the

8 UK/AQS: Air Quality Standard – these are currently legally binding in the UK and are derived from CAFE, with the exception of the 15 minutes mean SO_2 AQO which is UK specific

9 H1: Derived from version 2.1 and/or version 2.2 of the Environment Agency H1 guidance document

10 EPAQS: UK Expert Panel on Air Quality Standards guidelines

Wildlife and Countryside Act, see below). The 2010 Regulations replace the Conservation (Natural Habitats, &c.) Regulations 1994.

2.33 Regulation 61 (1) states that

> "*A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which*
> *(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects), and*
> *(b) is not directly connected with or necessary to the management of that site, must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.*
> *(2) A person applying for any such consent, permission or other authorisation must provide such information as the competent authority may reasonably require for the purposes of the assessment or to enable them to determine whether an appropriate assessment is required.*"

2.34 In order to clarify the procedure for assessing the impact of Industrial facilities under the Habitat Regulations; the Environment Agency has prepared Operational Instructions. These operational instructions form Appendix 7[11] of the Agency's guidance (the EU Habitats & Birds Directive Handbook) on how the Agency implements the Habitats Regulations when they consider new consents and review old consents. They define a 4-stage assessment procedure as detailed below:

- Stage1 – identification of relevant application by distance from designated site;
- Stage 2 – identification of permissions that are likely to be significant;
- Stage 3 – the 'appropriate assessment'; and
- Stage 4 – determination of the permission.

2.35 As part of the 'stage 2' assessment, the significance of the long-term process contribution (PC) is assessed against the following criteria: If the PC is less than 1% of the relevant long-term or 10% of the relevant short-term benchmark (EAL, critical level or critical load), the emission is 'not likely to have a significant effect alone or in combination irrespective of the background levels'.

2.36 Where this criterion is exceeded; consideration of the predicted environmental concentration (PEC) is required and the following criteria applied that if the PEC is less than 70% of the relevant long-term benchmark, the emission is 'not likely to have a significant effect'.

2.37 If on the basis of this Stage 2 assessment it cannot be concluded that the emission is not likely to have a significant effect, a Stage 3 'appropriate assessment' is required.

2.38 Where it is identified that a Stage 3 'appropriate assessment' is required in relation to emissions to air, the results of detailed atmospheric dispersion modelling are

[11] Appendix 7, Assessment of new PIR permissions under the Habitat Regulations, Operational Instruction. Environment agency, Version 2, 06/06/07

used to predict impacts of various pollutants at the sensitive locations. The procedure for undertaking such an 'appropriate assessment' has been defined by the Agency in conjunction with Natural England in the AQTAG06 guidance document.

2.39 The AQTAG06 procedure defines the dispersion modelling approach in terms of receptor location and arrays, use of topographical and terrain data, the calculation of deposition fluxes, how these should be considered alongside the background conditions and relevant critical levels and loads.

Wildlife and Countryside Act

2.40 The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the European Union Directives on the Conservation of Wild Birds (79/409/EEC) and Natural Habitats and Wild Fauna and Flora (92/43/FFC) are implemented in Great Britain. Planning authorities are required to consult Natural England (NE) before granting planning permission for the development of land in a Site of Special Scientific Interest (SSSI), or within the consultation area around a SSSI, as defined by NE. The planning authority is also required to consult NE if the development is considered likely to affect a SSSI, even if the application site falls outside the SSSI and surrounding consultation area.

Natural Environment and Rural Communities (NERC) Act

2.41 The Natural Environment and Rural Communities (NERC) Act came into force on 1st Oct 2006. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with Natural England, as required by the Act. The requirement to assess the impacts of activities on local sites (non statutory sites) comes under this Act 2006 (where previously the CROW Act was of relevance).

Local Planning Policy Context[12]

2.42 Staffordshire Moorlands Core Strategy, March 2014, Policy SD4 - Pollution and Flood Risk and R1 - Rural Diversification have matters addressing air quality as follows:

> *"SD4 - Pollution and Flood Risk*
> *The Council will ensure that the effects of pollution (air, land, noise, water, light) are avoided or mitigated by refusing schemes which are deemed to be (individually or cumulatively) environmentally unacceptable and by avoiding unacceptable amenity impacts by refusing schemes which are pollution-*

[12] Staffordshire Moorlands Core Strategy, March 2014

sensitive adjacent to polluting developments, or polluting schemes adjacent to pollution sensitive areas, in accordance with national guidance."

2.43 This Policy deals specifically with issues of pollution and flood risk. Pollution not only can negatively impact on the quality of life of people, but can also contribute to climate change (impact on ozone etc) and adversely impact on biodiversity assets (which can also affect 'wealth creation'). The NPPF directs Councils to proactively provide needed economic development - however decisions should ensure that new development is "appropriate for its location" in pollution/contamination terms; and more generally development should contribute to securing good standards of amenity and reducing pollution. On the other hand the NPPF recognises that industrial expansions resulting in 'some' additional noise should not be unfairly restricted. The Council will apply these principles to any development where pollution or contamination considerations may arise.

2.44 "*R1 - Rural Diversification*

All development in the rural areas outside the development boundaries of the towns and villages will be assessed according to the extent to which it enhances the character, appearance and biodiversity of the countryside, promotes the sustainable diversification of the rural economy, facilitates economic activity, meets a rural community need and sustains the historic environment.

Appropriate development should not harm the rural character and environmental quality of the area or any sites designated for their nature conservation, or historical interest by virtue of the scale, nature and level of activity involved and the type and amount of traffic generated or by other effects such as noise and pollution.

Wherever possible development should be within suitably located buildings which are appropriate for conversion. Where new or replacement buildings are involved, development should have minimal impact on the countryside and be in close proximity to an existing settlement.

Within the Green Belt, inappropriate development which is otherwise acceptable within the terms of this policy, will still need to be justified by very special circumstances.

Priority will be given to the re-use of rural buildings for commercial enterprise, including tourism uses, where the location is sustainable and the proposed use does not harm the building's character and/or the character of its surroundings."

2.45 The need for rural areas to be able to meet their economic and community needs is recognised as an important issue in both the former West Midlands Regional Spatial Strategy (RSS) and national planning guidance. The former RSS recognised strengthening the rural economy and enabling sustainable

diversification as a key priority for the region. There is a particular need in the District to support the rural economy, enable farm diversification and support rural communities whilst at the same time protecting the countryside from inappropriate development. The Sustainable Community Strategy recognises that "We should make best use of the opportunities for economic development within our district without prejudice to our major employers or our environment and quality of life" with one of its five themes being to enhance conditions for business growth and sustainability.

2.46 In line with national guidance in the NPPF and the Staffordshire Moorlands Sustainable Community Strategy, Policy R1 sets out the criteria for economic, community and recreation development that the Council will be supportive of in rural locations and the need for such development not to have a detrimental impact on rural character or environmental quality.

2.47 Sustainable Development, Sustainability is generally defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It means recognising that our economy, the environment and social well-being are interdependent. It requires that we have strong local economies to create the wealth we need to provide for our social infrastructure but in ways that protect and improve the environment. In planning terms this means considering the effects of development in terms of any resource depletions, vehicular/pollution emissions etc, as to whether this can be sustained. Since development location is a factor in car/vehicle use (and vehicle emissions contribute to climate change) sometimes remote locations can be considered 'unsustainable', especially when there are no public transport options available.

Control Of Dust And Particulates Associated With Construction

2.48 Section 79 of the Environmental Protection Act (1990) states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as:

'Any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance', and
'any accumulation or deposit which is prejudicial to health or a nuisance'.

2.49 Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses. There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist – 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates. In the context of the proposed development, the main potential for nuisance of this nature will arise during the construction phase and this is assessed within this report.

3 BASELINE AND MODEL INPUTS

This section provides a summary of the local air quality to enable the assessment of impacts to be undertaken.

Description Of Site And Locality

3.1 The site is located at NGR 401850, 344440 (approximately) Cherry Ln, Cheadle, Stoke-on-Trent, Staffordshire ST10 4QS. The area immediately surrounding the site is rural/agricultural in nature. The closest residential receptor is adjacent to the site to the southern facility border.

Process Release Conditions

3.2 The facility is designed to operate on a largely unmanned basis, remotely operated by National Grid and MEB Ltd. The standby, diesel fuelled engines are to participate in the National Grid's capacity programme to provide stability to the National Grid during periods of high demand for electricity or where there are constraints on electricity available in England and Wales.

3.3 A reserve power plant such as this is expected to operate up to ca. 300 hrs per year, about 3.5% of the time, typically during the winter months. The latest National Grid Annual Short Term Operating Reserve (STOR) report indicates that the average running time for a STOR 'call' as 83 minutes and that 90% of these calls were for less than 3 hours in duration.

3.4 This air quality assessment assumes that the facility will operate for a maximum of 500 hours per year[13], which is considered to be a 'realistic worst case' scenario.

3.5 At the time of submission the design and layout of the Proposed Development has been fixed as shown in the site plans. However, the final choice of the generators has not been made.

3.6 Therefore an air quality assessment has been undertaken using the potential generator options available. The MEB Ltd facility at Cherry Barn, Cheadle will comprise of 5No. 0.4MWe diesel engines, for electricity generation that together will generate a total of 2.0MWe. Emissions to air will be via 5 No. engine exhausts of 8m in height, each serving a single engine.

3.7 The following process conditions supplied by MEB Ltd[14] presented in Table 3-5 were used to determine the pollutant emission rates and the physical parameter input for the dispersion modelling process.

[13] Telephone conversation MEB Ltd to Aerquality Ltd, 26th August 2016
[14] Email communication MEB Ltd to Aerquality Ltd, 12th July 2016

Table 3-5 Design Flow Rate

Parameter / Source	
Stack Location NGR (x,y)[15]	401841.7,344445.4; 401840.6,344448.0; 401839.7,344450.1; 401838.6,344452.1; 401837.6,344454.5
Stack Diameter (m) at Exit[16]	0.16
Stack Height (m)[17]	8
Emission Temperature (°K)[15]	797.15
Efflux velocity m.s^{-1} actual[18]	50
	Emission Rate (g.s^{-1})[19]
Oxides of nitrogen (NOx)	0.376
Carbon monoxide (CO)	0.049

Potentially Sensitive Receptors

3.8 The term 'sensitive receptors' includes any persons, locations or systems that may be susceptible to impact as a consequence of the facility.

Human Receptors

3.9 According to the LAQM TG(09), air quality standards should only apply to all locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant objective. Thus short term standards should apply to footpaths at site boundaries and other areas which may be frequented by the public even for a short period of time. Longer term standards, or annual means, should apply at houses, and other locations which the public can be expected to occupy on a continuous basis. These standards do not apply to exposure at the workplace.

3.10 The facility is also in proximity to residential areas (potentially long term sensitive receptors) located to the south. The closest residential property is adjacent to the southern facility border.

3.11 A 100m resolution receptor grid has been applied within the 2.5km x 2.5km study area, with discrete receptors located to include schools and residences. An additional high resolution 15m receptor grid was applied upon the apparent maxima zone to avoid the potential missing of peak ground concentrations. Specific identified discrete receptors are are presented in Table 3-6, and Appendix 1.

3.12 Whilst there are a number of sensitive receptors in the vicinity of the site, these discrete receptors are considered to be representative of sensitive locations around the site. Given that dispersion modelling has been completed using a 100m receptor grid/15m array, impact concentration for assessing impacts may effectively be determined at any location surrounding the site.

[15] Email communication MEB Ltd to Aerquality Ltd, 2nd September 2016

[16] Email communication MEB Ltd to Aerquality Ltd, 14th July 2016

[17] Telephone communication Aerquality Ltd to MEB Ltd, 6th September 2016

[18] Email communication MEB Ltd to Aerquality Ltd, 2nd September 2016

[19] Email communication MEB Ltd to Aerquality Ltd, 9th September 2016

Table 3-6 Identified Potentially Sensitive Human Receptors

	Receptor Reference/Description	Location (NGR) X	Location (NGR) Y	Distance (m) / Direction°	
A	Lockwood Hall Farm	402231	345393	1026	22
B	23 Lockwood Rd, Olde Thornbury Farm	402358	345243	950	32
C	Woodhouse Farm	402483	344803	730	60
D	Parkfields Farm	402340	344168	560	119
E	Cherry Lane Cottage	402293	343864	727	142
F	Hales Hall Farm	402137	344068	470	142
G	Hales Hall	402140	344032	501	145
H	Abbots Haye	402014	344182	306	148
I	Hales View Farm (Les Oaks&Sons residence)	402072	343723	751	163
J	Gibraltar	401880	343405	1035	178
K	Woodheadhall Farm	401862	344345	96	173
L	Broad Haye Farm	401441	344934	641	320
M	Cheadle Hospital	400755	342985	1821	217
N	Woodhouse Learning Disability Hospital	402619	344775	839	66
O	Church Terrace Nursing home	400547	343225	1781	227
P	Beech Lodge Nursing home	402075	342045	2406	175
Q	Bishop Rawle C Of E Aided Primary School	400648	343038	1846	221
R	Cheadle Primary School - Primary School	400927	342889	1805	211
S	St Giles Catholic Primary School	400857	343128	1646	217
T	Cheadle Methodist Nursery School	400936	343074	1644	214
U	Painsley Catholic College - School	400756	342626	2118	211
V	The Cheadle Academy - School	400558	342685	2180	216
W	St Werburghs C Of E Primary School	401362	346721	2332	348
X	The Tardis Surgery - Doctor	400997	343449	1308	221
Y	Allen Street Clinic - Medical Centre	401318	342981	1603	201
Z	Hague House Residential Home	401214	343536	1065	212
1	Harewood Park Nursing Home	400524	344221	1344	261

Table 3-7 Identified Sensitive Ecological Receptor Locations

Ref.	Receptor	NGR X	NGR Y	Dominant Habitat Habitat Type	Distance/ Direction from Site (m)	
ER1	Cecilly Brook (centre)	401452	343773	Neutral grassland - lowland	777	211
ER2	Hales Hall Pool (centre)	401761	343819	Standing Open Water and Canals- Arable & Horticultural	627	188

3.13 In accordance with AQTAG06, either discrete or array receptors have been used to represent these sensitive sites depending on their distance to the application site.

Specifically, a 10m interval linear array of receptors has been applied to the Cecilly Brook nature reserve, and a 10m grid array for Hales Hall Pool nature reserve as detailed above, as well as an additional approximate centroid.

Meteorological Conditions

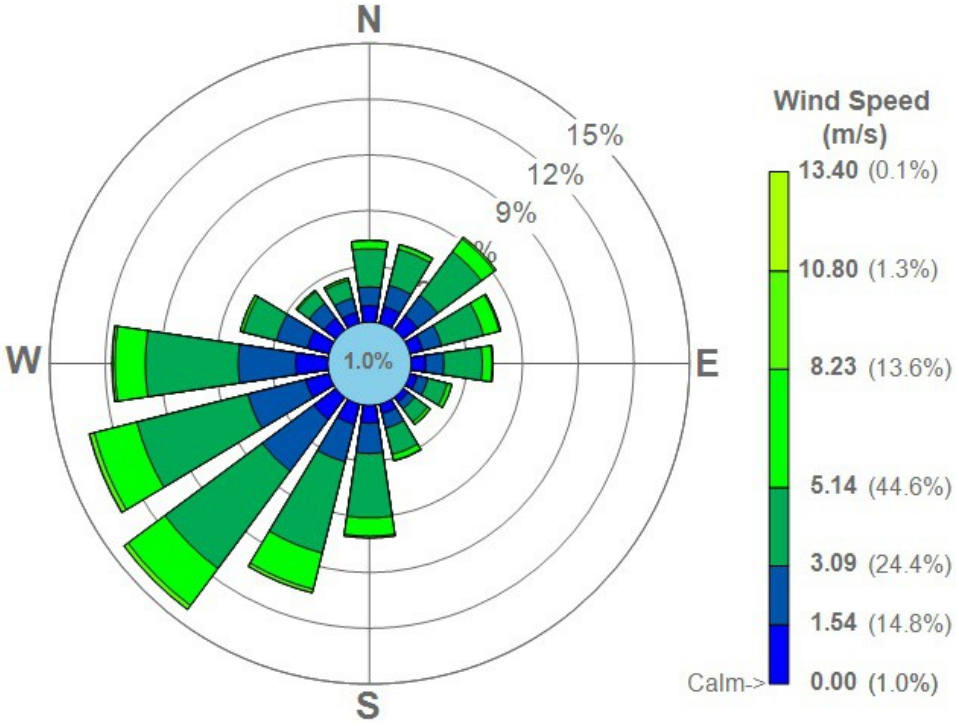
3.14 The most important meteorological parameters governing the atmospheric dispersion of pollutants are as follows:

- wind direction: determines the broad transport of the emission and the sector of the compass into which the emission is dispersed;
- wind speed: will affect ground level concentrations of emissions by increasing the initial dilution of pollutants in the emission; and
- atmospheric stability: is a measure of the turbulence, particularly of the vertical motions present.
- Advanced dispersion models use Monin-Obukhov lengths - a more advanced method of determining stability[20] than Pasquilll.

3.15 Nottingham meteorological station, located approximately 48km to the east of the application site, provided the most complete and representative data set for purposes of this assessment. A full data set was used for the dates 1st January 2011 to 31st December 2015 (inclusive).

3.16 A windrose for the Nottingham meteorological data for the period 2011 to 2015 (inclusive), providing the frequency of wind speed and direction, is presented in Figure 3-1.

Figure 3-1 Windrose for Nottingham Observing Station (2011 – 2015)



[20] Defined as: '*the height over the ground, where mechanically produced (by vertical shear) turbulence is in balance with the dissipative effect of negative buoyancy, thus where Richardson number equals to 1.*'

3.17 The meteorological data for Nottingham was obtained in .met format from the data supplier and converted to the required surface and profile formats for use in AERMOD using AERMET Pro (v7.7). Details specific to the exact site location were used for the conversion, such as latitude, longitude and surface characteristics in accordance with the latest guidance[21].

3.18 Given the varying nature of the surface features in around the proposed development site, the surface characteristics were divided into twelve sectors and applied as shown in Table 3-8.

Table 3-8 Applied Surface Characteristics

Zone	Albedo				Bowen				Roughness			
	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn
1	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.013	0.058	0.111	0.111
2	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.010	0.050	0.100	0.100
3	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.010	0.050	0.100	0.100
4	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.042	0.076	0.226	0.226
5	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.032	0.053	0.185	0.185
6	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.026	0.038	0.161	0.161
7	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.102	0.128	0.287	0.287
8	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.211	0.242	0.383	0.383
9	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.019	0.075	0.134	0.134
10	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.029	0.041	0.173	0.173
11	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.020	0.030	0.150	0.150
12	0.185	0.158	0.184	0.184	0.858	0.405	0.623	0.858	0.020	0.030	0.150	0.150

3.19 The predominant wind direction from the above windrose is from the south western quarter, approximately 57% of recorded winds, for all the years of data. The meteorological data has 429 calm hours identified (0.98%), and 118 (0.27% missing hours.

Topography

3.20 The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

3.21 The proposed facility is situated on a relatively flat 8km^2 area 160-200 AOD surrounding. The topography within the study area is of a similar 'plain and valley' nature, at 100-270 AOD for the surrounding 25km^2. These topographical features have been included within the dispersion model. Five years meteorological data was used in this assessment to comply with current EA modelling guidance. This accounts for inter-year variability in meteorological conditions.

[21] AERMOD Implementation guide. AERMOD implementation workgroup, USEAP. Last revised January 8, 2008.

Existing Local Sources

3.22 A summary of major industrial sources, within a 8km radius of the centre of the site coordinates 401850, 344440 (approx), is presented in Table 3-9[22]. The named industries represent potential sources of pollutants and/or dust that may impact on local background concentrations of pollutants and the amenity of the surround receptors.

Table 3-9 Sources Within 8km of The Facility

Operator	Type of Operation	Location (NGR)		Distance (m)/ Direction	
		x	y		
Johnson Matthey Plc, Cresswell	Glass And Glass Fibre	397735	339108	6735	218
Severn Trent Water Ltd, Checkley Stw	Sewage Treatment Works	403514	337621	7019	166

3.23 Emissions from these existing sources are considered to be included in the baseline ambient air quality data that has been applied and potential cumulative effects are therefore considered to have been included in the assessment.

Background Levels And Predictions

3.24 This section describes the existing baseline air quality in the region of the Cheadle Site.

Background Pollutant Mapping

3.25 The following 2019 background pollutant concentration data are presented in Table 3-10, for each receptor, and interpolated from the 1km x 1km spatial resolution grid provided by the 2013 UK National Air Quality Archive[23]. Background data of this type is routinely used to support EIAs and stand-alone air quality assessments.

3.26 The conversion factor of 10, between short term and long term CO, is based on typical observed ratios. Annual 2001 CO background levels for the site location were projected to first full year of operation using TG09 methodology.

[22] http://maps.environment-agency.gov.uk/
[23] http://www.airquality.co.uk/archive/laqm/laqm.php

Table 3-10 Predicted 2019 Background Pollutant Levels

Receptor	UK NGR		Annual Mean (µg/m³)			Short Term Mean (µg/m³)				
			NOx	NO_2	CO	NOx 1hr	NOx 24hr	NO_2 1hr	CO 1hr	CO 8hr
	X	Y								
Cherry Barn Facility	401850	344440	13.68	10.05	121.82	27.36	16.14	20.09	1218.2	852.8
A	402231	345393	13.27	9.77	121.16	26.53	15.65	19.53	1211.6	848.1
B	402358	345243	13.14	9.68	120.07	26.27	15.50	19.35	1200.7	840.5
C	402483	344803	13.14	9.68	120.07	26.27	15.50	19.35	1200.7	840.5
D	402340	344168	13.23	9.74	120.94	26.45	15.61	19.48	1209.4	846.6
E	402293	343864	13.23	9.74	120.94	26.45	15.61	19.48	1209.4	846.6
F	402137	344068	14.20	10.39	122.37	28.40	16.76	20.78	1223.7	856.6
G	402140	344032	14.20	10.39	122.37	28.40	16.76	20.78	1223.7	856.6
H	402014	344182	14.20	10.39	122.37	28.40	16.76	20.78	1223.7	856.6
I	402072	343723	14.72	10.73	122.92	29.44	17.37	21.47	1229.2	860.4
J	401880	343405	14.72	10.73	122.92	29.44	17.37	21.47	1229.2	860.4
K	401862	344345	13.68	10.05	121.82	27.36	16.14	20.09	1218.2	852.8
L	401441	344934	13.81	10.13	122.92	27.62	16.29	20.27	1229.2	860.4
M	400755	342985	15.21	11.07	126.21	30.42	17.95	22.15	1262.1	883.5
N	402619	344775	13.14	9.68	120.07	26.27	15.50	19.35	1200.7	840.5
O	400547	343225	15.24	11.10	127.53	30.48	17.98	22.20	1275.3	892.7
P	402075	342045	13.52	9.95	124.24	27.05	15.96	19.90	1242.4	869.7
Q	400648	343038	15.24	11.10	127.53	30.48	17.98	22.20	1275.3	892.7
R	400927	342889	15.21	11.07	126.21	30.42	17.95	22.15	1262.1	883.5
S	400857	343128	15.21	11.07	126.21	30.42	17.95	22.15	1262.1	883.5
T	400936	343074	15.21	11.07	126.21	30.42	17.95	22.15	1262.1	883.5
U	400756	342626	14.53	10.62	126.87	29.05	17.14	21.24	1268.7	888.1
V	400558	342685	14.98	10.93	128.19	29.96	17.68	21.85	1281.9	897.3
W	401362	346721	13.47	9.90	120.29	26.93	15.89	19.81	1202.9	842.0
X	400997	343449	15.89	11.52	125.55	31.79	18.75	23.05	1255.5	878.9
Y	401318	342981	15.18	11.05	124.24	30.36	17.91	22.09	1242.4	869.7
Z	401214	343536	16.29	11.77	124.24	32.58	19.22	23.55	1242.4	869.7
1	400524	344221	15.20	11.07	126.43	30.40	17.94	22.14	1264.3	885.0
ER1	401452	343773	15.17	11.04	123.80	30.35	17.91	22.08	1238.0	866.6
ER2	401761	343819	14.20	10.39	122.37	28.40	16.76	20.78	1223.7	856.6

Applied Environmental Assessment Level Concentrations

3.27 Background concentrations in Table 3-10 have been applied.

Table 3-11 Applied Environmental Assessment Level Concentrations

Species	Averaging Period[24]	Air Quality Objectives (AQO) (µg/m³)	Data Source
CO	8-hour (max. daily running average)	$1.00 \times 10^{+04}$	UK/EU AQS
CO	1 hour	$3.00 \times 10^{+04}$	H1
NO_2	Annual	$4.00 \times 10^{+01}$	
NO_2	1-hour (99.79th percentile)	$2.00 \times 10^{+02}$	

[24] Short term concentrations are derived from the annual mean by multiplying by 2 to generate an hourly mean and then applying a correction factor to generate other averaging periods (e.g.1.34 for 15 min mean, 0.7 for 8hr and 0.59 for 24 hr means)

Applied Critical Levels And Critical Loads

3.28 To assess the impact from the installation at the identified ecological receptors, discrete receptors were located within each SSSI as recommended in AQTAG06. The location of the discrete receptors was then used alongside the citation of the SSSI to obtain the existing critical level of NO_x, critical loads (and current loads) of nitrogen and acid deposition from the UK Air Pollution Information System (www.apis.ac.uk) as summarised in Table 3-12 to Table 3-14.

Table 3-12 Nitrogen Oxide Critical Load and Current Level

Ref.	Receptor	Habitat Type[25]	Critical Level[26]	Current Nitrogen Oxide µg/m^3 (as NO_2)[27]	Exceedance
ER1	Cecilly Brook (centre)	Neutral grassland - lowland	30	17.7[28]	-12.3
ER2	Hales Hall Pool (centre)	Standing Open Water and Canals (arable and horticultural)	30	17.7	-12.3

Table 3-13 Acid Deposition Critical Load and Current Level (keq/ha/yr)

Ref.	Receptor	Acid Deposition (keq/ha/yr) Critical Load	Current Level[29]
ER1	Neutral Grassland (Calcareous grassland (using base cation)	CLmaxS: 4.03 CLminN: 0.85 CLmaxN: 4.89	1.94 (N: 1.75 | S: 0.4)
ER2	Standing Open Water and Canals (Arable and Horticultural)	This habitat is not sensitive to acidity	1.94 (N: 1.75 | S: 0.4)

Table 3-14 Nitrogen Deposition Critical Load and Current Level

Ref.	Receptor	Nitrogen Deposition (N/ha/yr) Critical Load	Current Level[30]
ER1	Neutral Grassland	20-30	24.5
ER2	Standing Open Water and Canals (Arable and Horticultural)	No comparable habitat with established critical load estimate available [24.5] Kg N/ha/year	24.5

25 Where habitat designations are not detailed on the APIS resource, the most suitable APIS designation has been applied

26 Established by: Working Group on Effects of the UNECE Convention on Long Range Transboundary Air Pollution

27 Critical levels (CL) of Nitrogen Oxides and Sulphur dioxide, are 30 and 20 respectively

28 Data Year: 2012 - 2014

29 Data Year: 2012 - 2014

30 Data Year: 2012 - 2014

Habitat Descriptions[31,32]

3.29 Hales Hall Pool; the most obvious plants are the Greater Tussock Sedge and Lesser Reedmace. Tussock Sedge forms bushy rounded tufts about 0.5m to 1m high. Lesser Reedmace is now rare in this county and is similar to its relative the more commonly known bulrush. The site hosts a number of waterfowl that include Moorhen, Coot, Great-crested grebe, Reed-bunting, Mute swans and Mallard duck. During the summer months dragonflies and damselflies are also present at the site.

3.30 Cecilly Brook is essentially a linear feature orientation south to north close to the proposed development. The site follows a 1.25 km stretch of Cecilly Brook through Cheadle and is one of the most important sites for water voles in Staffordshire. Ancient flower rich meadows occur at Thorley Drive adjacent to Cecilly Brook and are of county importance for their flora. Mature hawthorn-blackthorn hedges surround the fields with dog rose, elder and hazel. Ivy and honeysuckle provide rich nectar sources for invertebrates.

31 http://www.lnr.naturalengland.org.uk/special/lnr/lnr_details.asp?themeid=1009378
32 http://www.lnr.naturalengland.org.uk/special/lnr/lnr_details.asp?themeid=1009902

4 METHODOLOGY AND APPROACH

This chapter provides information relating to methods used in this assessment. The methodologies used are consistent with the source literature and regulations detailed in Section 2 of this assessment.

Detailed Atmospheric Dispersion Modelling

4.1 Detailed atmospheric dispersion modelling has been undertaken with due consideration to relevant guidance[33] [34] , and the modelling approach is based upon the following stages:

- Identification of sensitive receptors;
- Review of emissions from other existing and local industrial sources;
- Review of process design proposals and emission sources;
- Calculation of process contribution to ground level concentrations and deposition for key pollutants emitted from the process.

4.2 The AERMOD[35] dispersion modelling program has been applied in this assessment and it is widely used and accepted by the Environment Agency in the UK for undertaking such assessments and its predictions have been validated against real-time monitoring data by the USEPA[36].

4.3 To ensure that representative operational situations have been assessed, the model has been set up to assume the operation of the plant for the entire year, however the long term emissions have been reduced by a factor of 17.5 in order that the same total mass emission is released, that would be the case for only 5.7% of the year (500 hours).

4.4 Manufacturer emission concentrations have been assumed for the purposes of the modelling assessment and the plant is assumed to be operating at full load for the following scenarios:

- For the entire year (8765 hours per year) for short term 1 hour impacts as these rely on a maximum value rather than average over the period;
- For 5.7% of the entire year (500 hours per year) for annual average impacts.

Nitric Oxide To NO_2 Conversion

4.5 Oxides of nitrogen (NO_x) emitted to atmosphere as a result of combustion will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, NO is oxidised to Nitrogen Dioxide (NO_2). The proportion of NO converted to NO_2 depends on a number of factors including wind

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33 Air Dispersion modelling report requirements (for detailed air dispersion modelling). AQMAU, Environment Agency (not dated)

34 Guidelines for the Preparation of Dispersion Modelling Assessment for Compliance with Regulatory Requirements – an update to the 1995 Royal Meteorological Society guidance. UK Atmospheric Dispersion Modelling Committee (ADMLC), Version 1.4, 2004

35 Breeze AERMOD version 7.10

36 AERMOD: Latest Features and Evaluation Results. USEPA Report: EPA-454/R-03-003 June 2003

speed, distance from the source, solar radiation and the availability of oxidants, such as ozone (O_3).

4.6 Following the recent Environment Agency and DEFRA guidance[37] on conversion ratio for NO_x and NO_2 a worst case scenario has been applied in that 50% of NO_x is presented as NO_2 in relation to short term impacts and 100% of NO_x is present as NO_2 in relation to long term impacts.

Assessment Of Impacts On Air Quality

4.7 The significance of impacts from industrial sources on air quality is determined using H1 methodology which states that 'process contribution' (PC) can be considered insignificant if:

- The long term process contribution is <1% of the long term environmental standard;
- The short term process contribution is <10% of the short term environmental standard.

4.8 On this basis the PC is described as either 'insignificant' or 'not insignificant'.

4.9 Where impacts are not classified as 'not insignificant', consideration of the resultant Predicted Environmental Concentration (PEC) as a percentage of the applied limit value is required. The PEC is then used to identify whether the emission is 'potentially significant' as follows:

- [Maximum Process Contribution (long term) + background concentration] ≥ 70% of the Environmental Assessment Level; or
- [Maximum Process Contribution (short term) + 0.2 * background concentration] ≥ 20% Environmental Assessment Level.

4.10 The H1 guidance indicates that impacts are likely to be considered to be unacceptable where significant breaches (or significant addition to an existing breach) of the EAL's occur as a result of the impact from the facility.

Assessment Of Impacts On Habitats

4.11 The Environment Agency's Operational Instruction 66_12[38] details how the air quality impacts on ecological sites should be assessed. This guidance provides risk based screening criteria to determine whether impacts will have 'no likely significant effects (alone and in-combination)'. In order for the proposal to be insignificant they will need to demonstrate that the following:

- PC <1% long-term critical level and/or load or that the PEC <70% long-term critical level and/or load for European sites and SSSIs;
- PC <10% short-term critical level for NO_x and HF (if applicable) for European sites and SSSIs;

[37] Air emissions risk assessment for your environmental permit, Environment Agency and Department for Environment, Food & Rural Affairs, 2 August 2016

[38] Operational Instruction 66_12 Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated Industry for impacts on nature conservation. Environment Agency (2012)

- PC <100% long-term critical level and/or load other conservation sites;
- PC <100% short-term critical level for NO_x and HF (if applicable) for other conservation sites.

4.12 Where impacts cannot be classified as resulting in 'no likely significant effect' more detailed assessment may be required depending on the sensitivity of the feature in accordance with The Environment Agency's Operational Instruction 67_12[39]. This can require the consideration of the potential for in-combination effects on the sensitive features within the site.
The guidance provides the following further criteria:

- If the PEC<100% of the appropriate limit it can be assumed there will be no adverse effect;
- If the background is below the limit, but a small PC leads to an exceedance – decision based on local considerations;
- If the background is currently above the limit and the additional PC will cause a small increase – decision based on local considerations;
- If the background is below the limit, but a significant PC leads to an exceedance – cannot conclude no adverse effect;
- If the background is currently above the limit and the additional PC is large - cannot conclude no adverse effect.

Critical Levels

4.13 Critical levels are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Critical levels for the protection of vegetation and ecosystems are specified within relevant European air quality directives and corresponding UK air quality regulations.

4.14 For all European sites, SSSIs and other ecological sites in the study area process contributions (and predicted environmental concentrations where required) of NO_x , have been calculated for comparison against critical level thresholds.

Critical Loads

4.15 Critical loads are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. In relation to combustion emissions critical loads for eutrophication and acidification are relevant which can occur via both wet and dry deposition, however on a local scale only dry (direct deposition) is considered significant.

4.16 Empirical critical loads associated with each sensitive ecosystems as derived from the UK Air Pollution Information System (APIS) website (www.apis.ac.uk/) are set for the deposition of various substances based upon a range of experimental studies. Predicted contributions to acid deposition and nitrogen deposition have

[39] Environment Agency (2012b) Operational Instruction 67_12 Detailed assessment of the impact of aerial emissions from new and expanding IPPC regulated industry for impacts on nature conservation

been calculated and compared with the relevant critical load range for the habitat types.

4.17 Deposition rates were calculated using dispersion modelling results processed by following empirical methods recommended by the Environment Agency in AQTAG06[40].

Calculation of Contribution to Critical Loads

4.18 Deposition rates were calculated using empirical methods recommended by the Environment Agency (AQTAG06), as described below. Calculate dry deposition flux using the following equation:

Dry deposition flux (µg/m²/s) = ground level concentration (µg/m³) x deposition velocity (m/s)

The applied deposition velocities for various chemical species are as shown in Table 4-16.

Table 4-15 Applied Deposition Velocities[41]

Chemical Species	Recommended Deposition Velocity (m/s)	
NO_2	Grassland	0.0015
	Woodland	0.003
SO_2	Grassland	0.012
	Woodland	0.024
NH_3	Grassland	0.02
	Woodland	0.03

4.19 The units are then converted from µg/m²/s to units of kg/ha/year by multiplying the dry deposition flux by standard conversion factors as summarised in Table 4-15.

Table 4-16 Applied Deposition Conversion Factors

Chemical Species		Conversion Factor [µg/m²/s to kg/ha/year]
NO_2	of N:	96
SO_2	of S:	157.7
NH_3	of N:	259.7

4.20 Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow, and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

Critical Loads – Eutrophication

4.21 The contribution to critical loads for Nitrogen deposition presented in Table 5-22 are recorded as KgN/ha/yr.

[40] AQTAG06: Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air. Status: Final for implementation (08/11/12)

[41] Environment Agency SNIFFER AQ02: Source attribution and critical loads assessment February, 2007

Critical Loads – Acidification

4.22 The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by dividing the dry deposition flux (kg/ha/year) by standard conversion factors as presented in Table 4-17.

Table 4-17 Applied Acidification Conversion Factors

Chemical Species	Conversion Factor [kg/ha/year to keq/ha/year]
of N:	divide by 14
of S:	divide by 16

4.23 The predicted dry N and S deposition (keq/ha/year) are summed to determine total acid deposition.

Calculation of PC as a percentage of Acid Critical Load Function

4.24 The calculation of the process contribution of N and S to the critical load function has been carried out according to the guidance on APIS, which is as follows:

'The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than $CL_{min}N$ will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less that $CL_{min}N$ only the acidifying affects of sulphur from the process need to be considered:

- *Where PEC N Deposition < $Cl_{min}N$; PC as % CL function = (PC S deposition/$CL_{max}S$)*100*
- *Where PEC is greater than $CL_{min}N$ (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the $CL_{max}N$.*
- *Where PEC N Deposition > $Cl_{min}N$; PC as %CL function = ((PC of S+N deposition)/$CL_{max}N$)*100*'

5 ASSESSMENT OF IMPACTS

This section contains assessment of air quality impacts, followed by mitigation if appropriate, and any further actions if required.

5.1 There are a number of sources of emissions to air in the area surrounding the application site; predominately these are associated with traffic, domestic, small industrial and agricultural sources within the local area. The local area has very few larger industries that have the potential for combined effects on air quality with atmospheric emissions from the facility and are detailed in Table 3-9 Sources Within 8km of The Facility.

Model Results

5.2 For the purposes of the dispersion modelling of emission (i.e. process contribution) from the Cherry Barn stack; one scenario has been defined.

Building Downwash

5.3 The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations.

5.4 Building downwash should always be considered for buildings that have a maximum height equivalent to at least 40% of the emission height, and which within a distance defined as five times the lesser of the height or maximum projected width of the building.

5.5 The engine container is 2.3m in height to the top of the radiators and have been included in the dispersion model to account for potential downwash effects. All other site buildings within 5 stack heights are lower than 40% of the stack and are therefore not relevant to the model.

Detailed Modelling - Short Term Impacts Air Quality Impacts

5.6 The Short Term (1 hour, 8-hour and 24 hour) process contributions are presented in Table 5-18.

Table 5-18 Short Term Results All Locations

	Averaging	Coordinates X	Coordinates Y	PC Max (µg/m^3)	*% of EAL*	*Back-ground*	PEC (µg/m^3)	PEC % of EAL
NO_2	1-hr (99.79th %ile)	401890	344490	156.0	78.0%	20.1	176.1	88.1%
CO	1 hour	402175	344250	54.5	0.18%	1218.2	1272.7	4.24%
CO	8-hr rolling average	401905	344505	22.2	0.22%	852.8	875.0	8.75%

5.7 The contributions for carbon monoxide remain below 10% for all points and can therefore be considered insignificant.

5.8 As shown in Table 5-18, although the PC for NO_2, is greater than 10% as a worst case scenario, the PEC is well below 100% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution.

5.9 Further detail has been provided in Table 5-19 for discrete receptors. The PC +0.2* background is not below 20% of the EAL, therefore the emission is 'potentially significant'.

Table 5-19 Scenario 1: Short Term Results NO_2

Receptor/D	UK NGR		1-hr (99.79th %ile) (µg/m^3)				
	X	Y	PC Max (µg/m^3)	% of EAL	Background	PC+0.2* Background (µg/m^3)	% of EAL
A	402231	345393	34.3	17.2%	19.53	38.2	19.1%
B	402358	345243	48.6	24.3%	19.35	52.5	26.2%
C	402483	344803	86.9	43.4%	19.35	90.7	45.4%
D	402340	344168	111.5	55.8%	19.48	115.4	57.7%
E	402293	343864	23.8	11.9%	19.48	27.7	13.8%
F	402137	344068	45.0	22.5%	20.78	49.2	24.6%
G	402140	344032	36.3	18.2%	20.78	40.5	20.2%
H	402014	344182	51.7	25.8%	20.78	55.8	27.9%
I	402072	343723	24.7	12.4%	21.47	29.0	14.5%
J	401880	343405	19.4	9.7%	21.47	23.7	11.9%
K	401862	344345	102.3	51.1%	20.09	106.3	53.1%
L	401441	344934	26.7	13.4%	20.27	30.8	15.4%
M	400755	342985	13.4	6.7%	22.15	17.8	8.9%
N	402619	344775	73.5	36.8%	19.35	77.4	38.7%
O	400547	343225	14.5	7.2%	22.20	18.9	9.5%
P	402075	342045	11.7	5.9%	19.90	15.7	7.8%
Q	400648	343038	15.0	7.5%	22.20	19.4	9.7%
R	400927	342889	11.6	5.8%	22.15	16.0	8.0%
S	400857	343128	15.3	7.6%	22.15	19.7	9.8%
T	400936	343074	13.5	6.7%	22.15	17.9	8.9%
U	400756	342626	10.8	5.4%	21.24	15.0	7.5%
V	400558	342685	10.5	5.2%	21.85	14.8	7.4%
W	401362	346721	12.1	6.0%	19.81	16.0	8.0%
X	400997	343449	19.2	9.6%	23.05	23.8	11.9%
Y	401318	342981	13.6	6.8%	22.09	18.0	9.0%
Z	401214	343536	19.9	9.9%	23.55	24.6	12.3%
1	400524	344221	14.8	7.4%	22.14	19.2	9.6%

Detailed Modelling - Long Term Impacts Air Quality Impacts

5.10 Annual levels have been modelled for all points within the study area shown in Table 5-20.

Table 5-20 Long Term Annual Results All Locations

Species	Coordinates		PC Max (µg/m^3)	% EAL (µg/m^3)	Background	PEC (µg/m^3)	PEC % of EAL
	X	Y					
NO_2	401905	344520	1.55	3.9%	10.05	11.60	29.0%

5.11 As shown in Table 5-20, although the PC for NO_2, is greater than 1% as a worst case scenario, the PEC is well below 70% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution.

5.12 Further detail has been provided in Table 5-21 for discrete receptors, however progression to a detailed assessment for emissions is not required. The PC for NO_2, is less than 1% as a worst case scenario at all receptor points, and can therefore be considered insignificant. The PEC is also well below 70% of the EAL

Table 5-21 Scenario 1: Five Engines, Long Term Results NO_2

	X	Y	PC Max (µg/m^3)	*% of EAL*	Background	PEC (µg/m^3)	PEC % of EAL
A	402231	345393	0.09	0.23%	9.77	9.9	24.6%
B	402358	345243	0.14	0.35%	9.68	9.8	24.5%
C	402483	344803	0.28	0.70%	9.68	10.0	24.9%
D	402340	344168	0.18	0.44%	9.74	9.9	24.8%
E	402293	343864	0.04	0.10%	9.74	9.8	24.5%
F	402137	344068	0.08	0.21%	10.39	10.5	26.2%
G	402140	344032	0.07	0.18%	10.39	10.5	26.2%
H	402014	344182	0.12	0.30%	10.39	10.5	26.3%
I	402072	343723	0.04	0.09%	10.73	10.8	26.9%
J	401880	343405	0.03	0.07%	10.73	10.8	26.9%
K	401862	344345	0.25	0.63%	10.05	10.3	25.7%
L	401441	344934	0.05	0.13%	10.13	10.2	25.5%
M	400755	342985	0.03	0.08%	11.07	11.1	27.8%
N	402619	344775	0.25	0.62%	9.68	9.9	24.8%
O	400547	343225	0.04	0.09%	11.10	11.1	27.8%
P	402075	342045	0.01	0.03%	9.95	10.0	24.9%
Q	400648	343038	0.03	0.09%	11.10	11.1	27.8%
R	400927	342889	0.02	0.06%	11.07	11.1	27.7%
S	400857	343128	0.04	0.09%	11.07	11.1	27.8%
T	400936	343074	0.03	0.08%	11.07	11.1	27.8%
U	400756	342626	0.02	0.05%	10.62	10.6	26.6%
V	400558	342685	0.02	0.06%	10.93	10.9	27.4%
W	401362	346721	0.02	0.04%	9.90	9.9	24.8%
X	400997	343449	0.05	0.13%	11.52	11.6	28.9%
Y	401318	342981	0.03	0.07%	11.05	11.1	27.7%
Z	401214	343536	0.05	0.13%	11.77	11.8	29.6%
1	400524	344221	0.02	0.05%	11.07	11.1	27.7%

Detailed Modelling - Impacts At Ecological Receptors

5.13 The annual process contribution for nitrogen oxides contribution to critical levels the protection of ecosystems and vegetation is presented in Table 5-22.

5.14 As shown in Table 5-22, although the PC for nitrogen oxides (as NO_2) are greater than 10% short term, as a worst case scenario, the PEC is well below 100% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution. The long term PC for NO_2, is less than 1% as a worst case scenario at all receptor points,

and can therefore be considered insignificant. The long term PEC is also well below 100% of the EAL.

Table 5-22 Critical Levels For The Protection of Ecosystems and Vegetation

Location	Species	Averaging	PC Max ($\mu g/m^3$)	Air Quality Objectives (AQO) ($\mu g/m^3$)	% EAL	Back-ground	PEC	% PEC of EAL
ER1 Cecilly Brook	Nitrogen oxides (as NO_2)	Daily	24.46	75	32.62%	17.91	42.37	56.49%
		Annual	0.08	30	0.26%	15.17	15.25	28.50%
ER2 Hales Hall Pool	Nitrogen oxides (as NO_2)	Daily	31.45	75	41.93%	16.76	48.21	64.28%
		Annual	0.07	30	0.24%	14.20	14.27	28.50%

Depositional Modelling

5.15 Calculations of the deposition of nitrogen as a result of emissions from the facility are presented below. The results presented are based on the following conservative assumptions:

- Impacts are based on the maximum predicted impact within each designated site, whereas actual impacts will vary across the site; and
- All habitat types are considered to be present at the point of maximum impact within the designated site.

Table 5-23 Nitrogen Oxide Critical Load and Current Level (keq/ha/yr)

Ref.	EAL/Critical Level	PC Max ($\mu g/m^3$)	%EAL/Critical Level	APIS Back-ground	PEC	% PEC of EAL
ER1	20	0.008	0.04%	24.5	24.508	122.5%
ER2	24.50	0.018	0.07%	24.5	24.518	100.07%

5.16 The annual process contribution for nitrogen oxide critical load and current level is presented in Table 5-23. The contribution remains below 1% at the SSSI and PEC below 100%, EAL and can therefore be considered insignificant.

Table 5-24 Acid Depositional Critical Load and Current Level (keq/ha/yr)

Ref.	EAL/Critical Level	PC Max ($\mu g/m^3$)	%EAL/Critical Level	APIS Back-ground	PEC	% PEC of EAL
ER1	4.89	0.002	0.04%	1.94	1.94	39.7%
ER2	-	0.011	-	1.94	1.95	-

5.17 The annual process contribution for acid depositional critical load and current level is presented in Table 5-24. The contribution remains below 1% at the SSSI, and the PEC below 100%, and can therefore be considered insignificant.

Table 5-25 Nitrogen Depositional Critical Load and Current Level (keq/ha/yr)

Ref.	EAL/Critical Level	PC Max ($\mu g/m^3$)	%EAL/Critical Level	APIS Back-ground	PEC	% PEC of EAL
ER1	20	0.012	0.06%	24.5	24.51	122.6%
ER2	24.50	0.064	0.26%	24.5	24.56	100.26%

5.18 The annual process contribution for nitrogen depositional critical load and current level is presented in Table 5-25. The contribution remains below 1% at the SSSI and the PEC is below 100% of the EAL, and can therefore be considered insignificant.

Cumulative Effects

5.19 There are a number of sources of emissions to air in the area surrounding the application site; predominately these are associated with traffic, domestic, small industrial and agricultural sources within the area. Cheadle Staffordshire has a few larger industries that have the potential for combined effects on air quality with atmospheric emissions from the Cherry Barn facility and are detailed in Table 3-9 Sources Within 8km of The Facility.

6 CONCLUSIONS

6.1 For all points, the short term Process Contributions for carbon monoxide remain below 10% for all points, and can therefore be considered insignificant.

6.2 For all points, although the short term Process Contributions for NO_2 are greater than 10%, as a worst case scenario, the Predicted Environmental Concentration (PEC) is well below 100% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution.

6.3 For discrete receptors, the short term (1 hour NO_2) 'Process Contributions +0.2* background' is not below 20% of the EAL, therefore the emission is 'potentially significant'.

6.4 For all points, although the long term Process Contributions for NO_2, is greater than 1% as a worst case scenario, the PEC is well below 100% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution.

6.5 For discrete receptors, the long term Process Contributions for NO_2, is less than 1%, as a worst case scenario, at all receptor points, and can therefore be considered insignificant. The PEC is also well below 70% of the EAL.

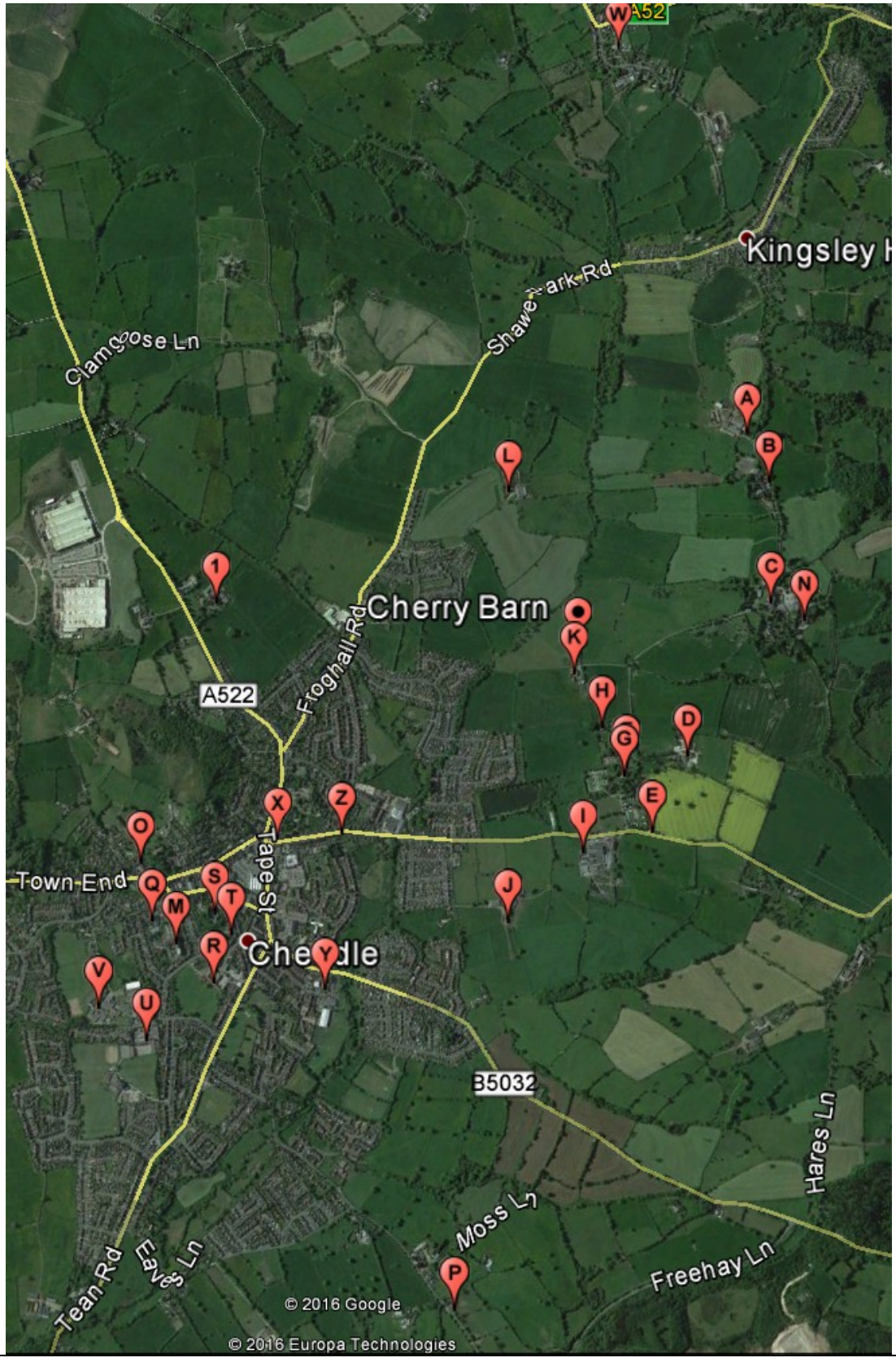
6.6 For all points, the annual process contribution for nitrogen oxides contribution to the protection of ecosystems and vegetation are less than 1% long term, as a worst case scenario, and can therefore be considered insignificant.

6.7 For all points, the short process contribution for nitrogen oxides contribution to critical levels for the protection of ecosystems and vegetation are greater than 10% short term, as a worst case scenario, however the PEC is well below 100% of the EAL. As such it is considered that, even when taking likely modelling uncertainties into account, there is little potential for significant pollution.

6.8 For all ecological receptors, the annual process contribution for nitrogen oxide, acid and nitrogen depositional are all less than the relevant 1% Critical Levels. Where PEC of EAL is greater than 100% of the EAL this is as a result that the predicted deposition already exceeds the appropriate EAL at the location. The background is currently above the limit and the additional PC will cause a small increase the would be decision based on local considerations.



Appendix 1



Aerquality

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Project : Cherry Barn, Cheadle

Client: MEB Ltd

Drawing Title: Human Receptor Locations

Drawing No: 139.001/Fig.1

Project No.: 139.001

Date: September 2016



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