Permit Variation

Meggitt, Holbrook Lane, Coventry

For Meggitt

Quality Management			
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Contents

Tables, Figures and Appendices

Tables

Figures

Appendices

1 Introduction

1.1 This report details the air quality assessment undertaken to accompany the application to vary the environmental permit for the Meggitt, Coventry site.

1.2 The assessment covers an evaluation of the impacts on the local area of emissions from the proposed sources and existing stacks operated on the site. The proposed sources comprise:

- 1 x SECO Oven;
- 3 x spray booths; and
- 5 x dust control extraction units.

1.3 The assessment also considers the effects of the proposed spray booths and SECO Oven on the surrounding area in the context of odour. The odour assessment has been undertaken in accordance with the Institute of Air Quality Management (IAQM) *Guidance on the Assessment of Odour for Planning* (2018) methodology [1], drawing on the evidence of multiple best-practice investigative tools. The IAQM odour guidance states that using different assessment tools in combination can *"minimise individual limitations and increase confidence in the overall conclusion. Best practice is to use a multi-tool approach where practicable."* The spray booths and SECO Oven are not yet in operation; therefore, a combination of predictive assessment tools (qualitative risk-based assessment and odour modelling) has been used to evaluate the operational effects of the spray booths and SECO Oven.

1.4 This report begins by setting out the policy and legislative context for the assessment. The methods and criteria used to assess potential air quality effects have then been described. The baseline air quality conditions have been established taking into account Defra estimates. The results of the assessment of air quality impacts have been presented. A conclusion has been drawn on the significance of the residual effects.

2 Policy and Legislative Context

Environmental Permitting Regulations

2.1 EU Directive 96/61/EC concerning Integrated Pollution Prevention and Control ("the IPPC Directive") [2] applies an integrated environmental approach to the regulation of certain industrial activities. The Environmental Permitting Regulations (EPR) 2016 [3] implement the IPPC Directive relating to installations in England and Wales. The Regulations define activities that require an Environmental Permit from the Environment Agency (EA).

2.2 EPR is a regulatory system that employs an integrated approach to control the environmental impacts of certain listed industrial activities. The intention of the regulatory system is to ensure that Best Available Techniques (BAT), required by the IPPC Directive, are used to prevent or minimise the effects of an activity on the environment, having regard to the effects of emissions to air, land and water via a single permitting process.

2.3 To gain a permit, Operators have to demonstrate in their applications, in a systematic way, that the techniques they are using or are proposing to use are the BAT for their installation and meet certain other requirements taking account of relevant local factors. The permitting process also places a duty on the regulating body to ensure that the requirements of the Industrial Emissions Directive (IED) are included for permitted sites to which these apply.

2.4 The essence of BAT is that the techniques selected to protect the environment should achieve a high degree of protection of people and the environment taken as a whole. Indicative BAT standards are laid out in national guidance and where relevant, should be applied unless a different standard can be justified for a particular installation. The EA is legally obliged to go beyond BAT requirements where EU Air Quality Limit Values may be exceeded by an existing operator.

2.5 The EA's on-line guidance entitled '*Environmental management – guidance, Air emissions risk assessment for your environmental permit*' [4] provides guidelines for air dispersion modelling. The assessment of air quality effects for the proposed development is consistent with this guidance.

Nuisance Provisions

2.6 Part III of the Environmental Protection Act 1990 defines a number of statutory nuisances and includes: *"any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance"*. The Act places a duty on local authorities to investigate the likely occurrence of statutory nuisance and to take reasonable steps to investigate local complaints. Where a local authority is satisfied of the existence or recurrence of statutory nuisance it must generally serve an abatement notice requiring the execution of such works and other steps necessary to rectify the nuisance. If ignored, this can result in proceedings in the Magistrates Court and imposition of an order to prevent the nuisance and a fine. The Act provides a defence for the operator to demonstrate that the Best Practicable Means (BPM) have been used to control potential nuisance. For a nuisance action to succeed the offence also has to be a cause of material harm or to be persistent or likely to recur.

2.7 The above statutory nuisance controls apply mainly to odour from premises not regulated under other specific environmental regulations, such as the Environmental Permitting Regulations (EPR). Indeed, a local authority requires the consent of the Secretary of State to institute statutory nuisance proceedings arising from operation of a “regulated facility” (including a waste operation, a Part A(1), Part A(2) or Part B EPR installation, mobile plant or mining operation); or an “exempt waste operation”. This is designed to avoid the operators of such regulated facilities or exempt waste operations being exposed to action by both the Environment Agency and the local authority for the same incident (i.e. to avoid “double jeopardy”) [5].

2.8 It is important to note that there is no numerical odour concentration limit that can indicate unequivocally whether a statutory (or other) nuisance is being caused and it is ultimately only the Court that can decide at what point it becomes “prejudicial to health or a nuisance” and whether a statutory nuisance is occurring.

The Ambient Air Quality Directive and Air Quality Standards Regulations

2.9 The 2008 Ambient Air Quality Directive (2008/50/EC) [6] aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants; it sets legally binding concentration-based limit values, as well as target values. There are also information and alert thresholds for reporting purposes. These are to be achieved for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. This Directive replaced most of the previous EU air quality legislation and in England was transposed into domestic law by the Air Quality Standards (England) Regulations 2010 [7], which in addition incorporates the 4th Air Quality Daughter Directive (2004/107/EC) that sets targets for ambient air concentrations of certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs). Member states must comply with the limit values (which are legally binding on the Secretary of State) and the Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values. The statutory air quality limit value relevant to this assessment is summarised in Table 2.1.

Table 2.1 Statutory Air Quality Limit Values

Pollutant	Averaging Period	Limit Values	Not to be Exceeded More Than
Nitrogen Dioxide (NO_2)	1 hour	200 $\mu g.m^{-3}$	18 times pcy
	Annual	40 $\mu g.m^{-3}$	-
Particulate Matter (PM_{10})	24 hour	50 $\mu g.m^{-3}$	35 times pcy
	Annual	40 $\mu g.m^{-3}$	-
Benzene	Annual	5 $\mu g.m^{-3}$	-

Non-Statutory Air Quality Objectives and Guidelines

2.10 The Environment Act 1995 established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and having been revised several times since, with the latest published in 2007 [8]. The Strategy sets UK air quality standards• and objectives# for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the EU Directives.

2.11 Non-statutory air quality objectives and guidelines also exist within the World Health Organisation Guidelines [9] and the Expert Panel on Air Quality Standards Guidelines (EPAQS) [10]. There are no non-statutory objectives and guidelines relevant to this assessment.

Environmental Assessment Levels

2.12 The Environment Agency's on-line guidance entitled 'Environmental management – guidance, Air emissions risk assessment for your environmental permit' [4] provides further assessment criteria in the form of EALs.

2.13 Table 2.2 presents all available EALs for the pollutants relevant to this assessment.

Table 2.2 Environmental Assessment Levels (EALs)

Pollutant	Long-term EAL, $\mu g.m^{-3}$	Short-term EAL, $\mu g.m^{-3}$
Nitrogen dioxide (NO_2)	40	200
Particulates (PM_{10})	40	50
VOCs (assuming 100% Benzene)	5	195
Acetic Acid	250	3700

Pollutant	Long-term EAL, μg.m^{-3}	Short-term EAL, μg.m^{-3}
P_2O_5#	1.74	40

Guideline values for P_2O_5 are drawn from UK HSE EH40 occupational values divided by a safety factor of 500 or 50 for long-term and short-term guidelines, respectively, as none are provided on in UK Environment Agency guidance.

2.14 Within the assessment, the statutory air quality limit and target values (as presented in Table 2.1) are assumed to take precedent over objectives, guidelines and the EALs. In addition, for those pollutants which do not have any statutory air quality standards, the assessment assumes the lower of either the EAL or the non-statutory air quality objective or guideline where they exist.

3 Assessment Methodology

Approach

3.1 The approach for the air quality assessment includes the key elements listed below:

- Establishing the background Ambient Concentration (AC) from consideration of Air Quality Review & Assessment findings and assessment of existing local air quality through a review of Defra background map data in the vicinity of the proposed site.
- Quantitative assessment of the operational effects on local air quality from stack emissions utilising a “new generation” Gaussian dispersion model, ADMS 5. Assessment of Process Contributions (PC) from the facility in isolation, and assessment of resultant Predicted Environmental Concentrations (PEC).

3.2 The odour assessment has used a multi-tool approach in accordance with the IAQM *Guidance on the Assessment of Odour for Planning (2018)* and incorporated multiple predictive assessment tools.

Dispersion Model Selection

3.3 A number of commercially available dispersion models are able to predict ground level concentrations arising from emissions to atmosphere from elevated point sources. Modelling for this study has been undertaken using ADMS 5, a version of the ADMS (Atmospheric Dispersion Modelling System) developed by Cambridge Environmental Research Consultants (CERC) that models a wide range of buoyant and passive releases to atmosphere either individually or in combination. The model calculates the mean concentration over flat terrain and also allows for the effect of plume rise, complex terrain, buildings and deposition. Dispersion models predict atmospheric concentrations within a set level of confidence and there can be variations in results between models under certain conditions; the ADMS 5 model has been formally validated and is widely used in the UK and internationally for regulatory purposes.

3.4 ADMS comprises a number of individual modules each representing one of the processes contributing to dispersion or an aspect of data input and output. Amongst the features of ADMS are:

- An up-to-date dispersion model in which the boundary layer structure is characterised by the height of the boundary layer and the Monin-Obukhov length, a length scale dependent on the friction velocity and the heat flux at the surface. This approach allows the vertical structure of the boundary layer, and hence concentrations, to be calculated more accurately than does the use of Pasquill-Gifford stability categories, which were used in many previous models (e.g. ISCST3). The restriction implied by the Pasquill-Gifford approach that the dispersion parameters are independent of height is avoided. In ADMS the concentration distribution is Gaussian in stable and neutral conditions, but the vertical distribution is non-Gaussian in convective conditions, to take account of the skewed structure of the vertical component of turbulence;

- A number of complex modules including the effects of plume rise, complex terrain, coastlines, concentration fluctuations and buildings; and
- A facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes and radioactivity, and percentiles of hourly mean concentrations, from either statistical meteorological data or hourly average data.

Model Inputs

Meteorological Data

3.5 The most important meteorological parameters governing the atmospheric dispersion of pollutants are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which the plume is dispersed;
- Wind speed affects the distance that the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise; and
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

3.6 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made.

3.7 The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations have been performed using five years of data from Coventry between 2012 and 2016.

3.8 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 1.

Stack Parameters and Emissions Rates used in the Model

3.9 The emissions characteristics for the proposed stacks are provided in Table 3.2. Stack height calculations have been performed for each type of plant proposed and are included in Appendix A.

Table 3.1: Proposed Stack and Emissions Characteristics

Parameter	A31	A32	A33	A34	A35	A36	A37
Type of Plant	Dust Control Extraction Unit1	Dust Control Extraction Unit 2	Dust Control Extraction Unit 3	Dust Control Extraction Unit 4	Dust Control Extraction Unit 5	Spray Booth	SECO Oven
Grid coordinates	433030, 282366	433033, 282366	433036, 282366	433037, 282328	433040, 282328	433049, 282322	433064, 282318
Stack height (m)	4.915	4.915	4.915	4.915	4.915	7.5	7.5
Efflux temperature (^{o}C)	25	25	25	25	25	Ambient	27
Internal diameter (m)	0.35	0.35	0.35	0.35	0.35	1.24 (effective diameter of three spray booths flue through one stack)	0.05
Actual efflux velocity ($m.s^{-1}$)	14.3	14.3	14.3	14.3	14.3	0.7	4
Actual volumetric flow ($Am^3.s^{-1}$)	1.376	1.376	1.376	1.376	1.376	0.843	0.008
NO_x mass emissions ($g.s^{-1}$)	-	-	-	-	-	-	0.00067
PM_{10} mass emissions ($g.s^{-1}$)	0.0051	0.0051	0.0051	0.0051	0.0051	-	-
VOC mass emissions ($g.s^{-1}$)	-	-	-	-	-	0.0057	-
Acetic Acid mass emissions ($g.s^{-1}$)	-	-	-	-	-	-	0.0116

Parameter	A31	A32	A33	A34	A35	A36	A37
P_2O_5 mass emissions ($g.s^{-1}$)	-	-	-	-	-	-	0.00067

*Calculated as the total emission rate of benzene from Appendix B.

3.10 The stack parameters for the existing stacks are shown in Table 3.2. These are taken from the July 2018 Air Quality Assessment Appendix A[11]. Emissions from existing stacks have only been included in this assessment for those pollutants emitted from the proposed stacks, i.e. NOx, PM_{10}, VOC, acetic acid or P_2O_5 is emitted.

Table 3.2: Stack and Emissions Characteristics – Existing Stacks

Parameter	A10	A11	A12	A13	A14	A19	A20	A21	A22	A23	A24	A25
Type of Plant	Boiler 1	Boiler 2	Boiler 3	Boiler 4	Cloth cell DCU stack	Machining shop DCU stack 1	Machining shop DCU stack 2	Machining shop DCU stack 3	Lesni thermal oxidiser	Mazak dust extraction unit	Chiron dust extraction unit	Chiron dust extraction unit
Grid coordinates	433098, 282360	433098, 282360	433092, 282346	433101, 282346	432955, 282360	433049, 282328	433053, 282328	433056, 282328	432996, 282323	433067, 282328	433061, 282361	433062, 282361
Stack height (m)	17.5	17.5	17.5	17.5	6.3	9.2	9.2	9.2	15	2	3	3
Efflux temperature (° C)	180	175	210	190	20	28	31	30	350	25	25	25
Internal diameter (m)	0.55	0.55	0.55	0.55	0.68	0.44	0.44	0.44	0.55	0.497	0.297	0.297
Actual efflux velocity ($m.s^{-1}$)	5.3	4.9	5.7	4.9	10.2	5.4	3.6	5.1	11.00	14.3	28.1	28.1
Actual volumetric flow ($Am^3.s^{-1}$)	1.26	1.16	1.35	1.16	3.7	0.82	0.55	0.78	2.60	2.8 d	1.9 d	1.9 d
O_2% (actual, dry)	8	10.1	5.8	6.4	Not corrected	Not corrected	Not corrected	Not corrected	18.00	Not corrected	Not corrected	Not corrected
H_2O% (actual)	11.8	11.6	5	19.4	1.1	1.5	1.1	1.2	5.90	1	1	1
NOx emission concentration ($mg.Nm^{-3}$)	200	200	200	200	-	-	-	-	1400	-	-	-
PM_{10} emission concentration ($mg.Nm^{-3}$)	-	-	-	-	0.64	10	10	10	10	2	5	5
VOC emission concentration ($mg.Nm^{-3}$)	-	-	-	-	-	-	-	-	10	-	-	-

Parameter	A10	A11	A12	A13	A14	A19	A20	A21	A22	A23	A24	A25
Acetic Acid emission concentration ($mg.Nm^{-3}$)	-	-	-	-	-	-	-	-	-	-	-	-
P_2O_5 emission concentration ($mg.Nm^{-3}$)	-	-	-	-	-	-	-	-	-	-	-	-
NOx mass emissions ($g.s^{-1}$)	0.068	0.053	0.086	0.063	-	-	-	-	0.44	-	-	-
PM_{10} mass emissions ($g.s^{-1}$)	-	-	-	-	0.0022	0.0076	0.005	0.0071	0.0032	0.0051	0.009	0.009
VOC mass emissions ($g.s^{-1}$)	-	-	-	-	-	-	-	-	0.0032	-	-	-
Acetic Acid mass emissions ($g.s^{-1}$)	-	-	-	-	-	-	-	-	-	-	-	-
P_2O_5 mass emissions ($g.s^{-1}$)	-	-	-	-	-	-	-	-	-	-	-	-

Operating Hours

3.11 To ensure the assessment is conservative, the model has been run assuming that all stacks will operate continuously throughout the year.

Surface Roughness

3.12 The roughness of the terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height, and the degree of atmospheric turbulence. This is accounted for by a parameter called the surface roughness length.

3.13 A surface roughness length of 1 m has been used within the model to represent the average surface characteristics across the study area.

Building Wake Effects

3.14 The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. Where building heights are greater than about 30 - 40% of the stack height, downwash effects can be significant. The building dimensions are listed in Table 3.3 and shown in Figure 2.

Table 3.3: Dimensions of Buildings Included Within the Dispersion Model

Building number	Location X(m)	Location Y(m)	Height (m)	Length(m)	Width(m)
1	433051	282344	15.6	105	31.8
2	433012	282356	18.5	8	7.8
3	433028	282358	18.5	6	4.5
4	432979	282341	10.5	38	38.6
5	433090	282315	15.6	15.6	28.2
6	432847	282333	9.8	179.5	187.5
7	433018	282293	7.5	60	114.4
8	433145	282261	10.8	54.4	23

Model Outputs

Receptors

3.15 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. Such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG16 [12] provides examples of exposure locations and these are summarised in

3.16 Table 3.4.

Table 3.4: Example of Where Air Quality Objectives Apply

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

3.17 The effects of the proposed development have been assessed at the façades of local existing receptors. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The locations of these discrete receptors are listed in Table 3.5 and illustrated in Figure 2.

Table 3.5: Modelled Sensitive Receptors

Receptor	National Grid Reference	
	X (m)	Y (m)
St Marys Priory 1	432967	282212
St Marys Priory 2	432917	282211
St Marys Priory 3	432871	282213
Bluebird Drive 1	432717	282254
Bluebird Drive 2	432706	282329
Bluebird Drive 3	432694	282412

Receptor	National Grid Reference	
	X (m)	Y (m)
Chillaton Road	432768	282502
Charleswood Road	432859	282586
Everdon Road 1	433012	282536
Everdon Road 2	433108	282530
Everdon Road 3	433188	282528
Everdon Road 4	433383	282542
Holbrook Lane 1	433536	282520
Holbrook Lane 2	433639	282245
Burnaby Road 1	433502	281997
Burnaby Road 2	433291	281996
Burnaby Road 3	433032	282018

Note: Receptors have been modelled at 1.5m above ground level, representative of typical head height

3.18 The impacts on designated ecological receptors have been considered in Appendix C.

Significance Criteria

3.19 As discussed in Section 2, the on-line EA guidance is for risk assessments and provides details for screening out substances for detailed assessment. In particular, it states that:

"To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:

- *the short-term PC is less than 10% of the short-term environmental standard*
- *the long-term PC is less than 1% of the long-term environmental standard*

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

3.20 It continues by stating that:

"You must do detailed modelling for any PECs not screened out as insignificant."

3.21 It then states that further action may be required where:

- *"your PCs could cause a PEC to exceed an environmental standard (unless the PC is very small compared to other contributors – if you think this is the case contact the Environment Agency)*
- *the PEC is already exceeding an environmental standard"*

3.22 On that basis, the results of the detailed modelling presented in this report have been used as follows:

- The effects are not considered significant if the short-term PC is less than 10% of the short-term Air Quality Assessment Level (AQAL); and
- The effects are not considered significant if the PEC is below the AQAL.

3.23 The Air Quality Assessment Level refers to the AQS air quality objective and the EU limit value.

Overview of Odour Assessment Tools Used

3.24 Most odours are mixtures of many chemicals that interact to produce what we detect as a smell. Odour-free air contains no odorous chemicals, whilst fresh air is usually perceived as being air that contains no chemicals or contaminants that are unpleasant (i.e. air that smells 'clean'). Fresh air may contain odorous chemicals, but these odours will usually be pleasant in character, such as freshly-mown grass or sea spray. Perceptions of an odour - whether we find it acceptable, objectionable or offensive - are partly innate and hard-wired, and partly determined through life experiences and hence can be subjective to the individual.

3.25 Before annoyance or nuisance can occur, there must be odour exposure. For odour exposure to occur, all three links in the source-pathway-receptor chain must be present:

- an emission **source** - a means for the odour to get into the atmosphere.
- a **pathway** - for the odour to travel through the air to locations off site, noting that:
  - anything that increases dilution and dispersion of an odorous pollutant plume as it travels from source to receptor will reduce the concentration at the receptor, and hence reduce exposure.
  - dilution and dispersion increase as the length of the pathway increases.
  - increasing the length of the pathway (e.g. by releasing the emissions from a high stack) will – all other things being equal – increase the dilution and dispersion.
- The presence of **receptors** (people) that could experience an adverse effect, noting that different people vary in their sensitivities to odour.

3.26 By convention, we restrict the term odour impact to the negative appraisal by a human receptor of the odour exposure. This appraisal, occurring over a matter of seconds or minutes, involves many complex psychological and socio-economic factors. Once exposure to odour has occurred, the process can lead to annoyance, nuisance and possibly complaints.

3.27 Both, or either, annoyance and nuisance can lead to loss of amenity and complaint action. However, a lack of complaints does not necessarily prove there is no loss of amenity, annoyance or nuisance. On the other hand, there needs to be an underlying level of annoyance before complaints are generated. The responses of annoyance and nuisance can change over time.

3.28 Several methods have been used as part of the assessment of the odour impact at the proposed development:

- The first tool used was a qualitative predictive assessment of the potential for odour impact, carried out using the source-pathway-receptor concept and following the method in the 2018 IAQM odour guidance. This assessment tool considers: the emission source; the presence of odour controls (both engineering controls and odour management procedures and with the assumption that regulators will properly and effectively enforce these); the prevailing wind direction relative to the locations and distances of the proposed receptors, and their sensitivity to the type of odour in question.
- Quantitative assessment of the odour impacts on the surrounding area from the stack emissions, by atmospheric dispersion modelling. A “new generation” Gaussian dispersion model, ADMS 5, was used. This predicts the odour impacts under the full range of meteorological conditions likely to be experienced over a year.

Methodology - Qualitative Predictive Odour Impact Assessment

3.29 A qualitative prediction of the odour impact of emissions from the proposed spray booths on the surrounding area was carried out using the risk-based assessment method in the IAQM Guidance Appendix 1, which provides examples of risk factors for odour source potential, pathway effectiveness and receptor sensitivity (set out in Table 3.6).

Table 3.6: IAQM Examples of Risk Factors for Odour Source, Pathway and Receptor

Source Odour Potential	Pathway Effectiveness	Receptor
Factors affecting the source odour potential include: ▪ the magnitude of the odour release (taking into account odour-control measures) ▪ how inherently odorous the compounds are ▪ the unpleasantness of the odour	Factors affecting the odour flux to the receptor are: ▪ distance from source to receptor the frequency (%) of winds from the source to receptor (or, qualitatively, the direction of receptors from source with respect to prevailing wind)	For the sensitivity of people to odour, the IAQM recommends that the air quality practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:

Source Odour Potential	Pathway Effectiveness	Receptor
	▪ the effectiveness of any mitigation/control in reducing flux to the receptor ▪ the effectiveness of dispersion/ dilution in reducing the odour flux to the receptor ▪ topography and terrain	
Large Source Odour Potential Magnitude - Larger Permitted processes of odorous nature or large STWs; materials usage hundreds of thousands of tonnes/m^3 per year; area sources of thousands of m^2. The compounds involved are very odorous (e.g. mercaptans), having very low Odour Detection Thresholds (ODTs) where known. Unpleasantness - processes classed as "Most offensive" in H4; or (where known) compounds/odours having unpleasant (-2) to very unpleasant (-4) hedonic score. Mitigation/control - open air operation with no containment, reliance solely on good management techniques and best practice.	**Highly Effective Pathway for Odour Flux to Receptor** Distance - receptor is adjacent to the source/site; distance well below any official set-back distances [a]. Direction - high frequency (%) of winds from source to receptor (or, qualitatively, receptors downwind of source with respect to prevailing wind). Effectiveness of dispersion/dilution - open processes with low-level releases, e.g. lagoons, uncovered effluent treatment plant, landfilling of putrescible wastes.	**High Sensitivity Receptor** - surrounding land where: ▪ users` can reasonably expect enjoyment of a high level of amenity; and ▪ the people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium Source Odour Potential Magnitude - smaller Permitted processes or small Sewage Treatment Works (STWs); materials usage thousands of tonnes/m^3 per year; area sources of hundreds of m^2. The compounds involved are moderately odorous. Unpleasantness - processes classed in H4 as "Moderately offensive"; or (where known) odours having neutral (0) to unpleasant (-2) hedonic score. Mitigation/control - some mitigation measures in place, but significant residual odour remains.	**Moderately Effective Pathway for Odour Flux to Receptor** Distance - receptor is local to the source. Where mitigation relies on dispersion/dilution - releases are elevated, but compromised by building effects.	**Medium Sensitivity Receptor** - surrounding land where: ▪ users' would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or ▪ people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Small Source Odour Potential Magnitude - falls below Part B threshold; materials usage hundreds of tonnes/m^3 per year; area sources of tens m^2. The compounds involved are only mildly odorous, having relatively high ODTs where known. Unpleasantness - processes classed as "Less offensive" in H4; or (where known)	**Ineffective Pathway for Odour Flux to Receptor** Distance - receptor is remote from the source; distance exceeds any official set-back distances. Direction - low frequency (%) of winds from source to receptor (or, qualitatively, receptors upwind of	**Low Sensitivity Receptor** - surrounding land where: ▪ the enjoyment of amenity would not reasonably be expected; or ▪ there is transient exposure, where the people would reasonably be expected to be

Source Odour Potential	Pathway Effectiveness	Receptor
compounds/odours having neutral (0) to very pleasant (+4) hedonic score. Mitigation/control ‑ effective, tangible mitigation measures in place (e.g. BAT, BPM) leading to little or no residual odour.	source with respect to prevailing wind). Where mitigation relies on dispersion/ dilution ‑ releases are from high level (e.g. stacks, or roof vents > 3 m above ridge height) and are not compromised by surrounding buildings	present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial, farms, footpaths and roads.

Notes: [a] Minimum setback distances may be defined for some odorous activities

3.30 The first step of this qualitative assessment is to estimate the odour-generating potential of the site activities, termed the "Source Odour Potential". This takes into account three factors:

- The scale (magnitude) of the release from the odour source, taking into account the effectiveness of any odour control or mitigation measures that are already in place. This involves judging the relative size of the release rate after mitigation and taking account of any pattern of release (e.g. intermittency). The assumption has been made, as required by the NPPF, that any pollution-control regimes applying to potentially-odorous sites will operate effectively and that the appropriate BAT standards of odour control will be enforced.
- How inherently odorous the emission is. In some cases it may be known whether the release has a low, medium or high odour detection threshold (ODT); this is the concentration at which an odour becomes detectable to the human nose. In most instances the odours released by a source will be a complex mixture of compounds and the detectability will not be known. However, for some industrial processes the odour will be due to one or a small number of known compounds and the detection thresholds will be a good indication of whether the release is highly odorous or mildly odorous.
- The relative pleasantness/unpleasantness* of the odour. Lists of relative pleasantness of different substances are given in the Environment Agency guidance H4 Odour Management [13].

3.31 Using the example risk ranking in Table 3.6, the Source Odour Potential can be categorised as small, medium or large.

Table 3.7: H4 Offensiveness of Odour Emission Sources

Offensiveness	Odour Emission Sources
Most Offensive	Processes involving decaying animal or fish remains Processes involving septic effluent or sludge Biological landfill odours

* This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score.

Offensiveness	Odour Emission Sources
Moderately Offensive	Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting
Less Offensive	Brewery Confectionary Coffee

3.32 Next, the effectiveness of the pollutant pathway as the transport mechanism for odour through the air to the receptor, versus the dilution/dispersion in the atmosphere, needs to be estimated. Anything that increases dilution and dispersion of the odorous pollutant plume as it travels from source (e.g. processes and plant) to receptor will reduce the concentration at the receptor, and hence reduce exposure. Important factors to consider here are:

- The distance of sensitive receptors from the odour source.
- Whether these receptors are downwind (with respect to the predominant prevailing wind direction). Odour episodes often tend to occur during stable atmospheric conditions with low wind speed, which gives poor dispersion and dilution; receptors close to the source in all directions around it can be affected under these conditions. When conditions are not calm, it will be the downwind receptors that are affected. Overall, therefore, receptors that are downwind with respect to the prevailing wind direction tend to be at higher risk of odour impact.
- The effectiveness of the point of release in promoting good dispersion, e.g. releasing the emissions from a high stack will - all other things being equal - increase the pathway, dilution and dispersion.
- The topography and terrain between the source and the receptor. The presence of topographical features such as hills and valleys, or urban terrain features such as buildings can affect air flow and therefore increase, or inhibit dispersion and dilution.

3.33 Using the example risk ranking in Table 3.6, the pollutant pathway from source to receptor can be categorised as ineffective, moderately effective, or highly effective.

3.34 In the third step, the estimates of Source Odour Potential and the Pathway Effectiveness are considered together to predict the risk of odour exposure (impact) at the receptor location, as shown by the example matrix in Table 3.8.

Table 3.8: Risk of Odour Exposure (Impact) at the Specific Receptor Location

		Source Odour Potential		
		Small	**Medium**	**Large**
Pathway Effectiveness	**Highly effective**	Low Risk	Medium Risk	High Risk
	Moderately effective	Negligible Risk	Low Risk	Medium Risk
	Ineffective	Negligible Risk	Negligible Risk	Low Risk

3.35 The next step is to estimate the effect of that odour impact on the exposed receptor, taking into account its sensitivity, as shown by the example matrix in Table 3.9. The odour effects may range from negligible, through slight adverse and moderate adverse, up to substantial adverse.

Table 3.9: Likely Magnitude of Odour Effect at the Specific Receptor Location

Risk of Odour Exposure	**Receptor Sensitivity**		
	Low	**Medium**	**High**
High	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
Medium	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
Low	Negligible Effect	Negligible Effect	Slight Adverse Effect
Negligible	Negligible Effect	Negligible Effect	Negligible Effect

3.36 This procedure results in a prediction of the likely odour effect at each sensitive receptor. The next step is to estimate the overall odour effect on the surrounding area, taking into account the different magnitude of effects at different receptors, and the number of receptors that experience these different effects*. This requires the competent and suitably experienced Air Quality Practitioner to apply professional judgement.

Methodology - Odour Dispersion Modelling

Stack Parameters used in the Model

3.37 The values of the stack emissions characteristics that were modelled are provided in Table 3.2. These are based on information provided by Meggitt.

* Unless there is only a small number of local receptors, then a representative selection of receptors will have been used in the assessment. This final stage of considering the overall effect needs to take into account how many receptors these selected ones represent.

Table 3.10 Stack Characteristics

Parameter	Unit	A36	A37
Location (x, y)	-	443049, 282322	433064, 282318
Stack height	m	7.5	7.5
Internal diameter	m	1.24 (effective diameter of three spray booths flue through one stack)	0.05
Efflux velocity	$m.s^{-1}$	0.7	4
Efflux temperature	°C	Ambient	27
Odour emission rate	$ou_E.s^{-1}$	295	270

Emissions Rates used in the Model

3.38 The Environment Agency draft H4 Guidance Note [14] advises that where emissions monitoring at source is not feasible, it is sometimes possible to use mass balance data/solvent use records to estimate the amount of product lost to air over a given period of time.

3.39 For the proposed spray booths (A36), Meggitt provided data on:

- the amount of each paint/solvent that the facility is expected to consume per year, when fully operational at 52 weeks in a year at 24 hours a day; and
- the chemical composition of each coating, contained in material safety data sheets.

3.40 The usage rate of each coating per annum, and the percentage composition of each VOC in the bulk material were used to calculate the emission rate of each VOC compound in $mg.s^{-1}$.

3.41 Then, the VOCs concentration ($mg.m^{-3}$) of each VOC compound contained in each coating was estimated by dividing the VOC emission rate of each VOC compound ($mg.s^{-1}$) by the volumetric flow rate ($m^3.s^{-1}$). The volumetric flow rate was calculated using the stack diameter and velocity of the spray-booth exhaust.

3.42 Next, the equation from the draft H4 guidance was used to estimate the odour concentration of each VOC compound contained in each coating.

$D = C_a/T_a$

Where, D = the odour concentration of a mixture ($ou_E.m^{-3}$)

C_a = the chemical concentration of the VOC compound ($mg.m^{-3}$)

T_a = the odour threshold of the VOC compound ($mg.m^{-3}$)

3.43 The odour concentration ($ou_E.m^{-3}$) derived for each VOC compound contained in each coating was then multiplied with the volumetric flow rate ($m^3.s^{-1}$) of air via each stack to estimate the odour emission rate ($ou_E.s^{-1}$) for each VOC.

3.44 The odour emission rates ($ou_E.s^{-1}$) for each VOC contained in each coating were then added together to give a total odour emission rate ($ou_E.s^{-1}$) for the facility. This gave total emission rate of 295 $ou_E.s^{-1}$ for spray booths. Appendix B provides a summary of the calculations used to determine the odour emission rate.

3.45 This is a very conservative approach to calculating the odour emissions rate, as in practice odours having different characters are not additive in their effects.

3.46 For the SECO Oven (A37), the acetic acid emission rate was provided, and the odour emission rate of 270 $ou_E.s^{-1}$ was calculated as set out above. The calculations are shown in Appendix B.

Model Outputs

Receptors

3.47 The odour assessment predicts the impacts at relevant sensitive receptors. The IAQM *Guidance on the Assessment of Odour for Planning* provides examples of receptor sensitivity to odour which are summarised in Table 3.11.

Table 3.11 Receptor sensitivity to odours

For the sensitivity of people to odour, the IAQM recommends that the Air Quality Practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:	
High sensitivity receptor	Surrounding land where: • Users can reasonably expect enjoyment of a high level of amenity; • People would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium sensitivity receptor	Surrounding land where: • Users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • People wouldn't reasonably expect to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.

For the sensitivity of people to odour, the IAQM recommends that the Air Quality Practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:	
High sensitivity receptor	Surrounding land where: • Users can reasonably expect enjoyment of a high level of amenity; • People would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
	Examples may include places of work, commercial/retail premises and playing/recreational fields.
Low sensitivity receptor	Surrounding land where: • The enjoyment of amenity would not reasonably be expected; or • There is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial use, farms, footpaths and roads.

3.48 The modelling assessment predicted the odour impacts across the modelled domain: a grid of 3 km by 3 km with a grid spacing of 30 m.

3.49 In addition, the odour impacts of the facility have been predicted at the façades of representative discrete local existing receptors. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The locations of these discrete receptors are listed in Table 3.12 and illustrated in Figure 2.

Table 3.12 Modelled Discrete Sensitive Receptors

ID	Name	Receptor Type	x	y
1	St Marys Priory 1	Residential	432967	282212
2	St Marys Priory 2		432917	282211
3	St Marys Priory 3		432871	282213
4	Bluebird Drive 1		432717	282254
5	Bluebird Drive 2		432706	282329
6	Bluebird Drive 3		432694	282412
7	Chillaton Road		432768	282502
8	Charleswood Road		432859	282586
9	Everdon Road 1		433012	282536
10	Everdon Road 2		433108	282530
11	Everdon Road 3		433188	282528
12	Everdon Road 4		433383	282542

ID	Name	Receptor Type	x	y
13	Holbrook Lane 1		433536	282520
14	Holbrook Lane 2		433639	282245
15	Burnaby Road 1		433502	281997
16	Burnaby Road 2		433291	281996
17	Burnaby Road 3		433032	282018

Significance Criteria - Odour Stack Impacts

3.50 In accordance with convention, odour levels across the project site have been predicted by the model as the 98th percentiles of the 1-hour average concentrations. Odours from paint booths would not be expected to be at the 'most offensive' end of the spectrum and can be considered 'moderately offensive' odours.

3.51 The 2018 IAQM odour guidance for planning categorises the odour effects likely to result from various 98 percentile 1-hour average odour exposure levels, as reproduced in Table 3.13.

Table 3.13 IAQM Proposed Odour Effect Descriptors for Impacts Predicted by Modelling (Moderately Offensive Odours)

Odour Exposure Level C_{98}, ou_E /m^3	Receptor Sensitivity		
	Low	Medium	High
≥10	Moderate	Substantial	Substantial
5- <10	Slight	Moderate	Moderate
3- <5	Negligible	Slight	Moderate
1.5- <3	Negligible	Negligible	Slight
0.5- <1.5	Negligible	Negligible	Negligible
<0.5	Negligible	Negligible	Negligible

Uncertainty

3.52 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

3.53 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

3.54 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the range informed by an analysis of relevant, available data.

3.55 The main components of uncertainty in the total predicted concentrations include those summarised in Table 3.14.

Table 3.14 Approaches to Dealing with Uncertainty used Within the Modelling Assessment

Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Emissions and stack characteristics	Emission rates have been derived using a number of conservative assumptions. This is likely to be a central estimate, with associated uncertainty attached.	The predicted concentration is likely to be between a central estimate and the top of the uncertainty range.
Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for five full years of meteorological conditions. This means that the conditions in 43,800 hours have been considered in the assessment.	
Receptors	Receptor locations have been identified where concentrations are expected to be the highest or where the greatest changes are expected.	

3.56 The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely fall between a central estimate and the top of the uncertainty range (i.e. tending towards worst-case).

4 Baseline Air Quality Conditions

Overview

4.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the background concentration selected for the assessment is realistic. EPUK/IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality.

4.2 For this assessment, the background air quality has been characterised by drawing on information from the following public sources:

- Defra maps [15], which show estimated pollutant concentrations across the UK in 1 km grid squares;
- published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies; and
- results published by national monitoring networks.

4.3 There is no urban background monitoring NO_2 or PM_{10} in the vicinity of the site so the background concentrations have been derived from the Defra mapped background concentration estimate at the site. The background concentrations used in the assessment are set out in Table 4.1.

Table 4.1 Summary of Assumed Background Concentrations

Pollutant	Averaging Period	Concentration ($\mu g.m^{-3}$)	Data Source
NO_2	1 hour (99.79th percentile)	39.2 (a)	Defra mapped (2018)
	1 hour (annual mean)	19.6	
PM_{10}	24 hour (90.41st percentile)	15.3	
	24 hour (annual mean)	15.3	

Note:
(a) Short-term background data approximately equate to the 90th percentile, which is approximately equivalent to 2 x the annual mean.

5 Assessment of Air Quality Impacts

Results of Stack Emissions Modelling

5.1 Table 5.1 summarises the predicted PCs associated with emissions from the site at the selected, representative sensitive receptors.

5.2 Figure 4 to Figure 7 show contour plots for NO_2 and PM_{10} concentrations from proposed stacks.

Table 5.1 Maximum Predicted Contributions at Sensitive Receptors

Pollutant		EAL ($\mu g.m^{-3}$)	Criteria (%)	AC ($\mu g.m^{-3}$)	PC ($\mu g.m^{-3}$)										Proposed PC as % of EAL	Total PC (Proposed and Existing) as % of EAL	PEC ($\mu g.m^{-3}$)	PEC as % of EAL ($\mu g.m^{-3}$)
					Total (existing)	A31	A32	A33	A34	A35	A36	A37	Total (Proposed)	Total (Proposed + Existing)				
NO_2	1 hour (99.79th percentile)	200	10	39.2	24.3	-	-	-	-	-	-	0.425	0.425	24.7	0	12	64.0	32
	1 hour (annual mean)	40	1	19.6	5.15	-	-	-	-	-	-	0.013	0.013	5.17	0	13	24.8	62
PM_{10}	24 hour (90.41st percentile)	50	10	15.3	14.5	3.00	2.70	1.80	2.33	2.33	-	-	12.2	26.6	24	53	41.9	84
	24 hour (annual mean)	40	1	15.3	5.25	1.016	0.978	0.582	0.904	0.905	-	-	4.38	9.63	11	24	24.9	62
VOCs (assumed to be 100% Benzene)*	1 hour (maximum)	195	10	-	0.321	-	-	-	-	-	1.47	-	1.47	1.79	1	1	-	-
	1 hour (annual mean)	5	1	-	0.038	-	-	-	-	-	0.002	-	0.002	0.040	0	1	-	-
Acetic Acid	1 hour (maximum)	3700	10	-	-	-	-	-	-	-	-	23.1	23.1	23.1	1	1	-	-
	1 hour (annual mean)	250	1	-	-	-	-	-	-	-	-	0.321	0.321	0.321	0	0	-	-
P_2O_5	1 hour (maximum)	40	10	-	-	-	-	-	-	-	-	1.33	1.33	1.33	3	3	-	-
	1 hour (annual mean)	1.74	1	-	-	-	-	-	-	-	-	0.018	0.018	0.018	1	1	-	-

*As recommended by the EAs on-line guidance, where the exact substances that make up the VOCs are unknown it has been assumed to be 100% benzene so has been compared with the EAL for benzene. As the emission rate for A36 is calculated from substances in the paints used the benzene emission rate is known. Therefore the PC for stack A36 is benzene only.
#PCs/PECs as a % of the EAL that exceed the relevant criteria are shaded in grey.

5.3 The maximum total PCs (Proposed and Existing) across the modelled receptors does not exceed 1% of the EAL for long-term and 10% of the EAL for short-term averaging periods for all pollutants except NO_2 and PM_{10} and the impacts are not considered to cause a significant effect.

5.4 Based on the PC alone, the NO_2 and PM_{10} impacts are potentially significant however, when the PCs are added to the background concentrations, the resulting PECs are all below the relevant EALs. On that basis the effects are not considered to be significant.

Significance of Effects

5.5 As set out in Section 3, it is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

5.6 The impacts at existing receptors are shown to be not significant even for this conservative scenario. Consequently, further sensitivity analysis has not been undertaken and, in practice, the impacts at sensitive receptors are likely to be lower than those reported in this conservative assessment.

6 Assessment of Odour Impacts

Qualitative Predictive Odour Impact

Source Odour Potential

6.1 The first step in the qualitative assessment of odour impact is to estimate the odour source potential which has been determined based on the guidance set out in Table 3.6. The factors affecting the Source Odour Potential are the magnitude of the odour release, how inherently odorous the compounds are, and the unpleasantness of the odour.

6.2 The total spray booths emission rate is 275 $ou_E.s^{-1}$, a relatively small scale of release.

6.3 The compounds involved are likely to be moderately odorous, with the majority of compounds having moderate Odour Detection Thresholds.

6.4 Regarding the unpleasantness of the odours and how inherently odorous the constituent compounds are the Environment Agency odour guidance H4 gives paint a hedonic score of -0.75. As this is towards the middle of the typical range of -4 to +4, the unpleasantness can be expected to fall into the "moderately offensive" category shown in Table 3.7.

6.5 Based on the above factors, RPS has conservatively categorised the Source Odour Potential as 'medium'.

Pathway Effectiveness

6.6 The odour flux from the odour sources is dependent on the effectiveness of odour transport to the receptors, versus the mitigating effect of dilution/dispersion in the atmosphere.

6.7 The locations of the proposed development site and the nearest sensitive receptors are shown in Figure 2. The nearest residential receptors are approximately 135 m to the southwest and 315 m to the north of the spray booths stack the nearest industrial receptors are approximately 250 m southeast of the stack.

6.8 The average wind directions at Coventry are shown in Figure 1. This data indicates that the prevailing wind direction is south to south-westerly.

6.9 The guidance examples in Table 3.6 suggest that releases from stacks adjacent to the site would be 'highly effective'. The nearest receptors are 135m from the stacks which is mostly upwind. The nearest receptors downwind of the stacks are further away at a distance of 315 m from the stacks. On that basis the pathway effectiveness is categorised as "moderately effective".

Receptor Sensitivity

6.10 The residential receptors are deemed to be “high sensitivity”.

Risk of Odour Exposure (Impact)

6.11 When the small source odour potential (ignoring mitigation) is considered in the context of the pathway effectiveness (Table 3.8), the risk of odour exposure (impact) is “low risk”.

Likely Magnitude of Odour Effect

6.12 When the above risk of odour exposure impact is considered in the context of the sensitivity of the receptors using the matrix in Table 3.9, the likely resulting odour effect is predicted to be:

- “slight adverse” at residential receptors; and
- “negligible” at industrial receptors.

Results of Stack Emissions Modelling

6.13 Table 6.1 presents the 98th percentile hourly-mean odour concentrations predicted at the nearest sensitive receptors.

Table 6.1 98th Percentile of Hourly Odour Concentrations ($ou_E.m^{-3}$)

Receptor ID	Receptor Type	Receptor Sensitivity	98th Percentile Hourly-mean Odour Concentration ($ou_E.m^{-3}$)	Odour Effect Descriptor
1	Residential	High	0.096	Negligible
2	Residential	High	0.195	Negligible
3	Residential	High	0.099	Negligible
4	Residential	High	0.017	Negligible
5	Residential	High	0.015	Negligible
6	Residential	High	0.020	Negligible
7	Residential	High	0.027	Negligible
8	Residential	High	0.082	Negligible
9	Residential	High	0.113	Negligible
10	Residential	High	0.099	Negligible
11	Residential	High	0.055	Negligible
12	Residential	High	0.027	Negligible
13	Residential	High	0.015	Negligible
14	Residential	High	0.011	Negligible

Receptor ID	Receptor Type	Receptor Sensitivity	98th Percentile Hourly-mean Odour Concentration ($ou_E.m^{-3}$)	Odour Effect Descriptor
15	Residential	High	0.017	Negligible
16	Residential	High	0.022	Negligible
17	Residential	High	0.013	Negligible

6.14 Table 6.1 shows that the predicted 98th percentile hourly odour concentrations at the nearest sensitive receptor locations are all well below the 1.5 $ou_E.m^{-3}$ benchmark.

Significance of Effects

6.15 It is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

6.16 The impacts predicted at individual receptors and the geographical extent over which such impacts occur, can be used to inform the judgement on the impact on the surrounding area as a whole, and whether the resulting overall effect is significant or not.

6.17 Using professional judgement, the resulting odour effect is considered to be 'not significant' overall.

7 Conclusions

7.1 This report details the air quality assessment undertaken to accompany the application to vary the permit for the Meggitt, Coventry site.

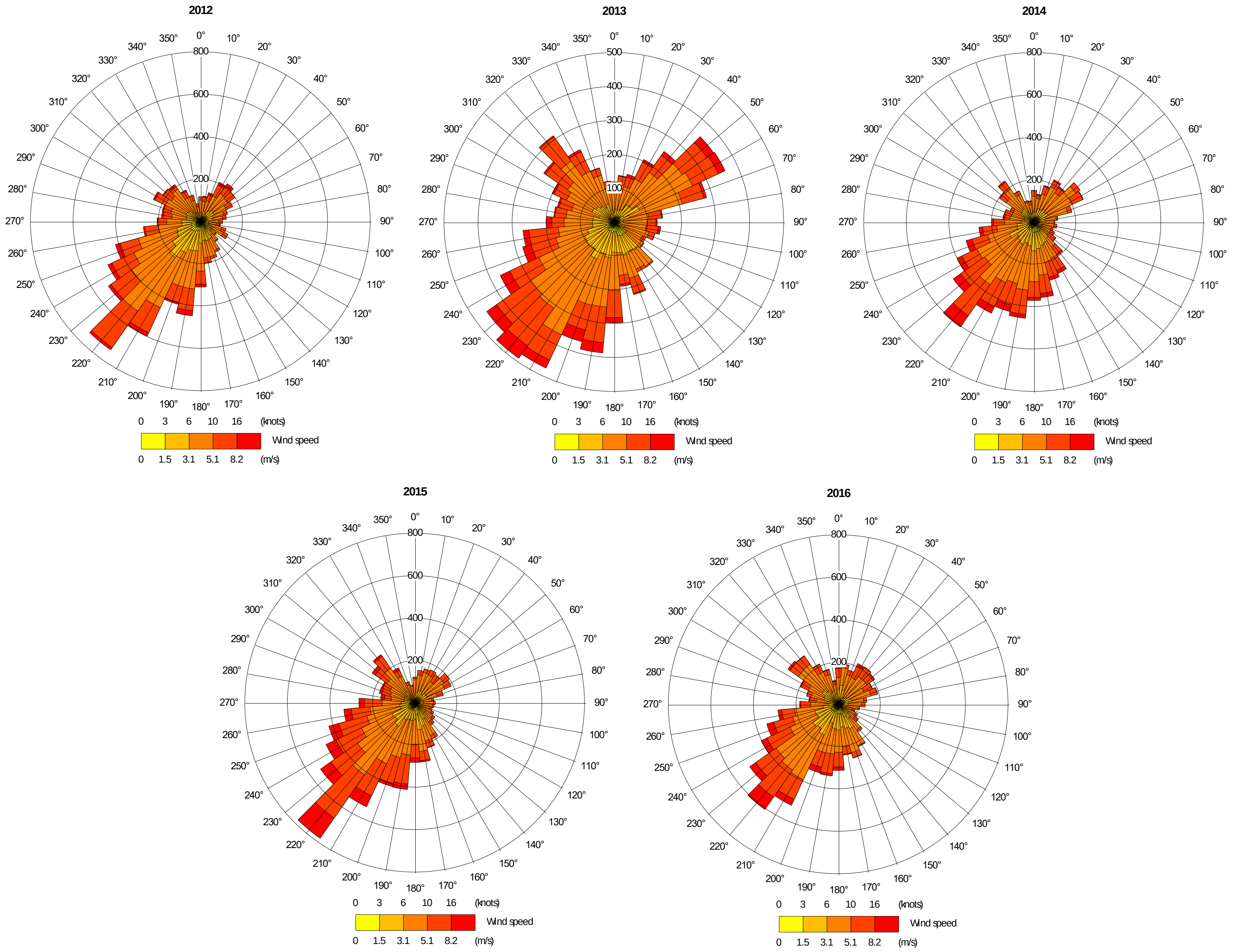
7.2 The assessment covers an evaluation of the impacts on the local area of NO_2, PM_{10}, VOC, acetic acid, P_2O_5 and odour emissions from the proposed and existing stacks operated on the site.

7.3 Detailed atmospheric dispersion modelling has been undertaken to predict contributions from the varied operations. Modelling has been undertaken using five years of hourly sequential meteorological data. Concentrations have been predicted at selected, representative receptors and compared with the relevant air quality standards.

7.4 The results show that, with the new stacks, the predicted concentrations associated with operations at the site are below the relevant air quality standards and the effects of the impacts are not considered to be significant.

7.5 Using professional judgement and experience of similar projects, the resulting air quality effect of the proposed variation is considered to be 'not significant' overall.

Figures



Notes

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Figure 1: Wind Roses – Coventry (2012 – 2016)

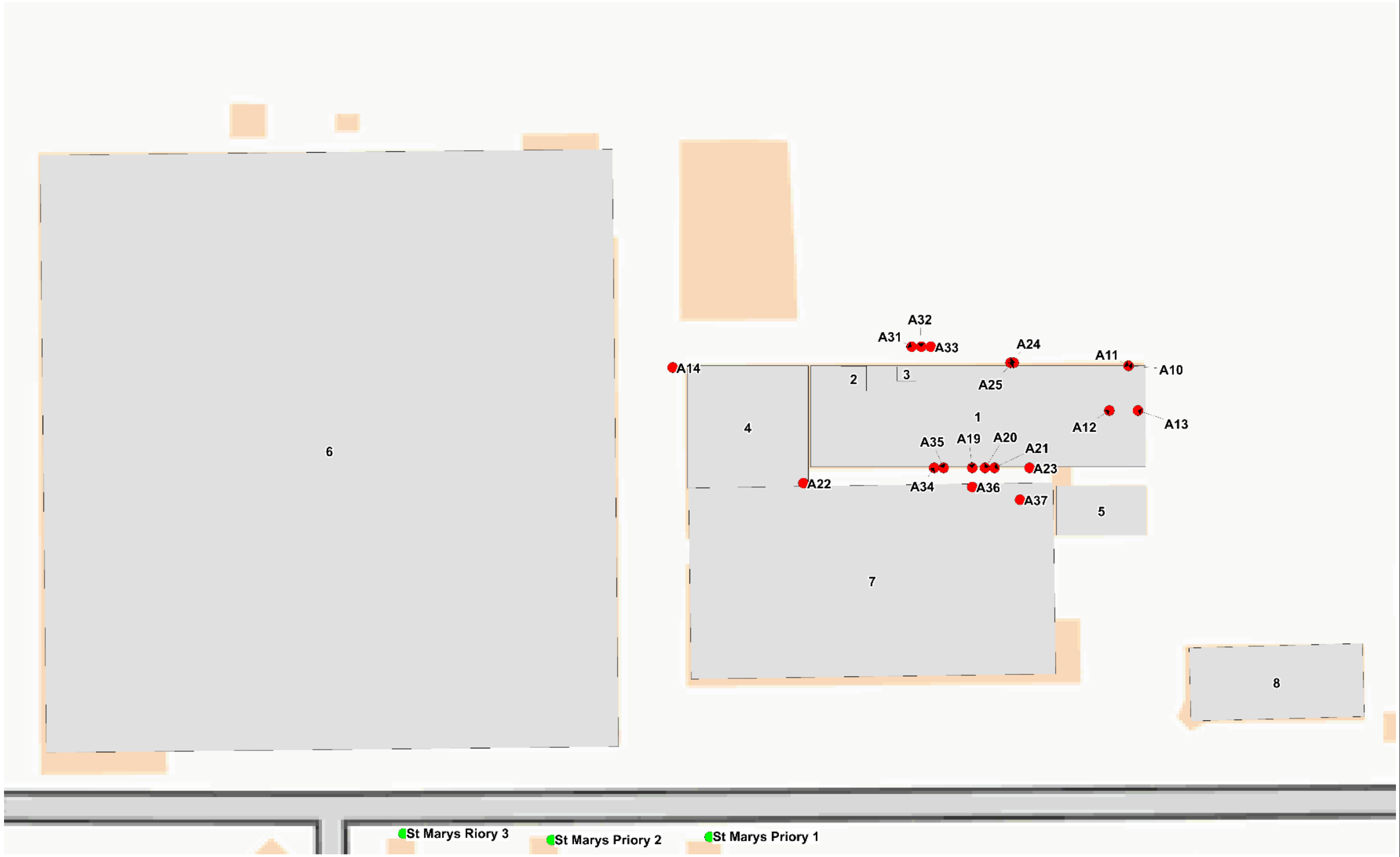

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Figure 2: Stacks and Buildings Modelled

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Figure 3: Modelled Sensitive Receptors

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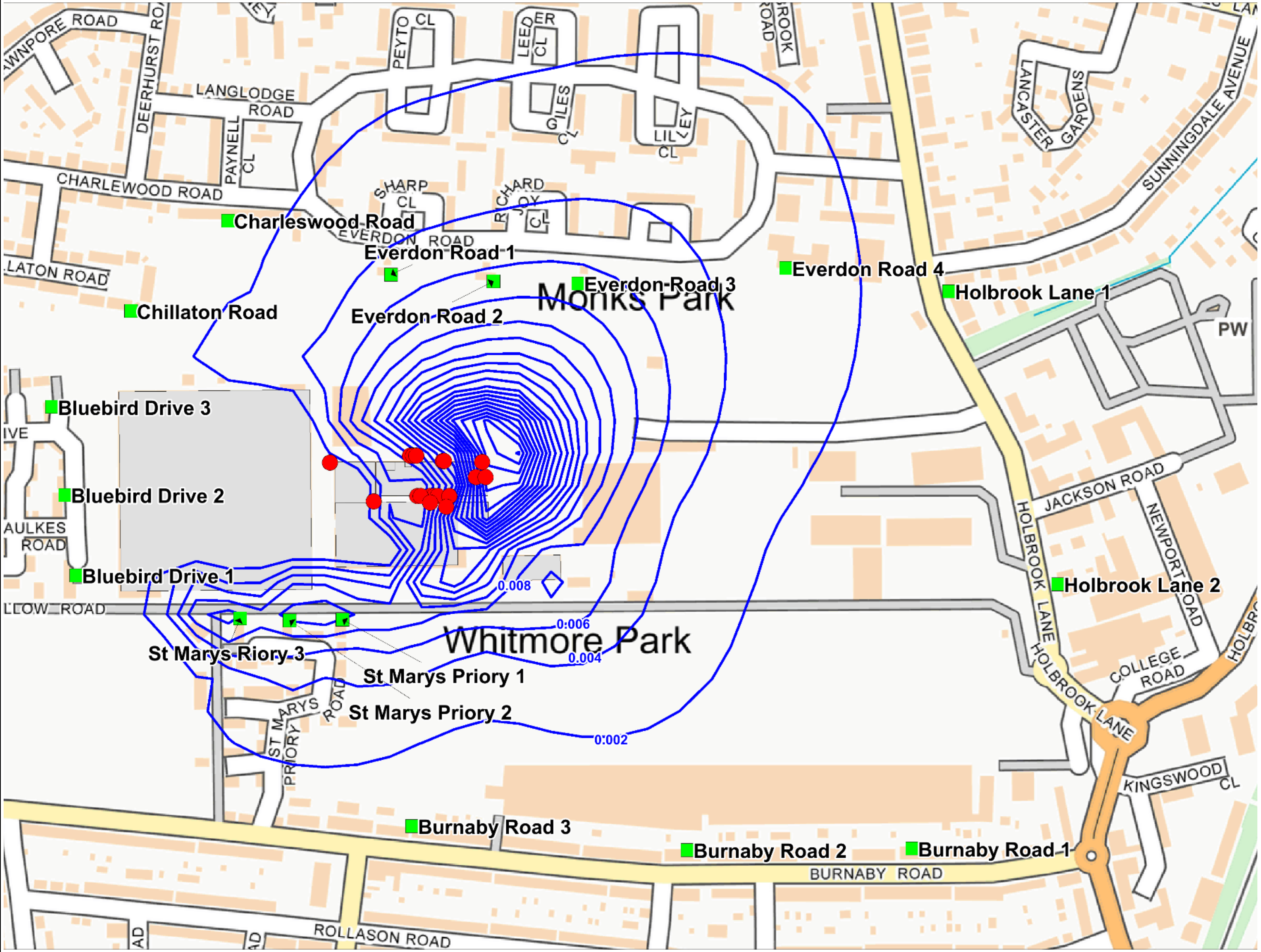

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Figure 4: Annual Mean NO_2 Concentrations (ug/m^3)

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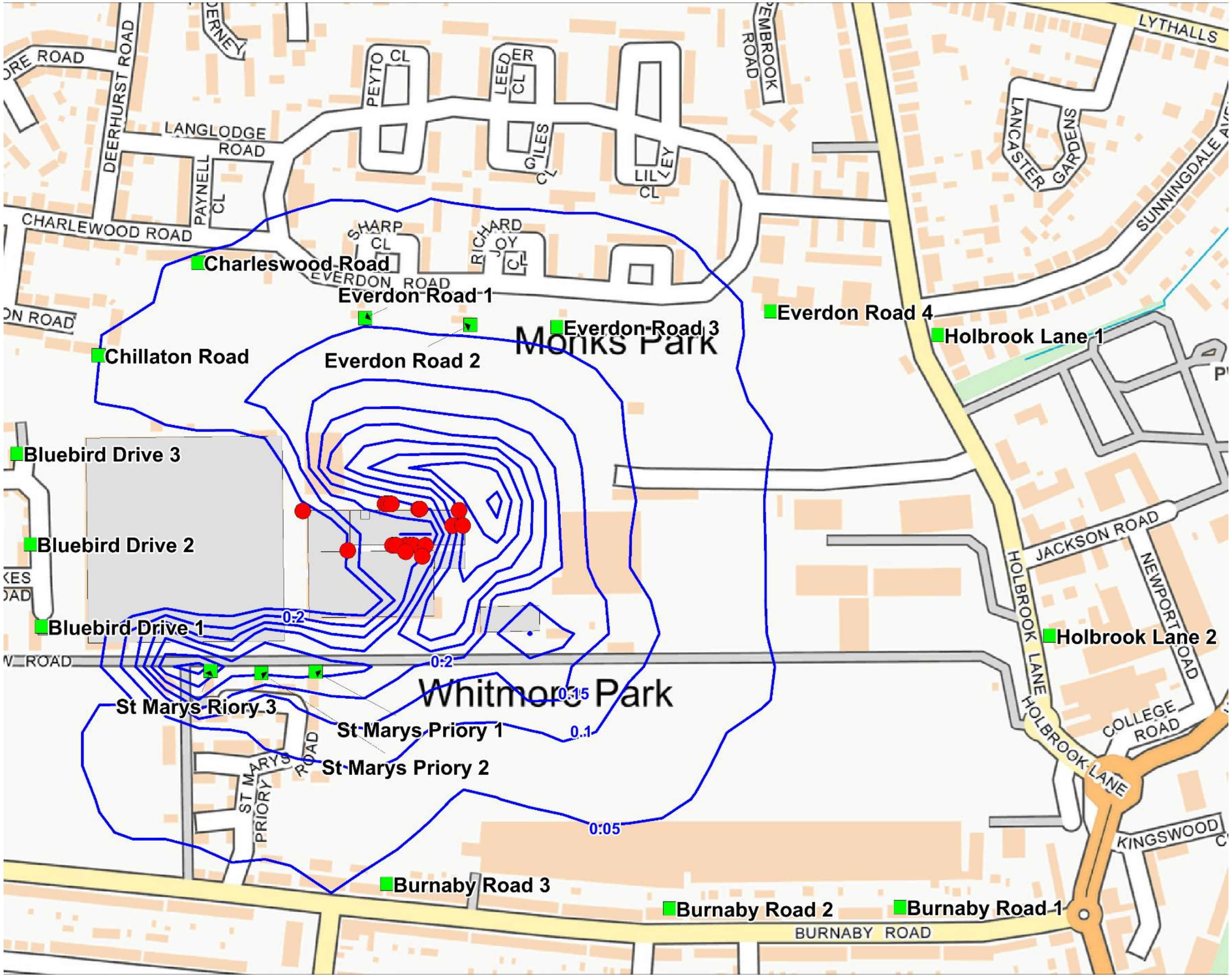

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Figure 5: 99.79th Percentile Hourly Mean NO_2 Concentrations (ug/m^3)

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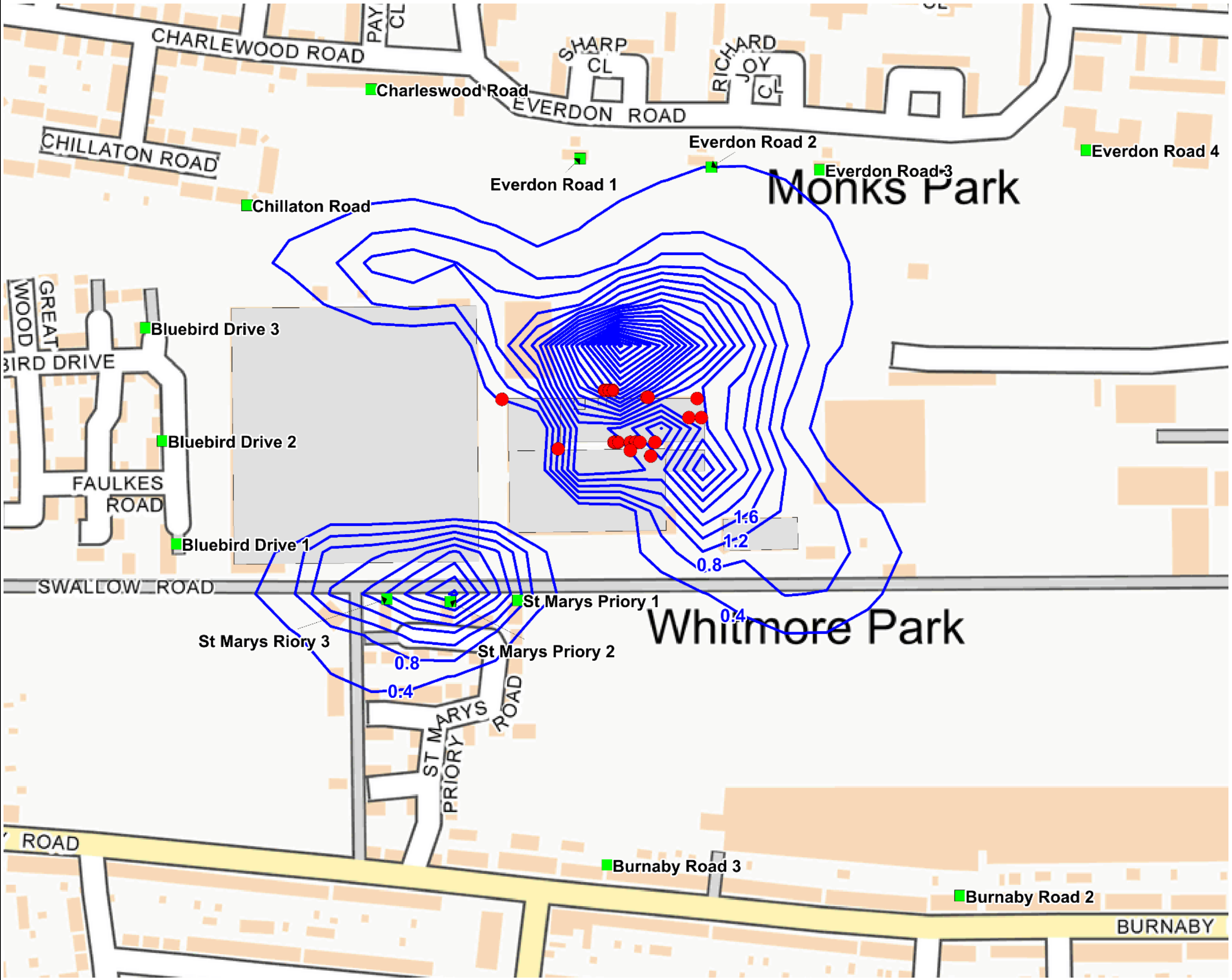

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Figure 6: Annual Mean PM_{10} Concentrations (ug/m^3)

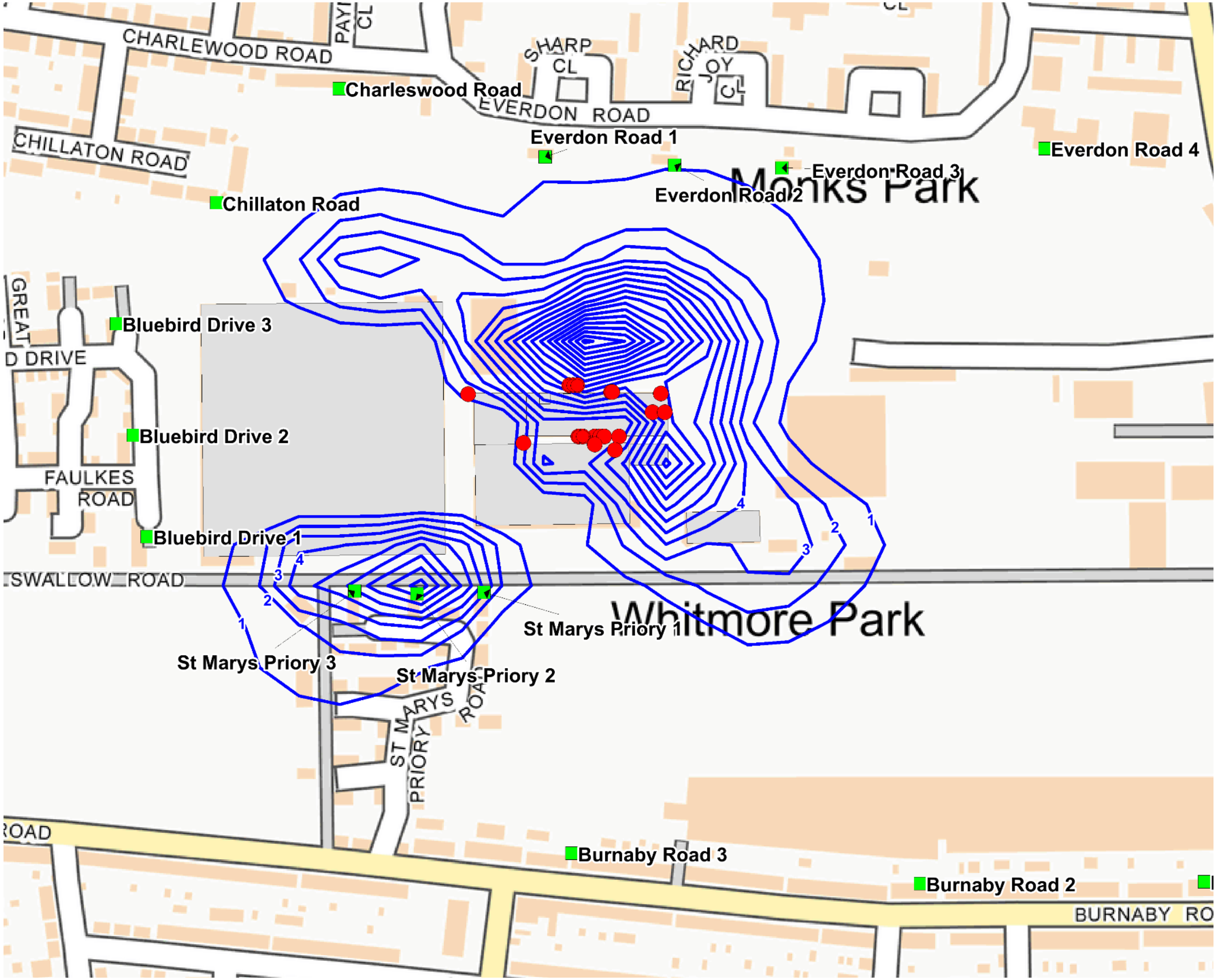

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Figure 7: 90.41st Percentile Daily Mean PM_{10} Concentrations (ug/m^3)

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Appendices

Appendix A: Stack Height Determination

A stack height determination has been undertaken to establish the height at which there is minimal additional environmental benefit associated with the cost of further increasing the generator stacks. The Environment Agency removed their detailed guidance, Horizontal Guidance Note EPR H1 (EA, 2010), for undertaking risk assessments on 1 February 2016; however, the approach used here by RPS is consistent with that EA guidance which required the identification of *"an option that gives acceptable environmental performance but balances costs and benefits of implementing it."*

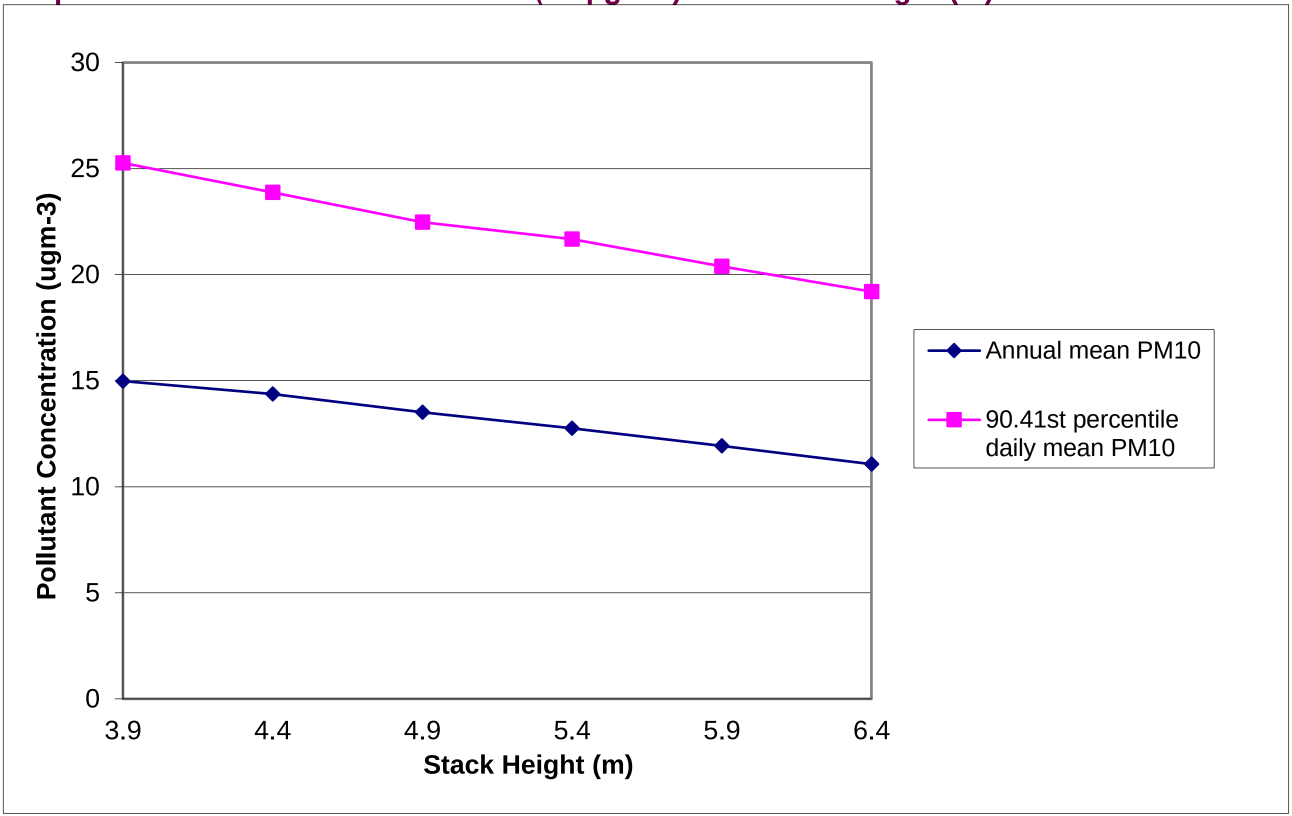
The emissions data used in the stack height determination are summarised in Section 3 of the report. Simulations have been run using ADMS 5 to determine what stack height is required to provide adequate dispersion/dilution and to overcome local building wake effects.

The stack height determination considers ground level concentrations over the averaging periods relevant to the air quality assessment, together with the full range of all likely meteorological conditions using five years of hourly sequential meteorological data from Coventry.

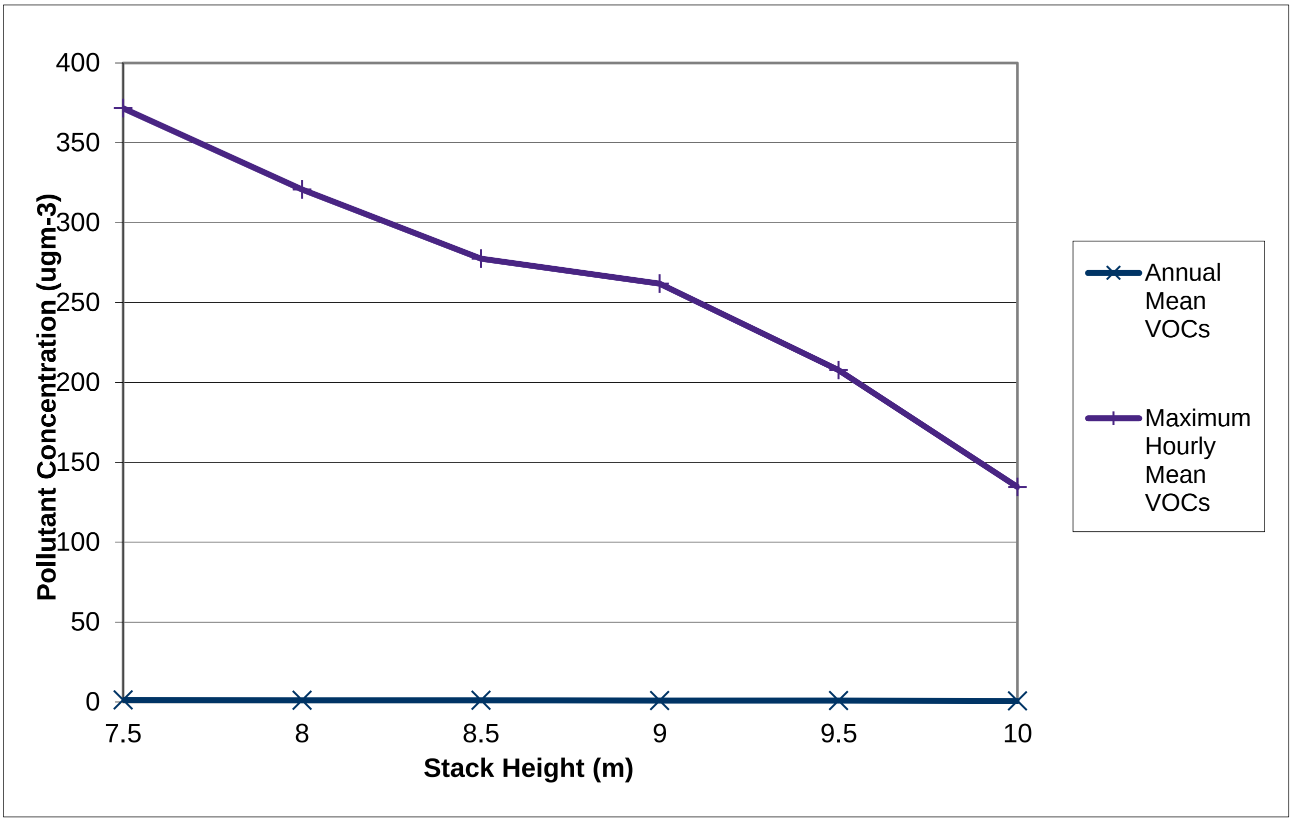
The dispersion modelling for the purposes of stack height determination assumed a domain of 3 km by 3 km centred on the proposed development and with a grid spacing of 30 m.

The maximum predicted contributions have been plotted against height to determine if there is a height at which no benefit is gained from increases in stack heights for each type of proposed stack in the graphs below.

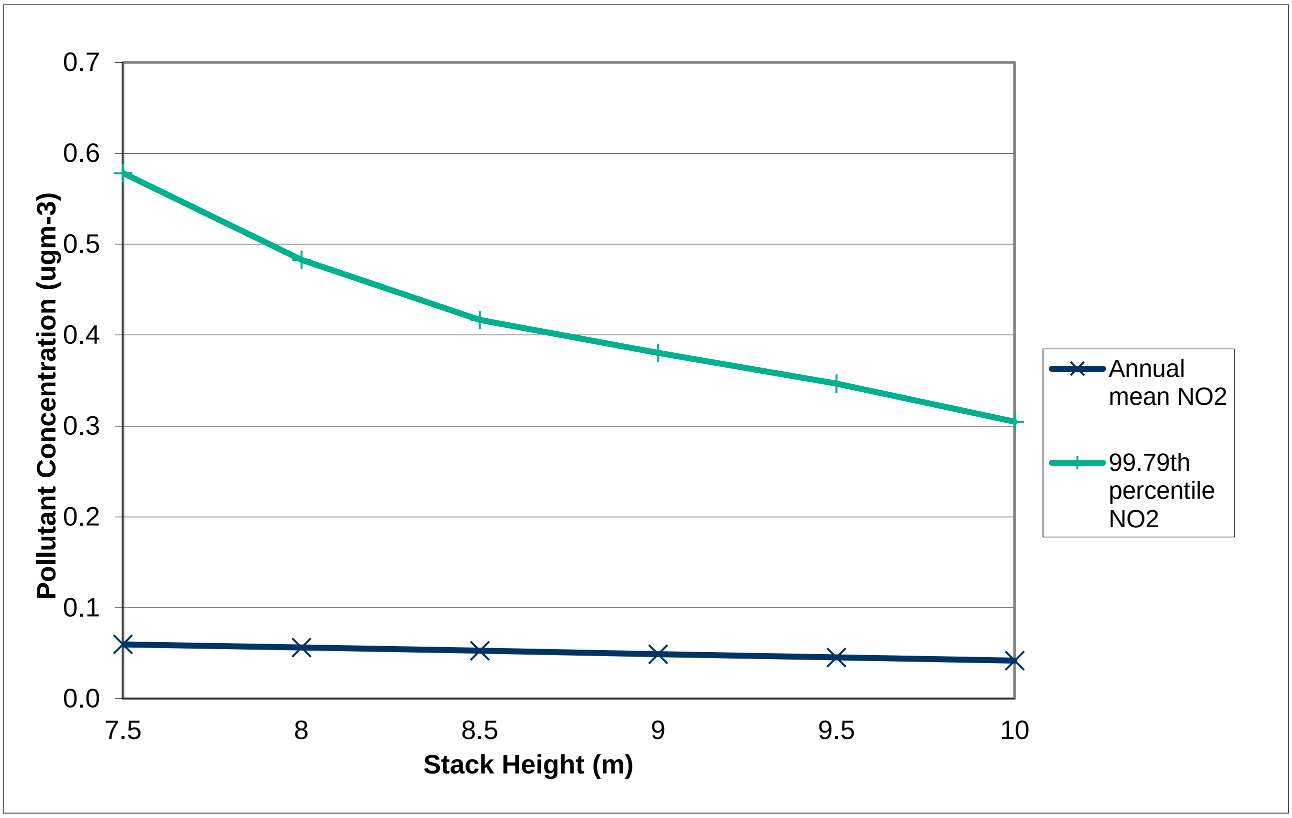
Graph A.1 Variation in Concentration (as µg.m^{-3}) with Stack Height (m) – Stacks A31 to A35



Graph A.2 Variation in Concentration (as µg.m^{-3}) with Stack Height (m) – Stack A36



Graph A.3 Variation in Concentration (as µg.m^{-3}) with Stack Height (m) – Stack A37



7.6 The graph does not indicate that there would be any appreciable improvement in an increase in the stack height above the heights modelled for this assessment. The stack height used in this assessment is 4.915 m for stacks A31 to A35 and 7.5 m for stacks A36 and A37.

Appendix B: Estimation of Odour Emission Rate from Stack A36 and A37

Stack A36 – Spray Booths

Amount of Coatings Used Per Year

Coatings	Litres per year	Density (g/ml)	Mass (grams)
CS100D Oxidation protective paint	333	1.80	599400
CSP-7 Oxidation protective primer solution	333	1.30	432900
DMS 744/745 Antioxidant paint	200	1.10	220000
DMS 815/819 Antioxidant paint	666	1.38	919080

Spraybooth (A36) Emissions Data

Actual Volumetric Flow Rate (m^3/s)	0.87

VOC Content of Coatings

	Maximum % VOC in Bulk Material	CAS	Molecular Mass	Formula	Mass of Compound in Material (g)	Emission Rate (g/s)	Emission Rate (mg/s)	Emission Concentration (mg/m^3)	ODT (ppm) at 293k	ODT ($mg.m^{-3}$) at 293k	Odour Emission Concentration ($Ou_e.m^{-3}$)	Odour emission rate ($Ou.s^{-1}$)
CS100D Oxidation protective pain												
Xylene	19	1330-20-7	106.16	C8H10	113886	0.004	3.611	4.166	0.016	0.078	53	46

Toulene	11	108-88-3	92.14	C7H8	65934	0.002	2.091	2.412	0.160	0.644	4	3
Benzene	0.16	71-43-2	78.11	C6H6	959	<0.0005	0.030	0.035	8.65	32.5	0	0
CSP-7 Oxidation protective primer solution												
Acetic acid	26	64-19-7	60.052	CH3COO H	112554	0.004	3.569	4.117	0.016	0.043	96	83
DMS 744/745 Antioxidant paint												
Acetic acid	25	64-19-7	60.052	CH3COO H	55000	0.002	1.744	2.012	0.016	0.043	47	41
DMS 815/819 Antioxidant paint												
Acetic acid	18	64-19-7	60.052	CH3COO H	165434	0.005	5.246	6.051	0.016	0.043	141	122
Total for Spray Booth (A36)								**18.793**	**-**	**-**	**340**	**295**

Notes:
ODT = Odour Detection Threshold
ODT obtained from EA Draft H4 Guidance Note, Appendix 10

Stack A37 – SECO Oven

SECO Oven (A37) Emissions Data

Actual Volumetric Flow Rate (m^3/s)							
	Emission Rate (g/s)	**Emission Rate (mg/s)**	**Emission Concentration (mg/m^3)**	**ODT (ppm) at 293k**	**ODT ($mg.m^{-3}$) at 293k**	**Odour Emission Concentration ($Ou_e.m^{-3}$)**	**Odour emission rate ($Ou.s^{-1}$)**
Acetic acid	0.012	11.624	1480	0.016	0.043	34419	**270**

Notes:
ODT = Odour Detection Threshold
ODT obtained from EA Draft H4 Guidance Note, Appendix 10

Appendix C: Assessment of Ecological Impacts Source

There is one nationally designated site within 10 km of the Application Site, Ensors Pool Special Area of Conservation (SAC). There are nine Local Wildlife Sites (LWS) within 2 km of the Application Site:

- Prologis Country Park LWS;
- Greenwood Farm Pastures LWS;
- Bassford Bridge Meadow LWS;
- Foleshill Gasworks and Three Spires Sidings LWS;
- Longford Nature Park LWS;
- Former Bell Green Goods Yard LWS;
- North Brook Lane LWS;
- Sandpits Lane Meadow LWS; and
- Houldsworth Crescent Corridor LWS.

Approach

Concentrations of NOx have been predicted using the same model as used in the assessment of impacts at human-health receptors. Modelling has been undertaken for the nearest point of each nature conservation site to the Application Site. The receptor points have been modelled at ground level.

Critical Levels

Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within relevant European air quality directives and corresponding UK air quality regulations. The total proposed PCs and, if appropriate, PECs of NOx have been calculated for comparison with the relevant critical level. Background concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database [16].

Critical Loads

Critical loads refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Nutrient nitrogen deposition and acid deposition are considered in this Appendix.

Critical Loads – Nutrient N Deposition

Percentage contributions to nutrient nitrogen deposition have been derived from the modelled NOx concentrations. Deposition rates have been calculated using empirical methods recommended by the Environment Agency, as follows:

1. The dry deposition flux ($\mu g.m^{-2}.s^{-1}$) has been calculated by multiplying the ground level NO_2 concentrations ($\mu g.m^{-3}$) by the deposition velocity of 0.003 $m.s^{-1}$ for forests/tall habitats and 0.0015 $m.s^{-1}$ for grassland/short habitats.

2. Units of $\mu g.m^{-2}.s^{-1}$ have been converted to units of $kg.ha^{-1}.year^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NOx.

3. Predicted contributions to nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database.

Critical Loads - Acidification

The acid deposition rate, in equivalents $keq.ha^{-1}.year^{-1}$, has been calculated by multiplying the dry deposition flux ($kg.ha^{-1}.year^{-1}$) by a conversion factor of 0.071428 for N. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

Wet deposition in the near field is not significant compared with dry deposition for N [17] and therefore for the purposes of this assessment, wet deposition has not been considered.

Predicted contributions to acid deposition have been calculated and compared with the minimum critical load function for the habitat types associated with the designated site as derived from the APIS database.

Significance Criteria

Maximum PCs and PECs of NO_x and N/acid deposition have been compared against the relevant EQS for the relevant habitat type/interest feature. The Environment Agency guidelines [18] state that:

"To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:

-the short-term PC is less than 10% of the short-term environmental standard

-the long-term PC is less than 1% of the long-term environmental standard

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

It continues by stating that:

"If your long-term PC is greater than 1% and your PEC is less than 70% of the long-term environmental standard, the emissions are insignificant – you don't need to assess them any further."

Results

The ambient NO_x concentrations and existing deposition rates have been obtained from APIS. The highest deposition rates have been obtained taking into account the various habitats across the sites. The critical loads for nitrogen deposition and acid deposition have been also obtained from APIS [[19]].

The maximum predicted annual-mean NO_x, and daily-mean NOx concentrations are compared with the critical level in Tables C1, C2, C3. The maximum predicted nutrient N deposition rates are compared with the critical load in Table C4. The maximum predicted acid deposition rates are compared with the critical load function in Table C5.

Table C1 Predicted Annual-Mean NOx Concentrations at Designated Sites

Designated Site	CL ($\mu g.m^{-3}$)	NOx Existing PC ($\mu g.m^{-3}$)	NOx Proposed PC ($\mu g.m^{-3}$)	Total (Proposed and Existing) PC as % of CL
Prologis LWS 1	30	1.04E-01	1.82E-04	0
Prologis LWS 2		1.30E-01	2.42E-04	0
Prologis LWS 3		1.24E-01	2.17E-04	0
Greenwood Farm LWS		2.05E-01	3.39E-04	1
Bassford Bridge 1		1.29E-01	2.03E-04	0
Bassford Bridge 2		1.57E-01	2.62E-04	1
Bassford Bridge 3		1.33E-01	2.35E-04	0
Foleshill LWS 1		2.23E-01	4.58E-04	1
Foleshill LWS 2		2.19E-01	4.70E-04	1
Foleshill LWS 3		1.65E-01	3.19E-04	1
Longford LWS 1		1.31E-01	2.40E-04	0
Longford LWS 2		1.03E-01	1.91E-04	0
Bell Green LWS 1		6.09E-02	1.48E-04	0
Bell Green LWS 2		5.29E-02	1.20E-04	0
North Brook LWS 1		3.76E-02	6.11E-05	0
North Brook LWS 2		3.70E-02	5.49E-05	0
North Brook LWS		5.70E-02	6.71E-05	0
Sandpits Lane LWS 1		5.81E-02	1.02E-04	0
Houldsworth LWS 1		8.29E-02	1.67E-04	0

Designated Site	CL (µg.m^{-3})	NOx Existing PC (µg.m^{-3})	NOx Proposed PC (µg.m^{-3})	Total (Proposed and Existing) PC as % of CL
Houldsworth LWS 2		1.16E-01	2.17E-04	0
Houldsworth LWS 3		1.52E-01	3.05E-04	1
Houldsworth LWS 4		1.81E-01	3.61E-04	1
Ensor's Pool SAC		1.62E-02	1.78E-05	0

Table C2 Predicted Daily-Mean NO_2 Concentrations at Designated Sites

Designated Site	CL (µg.m^{-3})	NOx Existing PC (µg.m^{-3})	NOx Proposed PC (µg.m^{-3})	Total (Proposed and Existing) PC as % of CL
Prologis LWS 1	30	4.70	0.011	6
Prologis LWS 2		4.07	0.014	5
Prologis LWS 3		3.16	0.012	4
Greenwood Farm LWS		4.57	0.014	6
Bassford Bridge 1		3.53	0.010	5
Bassford Bridge 2		3.89	0.011	5
Bassford Bridge 3		3.08	0.010	4
Foleshill LWS 1		5.16	0.021	7
Foleshill LWS 2		5.45	0.022	7
Foleshill LWS 3		4.13	0.015	6
Longford LWS 1		3.64	0.012	5
Longford LWS 2		3.23	0.010	4

Designated Site	CL ($\mu g.m^{-3}$)	NOx Existing PC ($\mu g.m^{-3}$)	NOx Proposed PC ($\mu g.m^{-3}$)	Total (Proposed and Existing) PC as % of CL
Bell Green LWS 1		3.32	0.013	4
Bell Green LWS 2		2.93	0.010	4
North Brook LWS 1		3.58	0.007	5
North Brook LWS 2		3.05	0.005	4
North Brook LWS		3.25	0.005	4
Sandpits Lane LWS 1		4.45	0.013	6
Houldsworth LWS 1		3.54	0.013	5
Houldsworth LWS 2		4.68	0.013	6
Houldsworth LWS 3		5.59	0.018	7
Houldsworth LWS 4		5.22	0.020	7
Ensor's Pool SAC		0.89	0.001	1

Table C3 Predicted Nutrient N Deposition at Designated Sites

Designated Site	CL ($kgN.ha^{-1}.yr^{-1}$)	Existing PC ($kgN.ha^{-1}.yr^{-1}$)	Proposed PC ($kgN.ha^{-1}.yr^{-1}$)	Total (Proposed and Existing) PC as % of CL
Prologis LWS 1	10	0.030	5.2E-05	0
Prologis LWS 2	10	0.037	7.0E-05	0
Prologis LWS 3	10	0.036	6.2E-05	0
Greenwood Farm LWS	10	0.059	9.8E-05	1
Bassford Bridge 1	10	0.037	5.9E-05	0

Designated Site	CL (kgN.ha^{-1}.yr^{-1})	Existing PC (kgN.ha^{-1}.yr^{-1})	Proposed PC (kgN.ha^{-1}.yr^{-1})	Total (Proposed and Existing) PC as % of CL
Bassford Bridge 2	10	0.045	7.5E-05	0
Bassford Bridge 3	10	0.038	6.8E-05	0
Foleshill LWS 1	20	0.032	6.6E-05	0
Foleshill LWS 2	20	0.031	6.8E-05	0
Foleshill LWS 3	20	0.024	4.6E-05	0
Longford LWS 1	10	0.038	6.9E-05	0
Longford LWS 2	10	0.030	5.5E-05	0
Bell Green LWS 1	20	0.009	2.1E-05	0
Bell Green LWS 2	20	0.008	1.7E-05	0
North Brook LWS 1	10	0.005	8.8E-06	0
North Brook LWS 2	10	0.005	7.9E-06	0
North Brook LWS	10	0.008	9.7E-06	0
Sandpits Lane LWS 1	20	0.008	1.5E-05	0
Houldsworth LWS 1	10	0.024	4.8E-05	0
Houldsworth LWS 2	10	0.033	6.2E-05	0
Houldsworth LWS 3	10	0.044	8.8E-05	0
Houldsworth LWS 4	10	0.052	1.0E-04	0
Ensor's Pool SAC	n/a	0.002	2.6E-06	1

Table C4 Predicted Acid Deposition at Designated Sites

Designated Site	CLF (keq.ha^{-1}.year^{-1})	Existing PC (keq.ha^{-1}.year^{-1})	Proposed PC (keq.ha^{-1}.year^{-1})	Total (Proposed and Existing) PC as % of CLF
Prologis LWS 1	2.699	2.14E-03	3.74E-06	0
Prologis LWS 2	2.699	2.67E-03	4.99E-06	0
Prologis LWS 3	2.699	2.56E-03	4.46E-06	0
Greenwood Farm LWS	2.699	4.21E-03	6.97E-06	0
Bassford Bridge 1	1.206	2.66E-03	4.18E-06	0
Bassford Bridge 2	1.206	3.23E-03	5.38E-06	0
Bassford Bridge 3	1.206	2.73E-03	4.84E-06	0
Foleshill LWS 1	4.856	2.30E-03	4.71E-06	0
Foleshill LWS 2	4.856	2.25E-03	4.83E-06	0
Foleshill LWS 3	4.856	1.70E-03	3.28E-06	0
Longford LWS 1	1.206	2.69E-03	4.94E-06	0
Longford LWS 2	1.206	2.12E-03	3.93E-06	0
Bell Green LWS 1	4.856	6.26E-04	1.52E-06	0
Bell Green LWS 2	4.856	5.44E-04	1.24E-06	0
North Brook LWS 1	2.7	3.86E-04	6.29E-07	0
North Brook LWS 2	2.7	3.80E-04	5.65E-07	0
North Brook LWS	2.7	5.86E-04	6.90E-07	0
Sandpits Lane LWS 1	5.071	5.98E-04	1.05E-06	0
Houldsworth LWS 1	2.7	1.70E-03	3.44E-06	0

Designated Site	CLF (keq.ha^{-1}.year^{-1})	Existing PC (keq.ha^{-1}.year^{-1})	Proposed PC (keq.ha^{-1}.year^{-1})	Total (Proposed and Existing) PC as % of CLF
Houldsworth LWS 2	2.7	2.38E-03	4.46E-06	0
Houldsworth LWS 3	2.7	3.13E-03	6.28E-06	0
Houldsworth LWS 4	2.7	3.73E-03	7.42E-06	0
Ensor's Pool SAC	n/a	1.66E-04	1.83E-07	0

7.7 For all pollutants and designated sites, the PCs do not exceed 1% of the CL and the impacts can be screened out as insignificant.

References

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6 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.

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11 RPS, July 2018. Air Impact Assessment for Meggitt Aircraft braking Systems.

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13 Environment Agency: H4 Odour Management. March 2011

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16 Air Pollution Information Systems, www.apis.ac.uk

17 Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4

18 Air emissions risk assessment for your environmental permit

19 Data downloaded from APIS December 2020