

**Proposed Crematorium
Turners Hill, Mid Sussex**

Air Quality Assessment



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1 INTRODUCTION

1.1 Entran Ltd has been commissioned to undertake an assessment of the likely local air quality impacts arising from the operation of a proposed new crematorium in Turners Hill, Mid Sussex. The Site comprises a 7.2 hectare plot, the location of which is presented in Figure 1.1.

1.2 The Proposed Development comprises:

'Outline application for single 'chapel' crematorium with a single abated cremator and natural burial site with associated access, car parking, landscaping and drainage with all matters reserved apart from access.'

1.3 A plan showing the proposed layout of the Proposed Development is presented in Figure 1.2

1.4 The key pollutants considered in this assessment are:

- oxides of nitrogen (NO_x as NO₂);
- carbon monoxide (CO);
- sulphur dioxide (SO₂);
- hydrogen chloride (HCl);
- particulate matter (as PM₁₀ and PM_{2.5});
- mercury (Hg);
- organic compounds, expressed as carbon; and
- dioxins and furans (PCDD/Fs).

1.5 Predicted concentrations of these pollutants are compared with relevant air quality standards and guidelines for the protection of health and sensitive habitat sites.

1.6 A glossary of common air quality terminology is provided in **Appendix A**.



Figure 1.1: Site Location

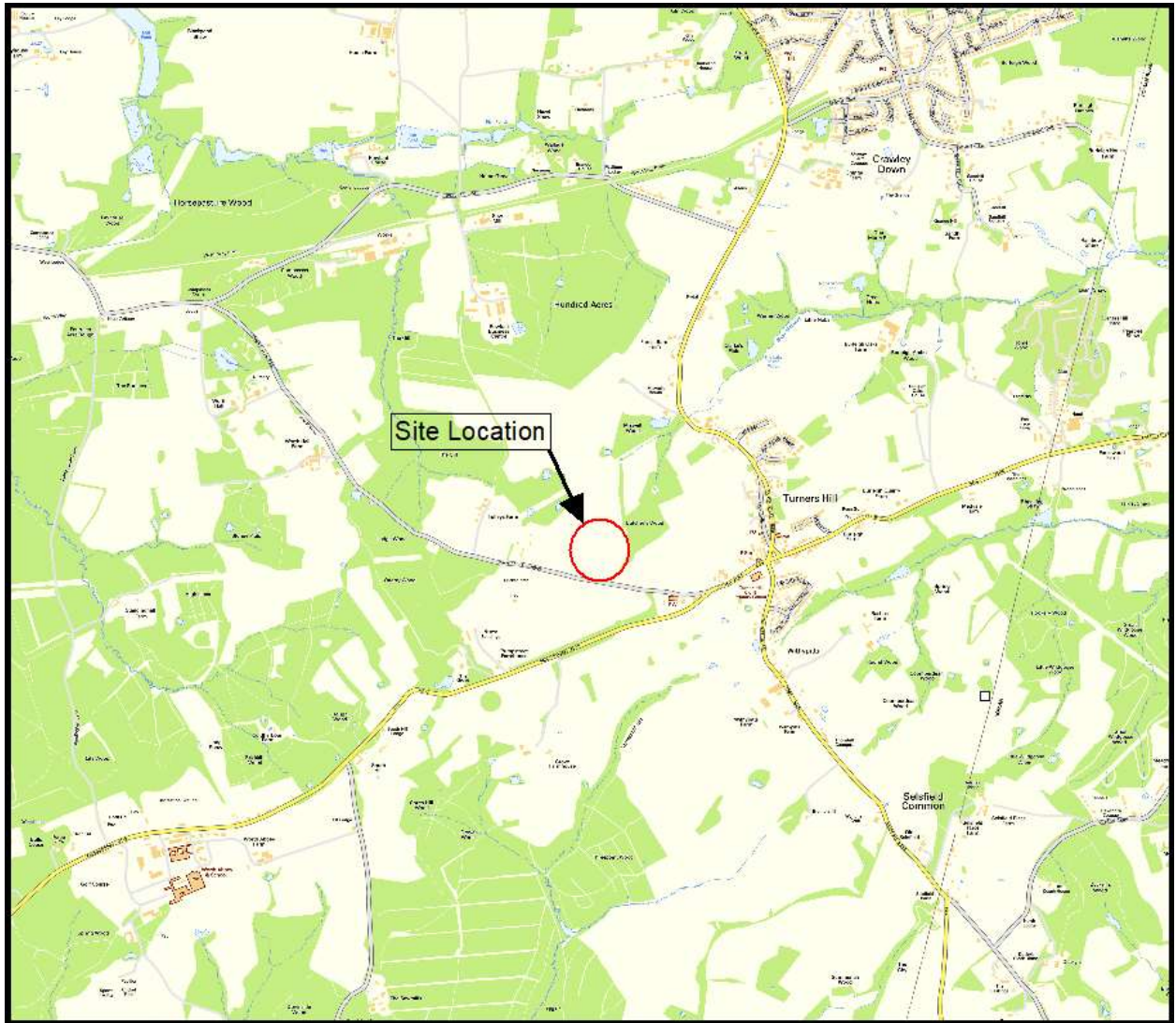




Figure 1.2: Illustrative Site Layout





2 LEGISLATION AND POLICY

The European Directive on Ambient Air and Cleaner Air for Europe

2.1 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. The Directive streamlines the European Union's air quality legislation by replacing four of the five existing Air Quality Directives within a single, integrated instrument.

2.2 The pollutants included are sulphur dioxide (SO₂), nitrogen dioxide (NO₂), particulate matter of less than 10 micrometres (µm) in aerodynamic diameter (PM₁₀), particulate matter of less than 2.5 µm in aerodynamic diameter (PM_{2.5}), lead (Pb), carbon monoxide (CO), benzene (C₆H₆), ozone (O₃), polycyclic aromatic hydrocarbons (PAHs), cadmium (Cd), arsenic (As), nickel (Ni) and mercury (Hg).

Air Quality Strategy for England, Scotland, Wales & Northern Ireland

2.3 The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007¹, pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

2.4 The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems.

2.5 The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

¹ Department for Environment, Food and Rural Affairs (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland



2.6 The air quality objectives (AQO) are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedences of the standard over a given period.

2.7 For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO₂, the short-term standard is for a 1-hour averaging period, whereas for PM₁₀ it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

Air Quality (England) Regulations

2.8 Many of the objectives in the AQS were made statutory in England with the *Air Quality (England) Regulations 2000*² and the *Air Quality (England) (Amendment) Regulations 2002* (the Regulations)³ for the purpose of Local Air Quality Management (LAQM).

2.9 The Air Quality Standards Regulations 2010⁴ have adopted into UK law the limit values required by EU Directive 2008/50/EC and came into force on the 10th June 2010. These regulations prescribe the 'relevant period' (referred to in Part I2V of the Environment Act 1995) that local authorities must consider in their review of the future quality of air within their area. The regulations also set out the air quality objectives to be achieved by the end of the 'relevant period'.

2.10 Ozone is not included in the Regulations as, due to its trans-boundary nature, mitigation measures must be implemented at a national level rather than at a local authority level.

2.11 The EALs, air quality standards and objectives for the pollutants considered in the assessment are presented in **Appendix B**.

² The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928

³ The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043

⁴ The Air Quality Standards Regulations 2010 – Statutory Instrument 2010 No. 1001



Local Air Quality Management (LAQM)

2.12 Part IV of the Environment Act 1995 also requires local authorities to periodically Review and Assess the quality of air within their administrative area. The Reviews have to consider the present and future air quality and whether any air quality objectives prescribed in Regulations are being achieved or are likely to be achieved in the future.

2.13 Where any of the prescribed air quality objectives are not likely to be achieved the authority concerned must designate that part an Air Quality Management Area (AQMA).

2.14 For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.

2.15 The Department of Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their Review and Assessment work⁵. This guidance, referred to in this chapter as LAQM.TG(16), has been used where appropriate in the assessment.

National Planning Policy Framework

2.16 The National Planning Policy Framework (NPPF)⁶ sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

2.17 The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to '*contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*'

⁵ Department for Environment, Food and Rural Affairs (DEFRA), (2016): Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16).

⁶ Ministry of Housing, Communities and Local Government: National Planning Policy Framework (February 2019).



2.18 Under Section 15: Conserving and Enhancing the Natural Environment, the NPPF (paragraph 170) requires that *'planning policies and decisions should contribute to and enhance the natural local environment by ...preventing 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. Development should, wherever possible help to improve local environmental conditions such as air and water quality.'*

2.19 In dealing specifically with air quality the NPPF (paragraph 181) states that *'planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan'*.

2.20 Paragraph 183 states that *'the focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively.'*



3 METHODOLOGY

Scope of the Assessment

3.1 The scope of the impact assessment for emissions from the Proposed Development has been determined in the following way:

- review of air quality data for the area surrounding the Site, including data from the Defra Air Quality Information Resource (UK-AIR);
- desk study to confirm the location of nearby areas that may be sensitive to changes in local air quality;
- review of emission parameters for the Proposed Development, which have been used as inputs to the dispersion model (Breeze AERMOD 7); and
- review of traffic data provided by the project team, which has been used as an input to the dispersion model (ADMS-Roads).

3.2 The Proposed Development is likely to result in emissions arising from the cremator plant and road traffic associated with the services.

3.3 Guidance provided by the EPUK & IAQM provides threshold criteria for establishing when significant impacts on local air quality may occur from road traffic changes and when a detailed assessment of potential impacts is required. At locations outside an Air Quality Management Area (AQMA), a change in light duty vehicles (LDV) of more than 500 per day and / or a change in heavy duty vehicles (HDV) of more than 100 per day is considered to result in potentially significant impacts on air quality. At locations within an AQMA, a change in light duty vehicles (LDV) of more than 100 per day and / or a change in heavy duty vehicles (HDV) of more than 25 per day is considered to result in potentially significant impacts on air quality.

3.4 The Site is not located within or near to an AQMA. Information provided by the transport consultants has indicated that the operation of the Proposed Development would result in the generation of an annual average daily traffic flow (AADT) of 27. An assessment of the impact of emissions arising from traffic generated by the Proposed Development is therefore not considered necessary.

3.5 However, due to the sensitivity of Ashdown Forrest which has been designated as a Special Area of Conservation (SAC), a Special Protection Area (SPA) and Site of Special Scientific



Interest (SSSI) an assessment of the impact of the emissions from traffic generated by the Proposed Development passing along the roads within Ashdown Forest has been assessed.

Detailed Modelling of Emissions arising from the Crematorium Stack

3.1 Air pollutant levels at selected receptors within the study are have been predicted using the detailed dispersion model AERMOD.

3.2 The key pollutants arising from the combustion process will be oxides of nitrogen (NO_x), CO and SO₂. The emissions from the plant will comply with the limits for abated cremators set out in the Defra Statutory Guidance for Crematoria⁷ (see Table 3.1).

Table 3.1: Emission Limits (273.15K, 11% O₂, 101.3 mb, dry)

Pollutant	Emission Limit
Mercury	50 µg/Nm ³
Hydrogen chloride	30 mg/Nm ³
Total particulate matter	20 mg/Nm ³
Carbon monoxide	100 mg/Nm ³
Organic compounds	20 mg/Nm ³
Dioxins and furans	0.1 ng/Nm ³ (ITEQ)

3.3 In addition, the technology suppliers (Facultatieve Technologies) have provided typical emission concentrations of 350 mg/Nm³ and 50 mg/Nm³ for NO_x and SO₂, respectively.

3.4 The input parameters for the proposed cremator are identified in **Appendix C**. The likely maximum operational profile of the facility is 8 hours per day, 5 days a week; the long-term mass emission rates have been scaled accordingly.

3.5 The proposed height of the stack is 7m, further detailed dispersion modelling was completed to determine the impact of changing the stack height. Details are provided in **Appendix D**).

⁷ Process Guidance Note 5/2 (12), Statutory Guidance for Crematoria, September 2012



3.6 Predicted concentrations are compared with relevant air quality standards for the protection of health and critical levels / loads for the protection of sensitive ecosystems and vegetation.

Local Meteorological Data

3.7 The dispersion modelling has been carried out using five years (2014 to 2018) of hourly sequential meteorological data in order to take account of inter-annual variability and reduce the effect of any atypical conditions. Data from meteorological station at Charlwood (approximately 10 km northwest of the Site) has been used for the assessment.

3.8 Wind roses for each year of meteorological data are presented in **Appendix E**.

Building Downwash / Entrainment

3.9 The presence of buildings close to emission sources can significantly affect the dispersion of pollutants by leading to a phenomenon called downwash. This occurs when a building distorts the wind flow, creating zones of increased turbulence. Increased turbulence causes the plume to come to ground earlier than otherwise would be the case and result in higher ground level concentrations closer to the stack.

3.10 Downwash effects are only significant where building heights are greater than 30 to 40% of the emission release height. The downwash structures also need to be sufficiently close for their influence to be significant.

3.11 The crematorium buildings have been included in the model as a potential downwash structures.

Nitric Oxide to NO₂ Conversion

3.12 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 NO₂. The proportion of NO converted to NO₂ depends on a number of factors



including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as ozone (O₃).

3.1 A conversion ratio of 70% NO_x:NO₂ has been assumed for comparison of predicted concentrations with the long-term objectives for NO₂. A conversion ratio of 35% has been utilised for the assessment of short-term impacts, as recommended by Environment Agency guidance⁸.

Sensitive Human Health Receptors

3.2 LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations '*where members of the public are regularly present*' should be considered. At such locations, members of the public will be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

3.3 For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standard (i.e. 15-minute mean or 1-hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term (such as 24-hour mean or annual mean) standards may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

3.4 The location of the sensitive receptors selected for the assessment is presented in Table 3.2 and Figure 3.1.

⁸ Environment Agency AQMAU, Conversion Rates for NO_x and NO₂.



Table 3.2: Sensitive Receptors

ID	Receptor	Type	Easting	Northing
R1	Stone Quarry Cottage	Residential	532821	135607
R2	Cottages at Tulleys Farm	Residential	532981	135690
R3	House at Tulleys Farm	Residential	533026	135777
R4	Worth Hall Farm	Residential	532435	135885
R5	Residential properties on Turners Hill Road	Residential	532135	136404
R6	40 Wallage Lane	Residential	533720	136969
R7	Oak Cottage, Turners Hill Road	Residential	533858	136495
R8	1 Miswells Cottage	Residential	533753	136109
R9	Hope Cottage	Residential	533903	136014
R10	Mantlemas Heath Cottage	Residential	534077	135769
R11	The Old Vicarage, Church Rd	Residential	534043	135527
R12	Turners Hill C of E Primary School	Residential	534080	135461
R13	Vicarage, Turners Hill Road	Residential	533806	135387
R14	Selsfield Road	Residential	534080	135294
R15	Bramblehill	Residential	534291	134531
R16	Grove Farmhouse	Residential	533256	134776
R17	Pumpstreet Farmhouse	Residential	533121	135117
R18	40 Grove Buildings	Residential	532962	135231
R19	South Hill Lodge	Residential	532614	134871
ST1	St Leonards Church	Short Term	533748	135397
ST2	Tulleys Escape Rooms & Tea Rooms	Short Term	532363	135919
ST3	Commercial Building	Short Term	533084	136473
D1	Chapel	Short Term (Proposed)	533494	135562
D2	Reception	Short Term (Proposed)	533470	135555
D3	Staff Room	Short Term (Proposed)	533471	135558

D4	Waiting Room	Short Term (Proposed)	533480	135544
D5	Garden of Remembrance	Short Term (Proposed)	533407	135537

Figure 3.1: Sensitive Receptor Locations



3.5 Pollutant concentrations have been predicted at both discrete receptor locations and over a 2km by 2km Cartesian grid of 25 m resolution.



Assessment of impact on Sensitive Ecological Areas

3.6 The EA risk assessment guidance states that the impact of emissions to air on vegetation and ecosystems should be assessed for the following habitat sites within 10 km of the source:

- Special Areas of Conservation (SACs) and candidate SACs (cSACs) designated under the EC Habitats Directive⁹;
- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive¹⁰; and
- Ramsar Sites designated under the Convention on Wetlands of International Importance¹¹.

3.7 Within 2 km of the source the following habitat sites should be assessed:

- Sites of Special Scientific Interest (SSSI) established by the 1981 Wildlife and Countryside Act;
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR);
- local wildlife sites (LWS) and potential wildlife sites (PWS);
- Sites of Importance for Nature Conservation (SINC) and
- ancient woodland.

3.8 Only one SPA, SAC or Ramsar Site is located within 10km of the Site. This is the Ashdown Forest SAC and SPA, of which only a small section is located within a 10km radius of the Site. A number of receptors have been included in the model within this designated site at the closest points to the Site.

3.9 Two SSSI's are located within 2km of the Site (Turners Hill SSSI and Wakehurst & Chiddingly Woods SSSI). Turners Hill SSSI is designated for geological interest rather than for ecological habitats and therefore not included in the assessment. Receptors have been included

⁹ Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

¹⁰ Council Directive 79/409/EEC on the conservation of wild birds

¹¹ Ramsar (1971), The Convention of Wetlands of International Importance especially as Waterfowl Habitat



in the model to represent the closest locations within the Wakehurst & Chiddingly SSSIs to the Site.

3.10 There are numerous ancient woodlands within 2km of the Site. Locations within the closest woodlands have been included as sensitive receptors within the model.

3.11 Details of LWS within the vicinity of the Site were not available, therefore the impact on LWSs have been assessed by considering the impact at the location where the highest concentration is predicted within the 2km grid. This will ensure a worst-case assessment is completed.

3.12 The modelled ground level pollutant concentrations are used to predict deposition rates, using typical deposition velocities. A summary of typical NO₂ and SO₂ dry deposition velocities is presented in Table 3.3.

Table 3.3: Dry Deposition Velocity (m/s)

Pollutant	Grassland	Woodland
Nitrogen Dioxide (NO ₂)	0.0015	0.0030
Sulphur Dioxide (SO ₂)	0.012	0.024

3.13 The predicted nitrogen deposition rates assume a 100% NO_x: NO₂ conversion. This represents a worst-case for the assessment since nitric oxide (NO) has a lower deposition velocity than NO₂ and consequently results in lower deposition rates.

3.14 Predicted ground level concentrations and acidification / nitrogen deposition rates are compared with relevant air quality standards for human health and critical levels and critical loads for the protection of sensitive ecosystems and vegetation (see **Appendix F**).

Assessment of Impacts from Traffic Emissions

3.15 In addition to the impact of emissions from the crematorium stack, emissions from traffic generated by the Proposed Development have been assessed on roads passing through Ashdown Forest. The detailed dispersion model ADMS-Roads has been used which is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.



3.16 The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x) at the selected receptors. Receptors were selected along the key roads within Ashdown Forest within transects at 1m, 5m, 10m and 20m from the kerbside.

3.17 Traffic data for road links through Ashdown Forest have been provided by the transport consultants. A summary of the traffic data used in the assessment can be found in **Appendix G**. The data includes details of annual average daily traffic flows (AADT), vehicle speeds and percentage Heavy Duty Vehicles (HDV) for the assessment years considered. Low traffic speeds have been assigned to appropriate road links for account for congestion and queuing vehicles.

3.18 The emission factors released by Defra in May 2019, provided in the emissions factor toolkit EFT2019_9.0 have been used to predict traffic related emissions in 2018 and 2023 (the proposed opening year of the Development). To ensure a worst-case assessment, the emission factors for the year 2018 have been used for the future year (2023).

3.19 To predict local air quality, traffic emissions predicted by the model must be added to local background concentrations. Background concentrations for 2018 have been used to predict concentrations in 2023 assuming no change in future years. Again, this is considered to represent a worst-case prediction of future concentrations.

3.20 To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process aims to minimise modelling uncertainty and systematic error by correcting the modelled results by an adjustment factor to gain greater confidence in the final results. This process was undertaken using the methodology outlined in Chapter 7, Section 4 of LAQM.TG(16).

3.21 An overall verification factor of 2.27 was determined which indicates that the model is under-predicting in this area. This factor was applied to the modelled road-NO_x concentrations. Further details of the determination of the verification factor are provided in **Appendix H**.

3.22 The location of receptors included in the models within the sensitive ecological habitats are summarised in Table 3.4 below and illustrated in Figures 3.2 to 3.4.



Table 3.4: Sensitive Ecological Receptors

ID	Habitat	Model
E1	Ashdown Forest SPA / SAC / SSSI	Stack Emissions
E2	Ashdown Forest SPA / SAC / SSSI	Stack Emissions
E3	Ashdown Forest SPA / SAC / SSSI	Stack Emissions
E4	Ashdown Forest SPA / SAC / SSSI	Stack Emissions
E5	Wakehurst & Chiddingly Woods SSSI	Stack Emissions
E6	Wakehurst & Chiddingly Woods SSSI	Stack Emissions
E7	Wakehurst & Chiddingly Woods SSSI	Stack Emissions
E8	Butchers Wood (ancient woodland)	Stack Emissions
E9	Butchers Wood (ancient woodland)	Stack Emissions
E10	Butchers Wood (ancient woodland)	Stack Emissions
E11	Tulleys Farm Wood (ancient woodland)	Stack Emissions
E12	Quarry Wood (ancient woodland)	Stack Emissions
E13	Ashdown Forest SPA / SAC / SSSI (Roadside Transect)	Road Emissions and Stack Emissions
E14	Ashdown Forest SPA / SAC / SSSI (Roadside Transect)	Road Emissions and Stack Emissions
E15	Ashdown Forest SPA / SAC / SSSI (Roadside Transect)	Road Emissions and Stack Emissions
E16	Ashdown Forest SPA / SAC / SSSI (Roadside Transect)	Road Emissions and Stack Emissions

Figure 3.2: Ecological Sensitive Receptor Locations (Overview)

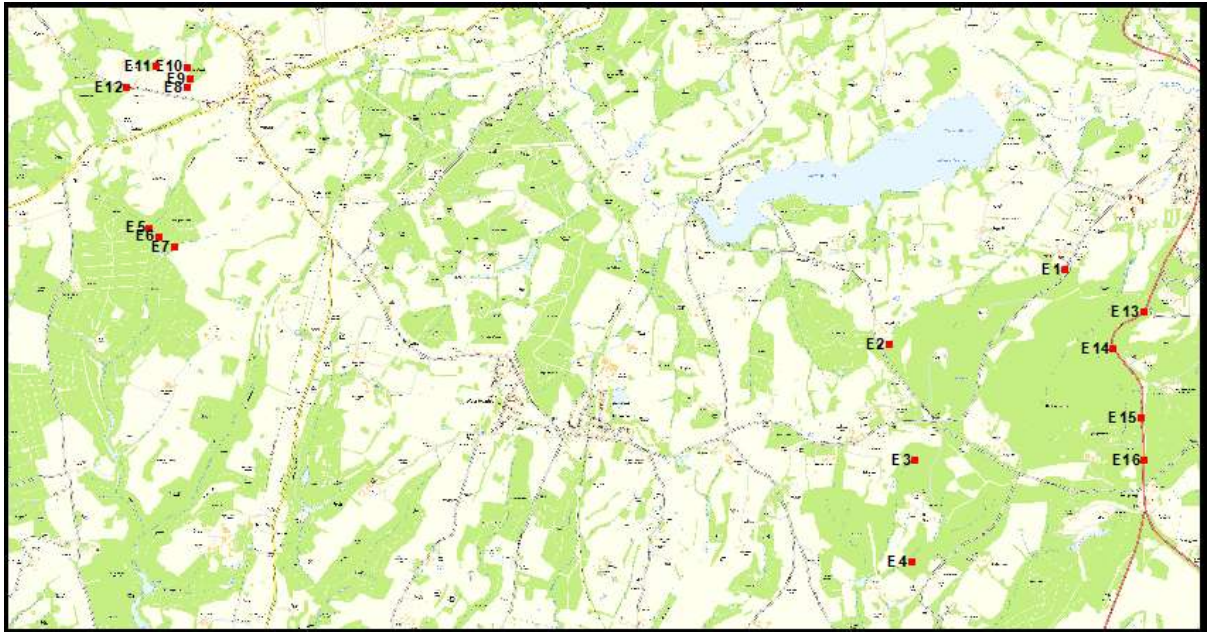


Figure 3.3: Ecological Sensitive Receptor Locations (Close to Site)

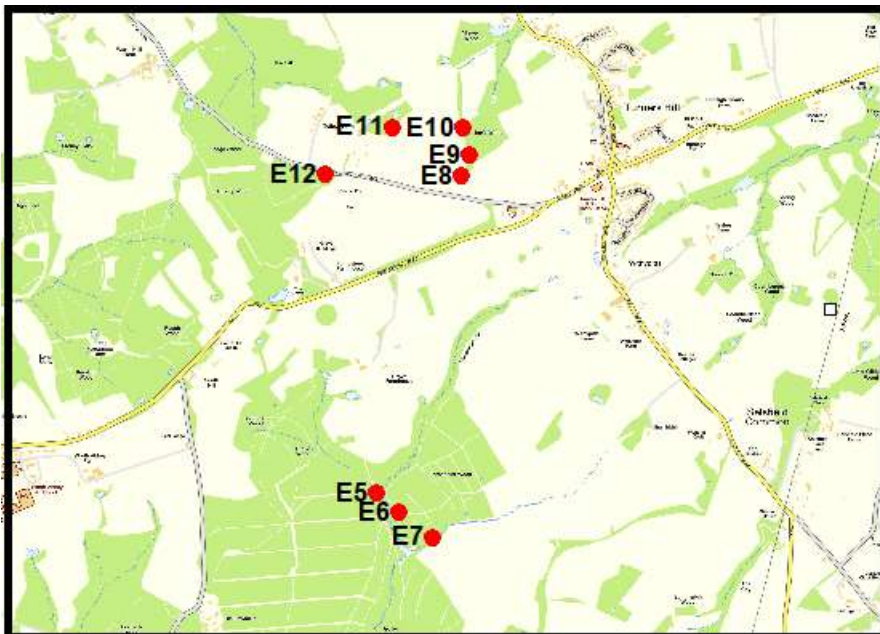


Figure 3.4: Ecological Sensitive Receptor Locations (Distant Receptors within Ashdown Forest)



Significance Criteria

Human Health Receptors

3.23 The significance of the predicted long-term impact at human health receptors is determined in accordance with the EPUK / IAQM planning guidance¹² in combination with the professional judgement of the author. The impact at individual receptors depends on the predicted change in the pollutant concentration compared with the relevant air quality standard or objective and existing air quality as illustrated in Table 3.5.

¹² EPUK/ IAQM (2017), Land-Use Planning & Development Control: Planning for Air Quality, January 2017



Table 3.5: Significance Descriptors for Individual Receptors (Long-Term Impacts)

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL) (a)			
	1	2-5	5-10	>10
75% or less of AQAL	Negligible	Negligible	Slight adverse	Moderate adverse
76-94% of AQAL	Negligible	Slight adverse	Moderate adverse	Moderate adverse
95-102% of AQAL	Slight adverse	Moderate adverse	Moderate adverse	Substantial adverse
103-109% of AQAL	Moderate adverse	Moderate adverse	Substantial adverse	Substantial adverse
110% or more of AQAL	Moderate adverse	Substantial adverse	Substantial adverse	Substantial adverse
(a) A change in concentration of less than 0.5% of the AQAL is considered insignificant, however changes between 0.5% and 1% are rounded up to 1%.				

3.24 Short-term impacts of less than 10% of the AQAL are described as negligible, regardless of existing air quality. Where the short-term process concentrations are 11-20% of the AQAL the severity of the impact is described as slight adverse. Impacts of 21-50% and over 51% are described as moderate and substantial adverse, respectively.

Ecological Receptors

3.25 The Environment Agency's environmental risk assessment guidance¹³ specifies criteria to enable the potential significance of an impact to be determined. The criteria are outlined in Table 3.6 below.

¹³ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>



Table 3.6: Significance Criteria for Ecological Sites

Ecological Habitat	Stage One	Stage Two
SPAs, SACs, Ramsar sites or SSSIs	The impact is considered insignificant if <ul style="list-style-type: none">• Short term PC < 10% short term critical level; and• Long term PC < 1% long term critical level	The impact is considered to be insignificant if <ul style="list-style-type: none">• Long term PC >1% and PEC <70% of the long term critical level.
Local Nature Sites (ancient woodlands, local wildlife sites, national and local nature reserves)	The impact is considered to be insignificant if: <ul style="list-style-type: none">• Short term PC <100% short term critical level; and• Long term PC < 100% long term critical level	



4 BASELINE CONDITIONS

Local Air Quality Management

4.1 The Proposed Development is located within the administrative area of Mid Sussex District Council (MSDC).

4.2 MSDC undertakes frequent review and assessments of air quality and produces Annual Status Reports in accordance with the requirements of Defra.

4.3 The Proposed Development does not lie within an Air Quality Management Area (AQMA). The nearest AQMA to the Site is 4.5km to the northwest of the Site, in Crawley and unlikely to be significantly affected by emissions from the crematorium.

Nitrogen Dioxide, Carbon Monoxide, Particulate Matter, Sulphur Dioxide and Total Organic Carbon (as Benzene)

4.4 MSDC does not currently monitor air quality using continuous automatic monitors. Concentrations of NO₂ across the district are measured using a network of diffusion tubes. None of the diffusion tubes are located in an appropriate location to establish a background concentration in the vicinity of the Site. For completeness, measured concentrations at the nearest monitoring locations are presented in Table 4.1 below.

Table 4.1: Measured NO₂ Concentrations at nearest diffusion tubes (µg/m³)

Diffusion Tube	Classification	Grid Reference	Measured NO ₂ Concentration				
			2014	2015	2016	2017	2018
MSAQ7	Suburban	530440, 137280	27.1	25.3	26.5	23.6	22.5
MSAQ25	Kerbside	531176, 138829	-	29.1	30.0	28.8	26.9
MSAQ3	Kerbside	538690, 138759	39.3	36.9	36.7	35.8	34.4
MSAQ5	Suburban	541245, 136996	37.2	32.8	34.5	31.0	30.0
MSAQ6	Roadside	526138, 129827	23.3	28.0	28.7	29.1	26.2
MSAQ9	Rural	525664, 125035	8.0	8.0	10.0	9.0	9.0



4.5 Due to the lack of suitable air quality monitoring undertaken in the vicinity of the Site, background pollutant concentrations have been obtained from the Defra UK Background Air Pollution maps¹⁴ for use in the assessment. These 1 km grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites.

4.6 The latest background maps for NO_x, NO₂, PM₁₀ and PM_{2.5} were issued in May 2019 and are based on 2017 monitoring data. The CO, SO₂ and benzene mapped concentrations are based on 2001 monitoring data. For CO and benzene, factors are available to project the concentrations to future years¹⁵. No reduction in SO₂ since 2001 is assumed.

4.7 The average background concentrations obtained from the nine 1km squares surrounding the Site have been used as background concentrations throughout the study area. A summary is presented in Table 4.2.

Table 4.2: Mapped Annual Mean Background Concentrations (µg/m³)

Pollutant	Annual Mean	AQAL
Nitrogen Dioxide (NO ₂)	10.0	40
Particles (PM ₁₀)	14.5	40
Particles (PM _{2.5})	9.6	25
Sulphur Dioxide (SO ₂)	2.7	n/a
Carbon Monoxide (CO)	122.8	n/a
Benzene (C ₆)	0.2	5

Hydrogen Chloride

4.8 Ambient monitoring of Hydrogen Chloride is carried out as part of the Defra Acid Gases and Aerosols Network (AGANET) at a number of, predominantly rural, locations around the UK.

4.9 For the purposes of the assessment, the 2011 to 2015 average HCl concentration (which is the latest available data) measured at the nearest rural background location of 0.40 µg/m³ is assumed to provide a reasonable estimate of the background concentration at the Site and nearby sensitive receptors.

¹⁴ <http://uk-air.defra.gov.uk/data/laqm-background-home>

¹⁵ <http://laqm.defra.gov.uk/tools-monitoring-data/year-adjustment.html>



Mercury

4.10 Defra currently monitors mercury at a number of locations as part of the Rural Automatic Mercury Network.

4.11 The annual average mercury concentration measured at the nearest rural site between 2016 and 2018 was 1.5 ng/m³. For the purposes of the assessment this concentration is assumed to provide a reasonable estimate of the existing concentration in the vicinity of the Proposed Development.

Dioxins and Furans

4.12 Monitoring of PCDD/Fs is currently carried out by Defra at six locations in the UK (Hazelrigg, High Muffles, London, Manchester, Auchencorth Moss and Weybourne) as part of the Toxic Organic Micropollutants (TOMPs) Network.

4.13 To provide an indication of the range of PCDD/F concentrations that occur in the UK, a summary of the annual mean concentrations measured between 2014 and 2016 is presented in Table 4.3.

Table 4.3: UK PCDD/Fs Concentrations (fg TEQ/m³)

Metal	Type	2014	2015	2016
London	Urban background	2.87	4.35	20.75
Manchester	Urban background	16.95	5.95	12.25
Auchencorth Moss	Rural background	0.01	<0.01	0.15
High Muffles	Rural background	1.44	1.06	3.7
Hazelrigg	Rural background	2.59	5.29	4.58
Weybourne	Rural background	1.62	1.42	17.78

4.14 In general, the concentration of dioxins and furans at rural locations is considerably lower than at urban locations.

4.15 The average concentration measured at the four rural background monitoring sites from 2014 to 2016 is 3.3 fg/m³ and is assumed to be reasonably representative of the baseline dioxin and furan concentration at the Site and nearby sensitive receptors.



5 ASSESSMENT OF IMPACT

Human Health Impacts

Introduction

5.1 Predicted process concentrations (PC) for the five years of meteorological data are presented as the maximum off-site ground level concentration (GLC) predicted across the grid and the maximum for each of the discrete receptors identified in Table 3.2.

5.2 In order to predict the long-term predicted environmental concentrations (PECs), annual mean background concentrations identified in Section 4 have been combined with the predicted long-term PC. To predict the short-term PECs, in accordance with the EA's Air Emissions Risk Assessment Guidance the predicted short-term PC is added to the short-term background concentrations which is assumed to be twice that of the annual average background concentration. The exception to this is the 24-hour mean PM₁₀ concentrations, for which the long-term background concentrations have been added in accordance with advice provided in LAQM.TG(16).

5.3 The maximum PEC is compared with the relevant air quality standard and the significance of the impact determined in accordance with the EPUK / IAQM criteria outlined in Table 3.5.

Nitrogen Dioxide

5.4 The predicted annual mean and 99.8th percentile of 1-hour mean NO₂ process concentrations are presented in Table 5.1.

Table 5.1: Predicted NO₂ Concentrations (µg/m³)

Receptor	Annual Mean		99.8 th Percentile of 1-Hour Means	
	PC	PC (% AQAL)	PC	PC (% AQAL)
Maximum GLC	-	-	31.34	15.67
R1: Stone Quarry Cottage	0.02	0.04	2.26	1.13
R2: Cottages at Tulleys Farm	0.02	0.04	2.55	1.27
R3: House at Tulleys Farm	0.02	0.04	2.43	1.21
R4: Worth Hall Farm	0.01	0.01	1.27	0.64
R5: Residential properties on Turners Hill Road	0.00	0.01	0.87	0.43



Receptor	Annual Mean		99.8 th Percentile of 1-Hour Means	
	PC	PC (% AQAL)	PC	PC (% AQAL)
R6: 40 Wallage Lane	0.02	0.04	1.39	0.69
R7: Oak Cottage, Turners Hill Road	0.04	0.10	2.02	1.01
R8: 1 Miswells Cottage	0.08	0.20	2.99	1.49
R9: Hope Cottage	0.08	0.20	3.03	1.52
R10: Mantlemas Heath Cottage	0.08	0.19	3.26	1.63
R11: The Old Vicarage, Church Rd	0.05	0.12	4.47	2.23
R12: Turners Hill C of E Primary School	0.03	0.08	3.51	1.76
R13: Vicarage, Turners Hill Road	0.08	0.20	9.23	4.62
R14: Selsfield Road	0.02	0.04	2.50	1.25
R15: Bramblehill	0.01	0.02	1.27	0.63
R16: Grove Farmhouse	0.02	0.04	1.92	0.96
R17: Pumpstreet Farmhouse	0.03	0.08	2.53	1.27
R18: 40 Grove Buildings	0.03	0.08	3.34	1.67
R19: South Hill Lodge	0.01	0.03	1.76	0.88
ST1: St Leonards Church	0.12	0.29	12.05	6.03
ST2: Tulleys Escape Rooms & Tea Rooms	0.01	0.01	1.22	0.61
ST3: Commercial Building	0.01	0.03	1.40	0.70
D1: Chapel	1.78	4.45	36.41	18.20
D2: Reception	2.94	7.36	55.31	27.66
D3: Staff Room	2.82	7.06	46.56	23.28
D4: Waiting Room	2.71	6.78	65.07	32.53
D5: Garden of Remembrance	0.94	2.36	38.44	19.22
AQAL	40.0		200	
Background	10.0		20.0	
Maximum PEC at location of relevant exposure	10.08		85.07	
Maximum PEC (% AQAL)	25.2%		42.5%	
Notes				
<ul style="list-style-type: none"> No long term exposure at receptors ST1, ST2, ST3, D1, D2, D3, D4 and D5 or at max location within the grid, therefore annual mean standard not applicable at these locations 				



5.5 The results indicate that there will be no exceedances of the relevant AQALs, which are the AQS annual objective level of $40\mu\text{g}/\text{m}^3$ and the hourly NO_2 objective level of $200\mu\text{g}/\text{m}^3$, as a result of the operation of the Proposed Development.

5.6 The maximum annual mean NO_2 PC arising from the Proposed Development at a location of relevant exposure is a concentration of $0.08\mu\text{g}/\text{m}^3$ which is 0.20% of the objective level. In accordance with the criteria outlined in the EPUK / IAQM guidance as presented in Table 3.5, the impact is considered to be negligible.

5.7 The maximum hourly mean NO_2 PC arising from the Proposed Development at an existing sensitive receptor is a concentration of $12.05\mu\text{g}/\text{m}^3$ at St Leonards Church which is 6.03% of the relevant objective level. In accordance with the criteria outlined in the EPUK / IAQM guidance, which states that an impact can be considered negligible if it is less than 10% of the objective level, the impact of the operation of the Proposed Development on hourly mean NO_2 concentrations is considered to be negligible.

5.8 At the sensitive locations within the Proposed Development (receptors D1 to D5), the predicted hourly mean NO_2 concentrations are well below the relevant objective level, therefore the impact with regard to exposure is also considered to be negligible.

5.9 Maximum predicted annual and 99.8th percentile of hourly mean NO_2 concentrations for 2018 are presented as contour plots in Figures 5.1 and 5.2 respectively.

Figure 5.1: Predicted Annual Mean NO₂ Process Concentration ($\mu\text{g}/\text{m}^3$)

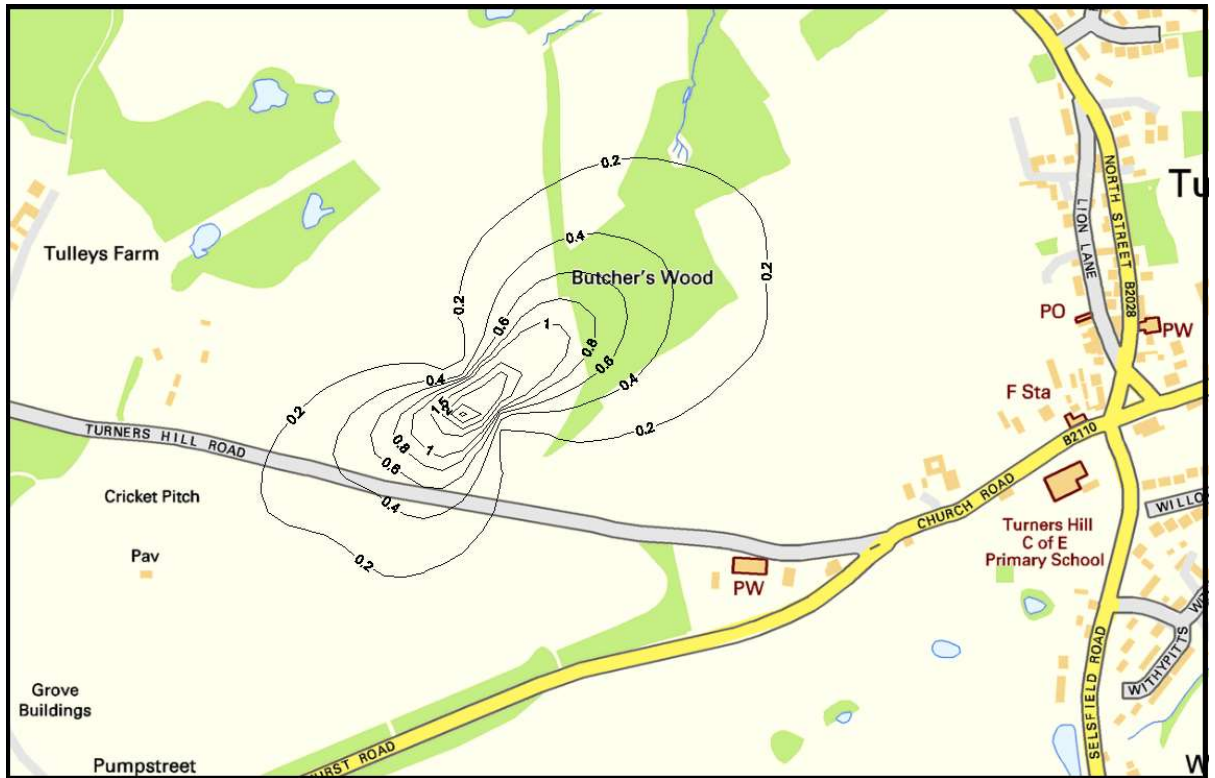
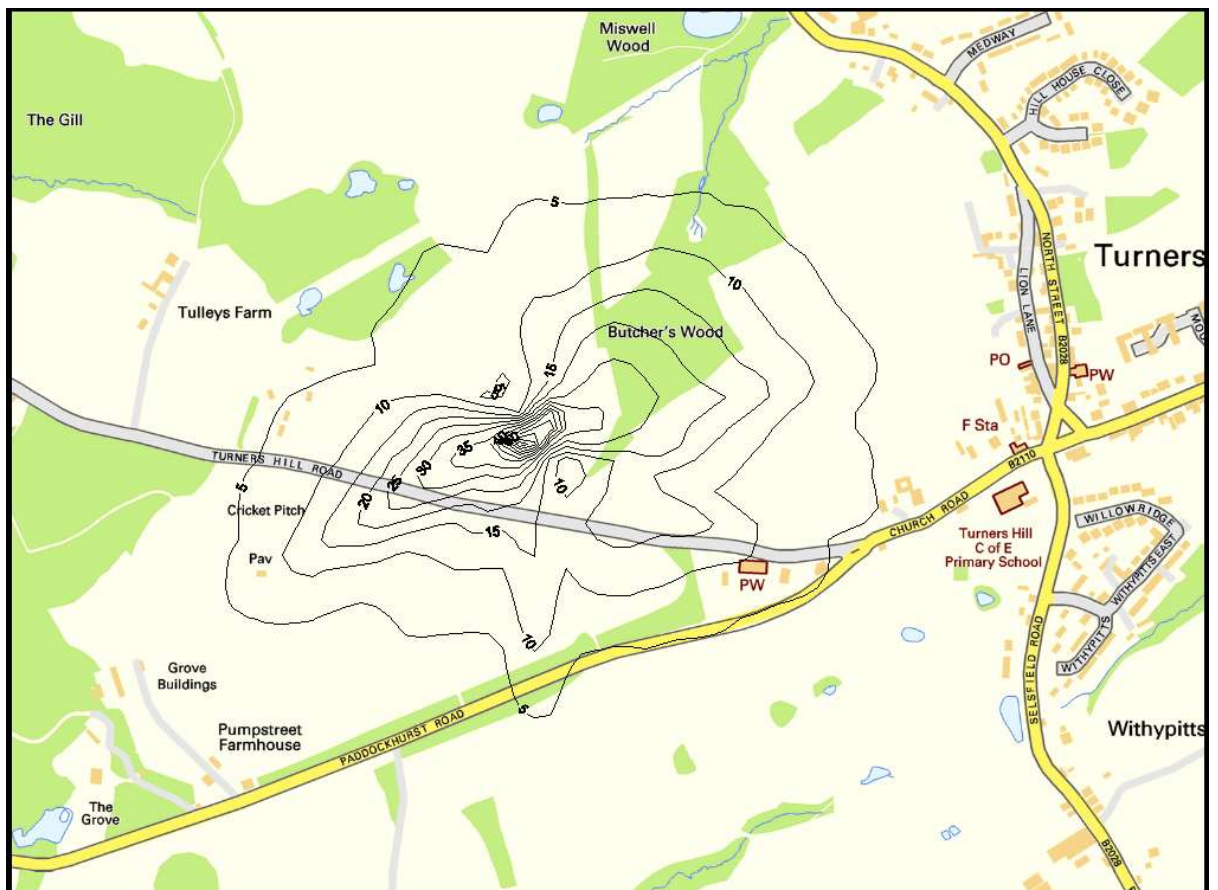


Figure 5.2: Predicted 99.8th Percentile of 1-Hour Mean NO₂ Process Concentrations ($\mu\text{g}/\text{m}^3$)





Carbon Monoxide (CO)

5.10 The predicted maximum 1-hour and 8-hour mean CO concentrations are presented in Table 5.2.

Table 5.2: Predicted CO Concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	Maximum 8-Hour Mean		Maximum 1-Hour Mean	
	PC	PC (% AQAL)	PC	PC (% AQAL)
Maximum GLC	19.77	0.20	31.80	0.11
R1: Stone Quarry Cottage	1.22	0.01	2.53	0.01
R2: Cottages at Tulleys Farm	1.28	0.01	3.05	0.01
R3: House at Tulleys Farm	1.38	0.01	3.25	0.01
R4: Worth Hall Farm	0.76	0.01	1.95	0.01
R5: Residential properties on Turners Hill Road	0.36	0.00	1.46	0.00
R6: 40 Wallage Lane	0.74	0.01	1.63	0.01
R7: Oak Cottage, Turners Hill Road	0.98	0.01	2.03	0.01
R8: 1 Miswells Cottage	1.48	0.01	2.74	0.01
R9: Hope Cottage	1.72	0.02	2.66	0.01
R10: Mantlemas Heath Cottage	1.74	0.02	2.92	0.01
R11: The Old Vicarage, Church Rd	2.36	0.02	4.97	0.02
R12: Turners Hill C of E Primary School	1.95	0.02	3.64	0.01
R13: Vicarage, Turners Hill Road	5.63	0.06	11.62	0.04
R14: Selsfield Road	1.58	0.02	2.91	0.01
R15: Bramblehill	0.85	0.01	1.82	0.01
R16: Grove Farmhouse	0.72	0.01	2.11	0.01
R17: Pumpstreet Farmhouse	0.89	0.01	2.87	0.01
R18: 40 Grove Buildings	1.42	0.01	3.43	0.01
R19: South Hill Lodge	0.72	0.01	2.44	0.01
ST1: St Leonards Church	6.63	0.07	14.95	0.05



Receptor	Maximum 8-Hour Mean		Maximum 1-Hour Mean	
	PC	PC (% AQAL)	PC	PC (% AQAL)
ST2: Tulleys Escape Rooms & Tea Rooms	0.74	0.01	1.90	0.01
ST3: Commercial Building	1.00	0.01	2.05	0.01
D1: Chapel	27.34	0.27	31.69	0.11
D2: Reception	42.48	0.42	47.02	0.16
D3: Staff Room	35.22	0.35	40.07	0.13
D4: Waiting Room	51.94	0.52	55.65	0.19
D5: Garden of Remembrance	21.64	0.22	37.11	0.12
AQAL	10,000		30,000	
Background	245.6		245.6	
Maximum PEC	297.54		301.25	
Maximum PEC (% AQAL)	2.98%		1.00%	

5.11 The results indicate that there will be no exceedances of the relevant AQALs, which are the AQS 8-hour objective level of $10000\mu\text{g}/\text{m}^3$ and the hourly EAL of $30,000\mu\text{g}/\text{m}^3$, as a result of the operation of the Proposed Development.

5.12 The maximum predicted 8-hour and 1-hour PCs are less than 10% of the relevant AQAL, therefore the significance of the impact is considered to be negligible.

5.13 At the sensitive locations within the Proposed Development (receptors D1 to D5), the predicted CO concentrations are well below the relevant objective levels, therefore the impact with regard to exposure is also considered to be negligible.

Sulphur Dioxide (SO₂)

5.14 Predicted SO₂ process concentrations are presented in Table 5.3.



Table 5.3: Predicted SO₂ Concentrations (µg/m³)

Receptor	99.2 nd Percentile of 24-Hour Means		99.7 th Percentile of 1-Hour Means		99.9 th Percentile of 15-Minute Means	
	PC	PC (% AQAL)	PC	PC (% AQAL)	PC	PC (% AQAL)
Maximum GLC	4.11	3.29	11.97	3.42	19.19	5.38
R1: Stone Quarry Cottage	0.18	0.14	0.83	0.24	1.48	0.56
R2: Cottages at Tulleys Farm	0.24	0.19	0.75	0.22	1.69	0.63
R3: House at Tulleys Farm	0.23	0.18	0.79	0.23	1.64	0.62
R4: Worth Hall Farm	0.09	0.08	0.42	0.12	0.93	0.35
R5: Residential properties on Turners Hill Road	0.06	0.05	0.23	0.07	0.61	0.23
R6: 40 Wallage Lane	0.14	0.11	0.51	0.14	0.85	0.32
R7: Oak Cottage, Turners Hill Road	0.20	0.16	0.78	0.22	1.16	0.44
R8: 1 Miswells Cottage	0.41	0.33	1.14	0.33	1.70	0.64
R9: Hope Cottage	0.37	0.30	1.19	0.34	1.70	0.64
R10: Mantlemas Heath Cottage	0.39	0.31	1.28	0.37	1.86	0.70
R11: The Old Vicarage, Church Rd	0.40	0.32	1.65	0.47	2.55	0.96
R12: Turners Hill C of E Primary School	0.24	0.20	1.19	0.34	2.13	0.80
R13: Vicarage, Turners Hill Road	0.81	0.65	3.22	0.92	5.82	2.19
R14: Selsfield Road	0.23	0.18	0.86	0.25	1.70	0.64
R15: Bramblehill	0.12	0.09	0.45	0.13	0.85	0.32
R16: Grove Farmhouse	0.13	0.10	0.65	0.19	1.23	0.46
R17: Pumpstreet Farmhouse	0.22	0.17	0.91	0.26	1.56	0.59
R18: 40 Grove Buildings	0.36	0.29	1.18	0.34	2.08	0.78
R19: South Hill Lodge	0.13	0.10	0.62	0.18	1.18	0.44



Receptor	99.2 nd Percentile of 24-Hour Means		99.7 th Percentile of 1-Hour Means		99.9 th Percentile of 15-Minute Means	
	PC	PC (% AQAL)	PC	PC (% AQAL)	PC	PC (% AQAL)
ST1: St Leonards Church	1.12	0.90	4.53	1.29	8.24	3.10
ST2: Tulleys Escape Rooms & Tea Rooms	0.08	0.07	0.41	0.12	0.87	0.33
ST3: Commercial Building	0.14	0.11	0.46	0.13	0.91	0.34
D1: Chapel	8.74	6.99	14.75	4.22	20.37	7.66
D2: Reception	16.90	13.52	22.45	6.41	30.97	11.64
D3: Staff Room	13.86	11.09	18.78	5.36	25.89	9.73
D4: Waiting Room	19.83	15.86	26.42	7.55	36.23	13.62
D5: Garden of Remembrance	6.65	5.32	14.75	4.21	21.89	8.23
AQAL	125		350		266	
Background	5.4		5.4		5.4	
Maximum PEC	25.2		31.8		41.6	
Maximum PEC (% AQAL)	20.0%		9.1%		15.7%	

5.15 The results indicate that there will be no exceedances of the relevant AQALs, which are the AQS 24-hour, 1-hour and 15-minute objective levels of 125µg/m³, 350µg/m³ and 266µg/m³ respectively, as a result of the operation of the Proposed Development.

5.16 At the location of the existing sensitive receptors, maximum predicted SO₂ PCs are less than 10% of the relevant air quality standards and are therefore considered to be of negligible significance.

5.17 At the sensitive locations within the Proposed Development (receptors D1 to D5), the short-term SO₂ concentrations are well below the relevant objective levels, therefore the impact with regard to exposure is also considered to be negligible.

Particulate Matter (as PM₁₀)

5.18 Predicted annual mean and 90.4th percentile of 24-hour mean ground level PM₁₀ process concentrations are presented in Table 5.4. The predictions assume that 100% of the particulate matter is emitted from the stack is PM₁₀.



Table 5.4: Predicted PM₁₀ Concentrations (µg/m³)

Receptor	Annual Mean		90.4 th Percentile of 24-Hour Means	
	PC	PC (% AQAL)	PC	PC (% AQAL)
Maximum GLC	-	-	0.30	0.60
R1: Stone Quarry Cottage	0.001	0.003	0.017	0.03
R2: Cottages at Tulleys Farm	0.001	0.003	0.013	0.03
R3: House at Tulleys Farm	0.001	0.003	0.011	0.02
R4: Worth Hall Farm	0.000	0.001	0.004	0.01
R5: Residential properties on Turners Hill Road	0.000	0.001	0.002	0.00
R6: 40 Wallage Lane	0.001	0.003	0.018	0.04
R7: Oak Cottage, Turners Hill Road	0.003	0.008	0.036	0.07
R8: 1 Miswells Cottage	0.007	0.017	0.075	0.15
R9: Hope Cottage	0.006	0.016	0.077	0.15
R10: Mantlemas Heath Cottage	0.006	0.015	0.074	0.15
R11: The Old Vicarage, Church Rd	0.004	0.010	0.048	0.10
R12: Turners Hill C of E Primary School	0.003	0.007	0.033	0.07
R13: Vicarage, Turners Hill Road	0.007	0.017	0.086	0.17
R14: Selsfield Road	0.001	0.004	0.013	0.03
R15: Bramblehill	0.001	0.002	0.005	0.01
R16: Grove Farmhouse	0.001	0.003	0.019	0.04
R17: Pumpstreet Farmhouse	0.003	0.006	0.036	0.07
R18: 40 Grove Buildings	0.003	0.007	0.037	0.07
R19: South Hill Lodge	0.001	0.003	0.015	0.03
ST1: St Leonards Church	0.010	0.024	0.131	0.26
ST2: Tulleys Escape Rooms & Tea Rooms	0.000	0.001	0.003	0.01
ST3: Commercial Building	0.001	0.002	0.010	0.02
D1: Chapel	0.145	0.362	1.758	3.52
D2: Reception	0.239	0.598	4.023	8.05



Receptor	Annual Mean		90.4 th Percentile of 24-Hour Means	
	PC	PC (% AQAL)	PC	PC (% AQAL)
D3: Staff Room	0.230	0.574	3.644	7.29
D4: Waiting Room	0.220	0.551	3.995	7.99
D5: Garden of Remembrance	0.077	0.192	1.141	2.28
AQAL	40		50	
Background	14.5		14.5	
Maximum PEC at a location with relevant exposure	14.51		18.52	
Maximum PEC (% AQAL)	36.3%		37.05%	
Notes				
<ul style="list-style-type: none"> No long term exposure at receptors ST1, ST2, ST3, D1, D2, D3, D4 and D5 or at max location within the grid, therefore annual mean standard not applicable at these locations 				

5.19 The results indicate that there will be no exceedances of the relevant AQALs, which are the AQS annual mean and 24-hour mean objective levels of 40µg/m³ and 50µg/m³ respectively, as a result of the operation of the Proposed Development.

5.20 In accordance with the significance criteria provided in the EPUK / IAQM guidance the impact of the operation of the Proposed Development on long and short term PM₁₀ concentration is considered to be of negligible significance.

5.21 At the sensitive locations within the Proposed Development (receptors D1 to D5), the 24-hour mean PM₁₀ concentrations are well below the relevant objective level, therefore the impact with regard to exposure is also considered to be negligible.

Particulate Matter (as PM_{2.5})

5.22 Predicted annual mean ground-level PM_{2.5} process concentrations are presented in Table 5.5. The predictions assume that 100% of the particulate matter emitted from the stack is PM_{2.5}.

Table 5.5: Predicted PM_{2.5} Concentrations (µg/m³)

Receptor	Annual Mean	
	PC	PC (% AQAL)
Maximum GLC	-	-
R1: Stone Quarry Cottage	0.001	0.005



Receptor	Annual Mean	
	PC	PC (% AQAL)
R2: Cottages at Tulleys Farm	0.001	0.005
R3: House at Tulleys Farm	0.001	0.005
R4: Worth Hall Farm	0.000	0.002
R5: Residential properties on Turners Hill Road	0.000	0.001
R6: 40 Wallage Lane	0.001	0.005
R7: Oak Cottage, Turners Hill Road	0.003	0.013
R8: 1 Miswells Cottage	0.007	0.027
R9: Hope Cottage	0.006	0.026
R10: Mantlemas Heath Cottage	0.006	0.025
R11: The Old Vicarage, Church Rd	0.004	0.016
R12: Turners Hill C of E Primary School	0.003	0.011
R13: Vicarage, Turners Hill Road	0.007	0.027
R14: Selsfield Road	0.001	0.006
R15: Bramblehill	0.001	0.002
R16: Grove Farmhouse	0.001	0.005
R17: Pumpstreet Farmhouse	0.003	0.010
R18: 40 Grove Buildings	0.003	0.011
R19: South Hill Lodge	0.001	0.004
ST1: St Leonards Church	0.010	0.038
ST2: Tulleys Escape Rooms & Tea Rooms	0.000	0.002
ST3: Commercial Building	0.001	0.004
D1: Chapel	0.145	0.579
D2: Reception	0.239	0.958
D3: Staff Room	0.230	0.919
D4: Waiting Room	0.220	0.882
D5: Garden of Remembrance	0.077	0.306



Receptor	Annual Mean	
	PC	PC (% AQAL)
AQAL	25	
Background	9.6	
Maximum PEC at a location with relevant exposure	9.61	
Maximum PEC (% AQAL)	38.4%	
Notes		
<ul style="list-style-type: none"> No long term exposure at receptors ST1, ST2, ST3, D1, D2, D3, D4 and D5 or at max location within the grid, therefore annual mean standard not applicable at these locations 		

5.23 The results indicate that there will be no exceedances of the relevant AQAL, which is the AQS annual mean objective level of 25µg/m³, as a result of the operation of the Proposed Development.

5.24 In accordance with the significance criteria outlined in the EPUK / IAQM guidance, the impact of the operation of the Proposed Development on concentrations of PM_{2.5} are of negligible significance.

Total Organic Compounds (as C₆H₆)

5.25 Predicted annual mean ground-level C₆H₆ concentrations are presented in Table 5.6.

Table 5.6: Predicted C₆H₆ Concentrations (µg/m³)

Receptor	Annual Mean		1-Hour Mean	
	PC	PC (% AQAL)	PC	PC (% AQAL)
Maximum GLC	-	-	6.35	3.26
R1: Stone Quarry Cottage	0.001	0.03	0.51	0.26
R2: Cottages at Tulleys Farm	0.001	0.03	0.61	0.31
R3: House at Tulleys Farm	0.001	0.02	0.65	0.33
R4: Worth Hall Farm	0.000	0.01	0.39	0.20
R5: Residential properties on Turners Hill Road	0.000	0.01	0.29	0.15
R6: 40 Wallage Lane	0.001	0.03	0.33	0.17
R7: Oak Cottage, Turners Hill Road	0.003	0.06	0.40	0.21
R8: 1 Miswells Cottage	0.007	0.13	0.55	0.28



Receptor	Annual Mean		1-Hour Mean	
	PC	PC (% AQAL)	PC	PC (% AQAL)
R9: Hope Cottage	0.006	0.13	0.53	0.27
R10: Mantlemas Heath Cottage	0.006	0.12	0.58	0.30
R11: The Old Vicarage, Church Rd	0.004	0.08	0.99	0.51
R12: Turners Hill C of E Primary School	0.003	0.05	0.73	0.37
R13: Vicarage, Turners Hill Road	0.007	0.13	2.32	1.19
R14: Selsfield Road	0.001	0.03	0.58	0.30
R15: Bramblehill	0.001	0.01	0.36	0.19
R16: Grove Farmhouse	0.001	0.03	0.42	0.22
R17: Pumpstreet Farmhouse	0.003	0.05	0.57	0.29
R18: 40 Grove Buildings	0.003	0.05	0.69	0.35
R19: South Hill Lodge	0.001	0.02	0.49	0.25
ST1: St Leonards Church	0.010	0.19	2.99	1.53
ST2: Tulleys Escape Rooms & Tea Rooms	0.000	0.01	0.38	0.19
ST3: Commercial Building	0.001	0.02	0.41	0.21
D1: Chapel	0.145	2.90	6.33	3.25
D2: Reception	0.239	4.79	9.39	4.81
D3: Staff Room	0.230	4.59	8.00	4.10
D4: Waiting Room	0.220	4.41	11.11	5.70
D5: Garden of Remembrance	0.077	1.53	7.41	3.80
AQAL	5		195	
Background	0.2		0.4	
Maximum PEC at a location with relevant exposure	0.207		11.51	
Maximum PEC (% AQAL)	4.13%		5.90%	
Notes				
<ul style="list-style-type: none"> No long term exposure at receptors ST1, ST2, ST3, D1, D2, D3, D4 and D5 or at max location within the grid, therefore annual mean standard not applicable at these locations 				



5.26 The results indicate that there will be no exceedances of the relevant AQALs, which are the AQS annual mean objective level of $5\mu\text{g}/\text{m}^3$ and hourly mean EAL of $195\mu\text{g}/\text{m}^3$, as a result of the operation of the Proposed Development.

5.27 In accordance with the significance criteria provided in the EPUK / IAQM guidance the impact of the operation of the Proposed Development on long and short-term TOC concentration is considered to be of negligible significance.

5.28 At the sensitive locations within the Proposed Development (receptors D1 to D5), the hourly mean TOC concentrations are well below the relevant objective level, therefore the impact with regard to exposure is also considered to be negligible.

Hydrogen Chloride (HCl)

5.29 The maximum predicted 1-hour mean ground-level HCl process concentrations are presented in Table 5.7.

Table 5.7: Predicted HCl Concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	1-Hour Mean	
	PC	PC (% AQAL)
Maximum GLC	9.53	1.27
R1: Stone Quarry Cottage	0.76	0.10
R2: Cottages at Tulleys Farm	0.91	0.12
R3: House at Tulleys Farm	0.97	0.13
R4: Worth Hall Farm	0.58	0.08
R5: Residential properties on Turners Hill Road	0.44	0.06
R6: 40 Wallage Lane	0.49	0.07
R7: Oak Cottage, Turners Hill Road	0.61	0.08
R8: 1 Miswells Cottage	0.82	0.11
R9: Hope Cottage	0.80	0.11
R10: Mantlemas Heath Cottage	0.87	0.12
R11: The Old Vicarage, Church Rd	1.49	0.20
R12: Turners Hill C of E Primary School	1.09	0.15
R13: Vicarage, Turners Hill Road	3.48	0.46
R14: Selsfield Road	0.87	0.12
R15: Bramblehill	0.54	0.07
R16: Grove Farmhouse	0.63	0.08



Receptor	1-Hour Mean	
	PC	PC (% AQAL)
R17: Pumpstreet Farmhouse	0.86	0.11
R18: 40 Grove Buildings	1.03	0.14
R19: South Hill Lodge	0.73	0.10
ST1: St Leonards Church	4.48	0.60
ST2: Tulleys Escape Rooms & Tea Rooms	0.57	0.08
ST3: Commercial Building	0.61	0.08
D1: Chapel	9.49	1.27
D2: Reception	14.08	1.88
D3: Staff Room	12.00	1.60
D4: Waiting Room	16.67	2.22
D5: Garden of Remembrance	11.11	1.48
AQAL	750	
Background	0.80	
Maximum PEC	17.47	
Maximum PEC (% AQAL)	2.33%	

5.30 The results indicate that there will be no exceedances of the relevant AQAL, which is the hourly mean EAL of $750\mu\text{g}/\text{m}^3$, as a result of the operation of the Proposed Development.

5.31 The predicted maximum 1-hour mean ground level HCl concentrations are less than 10% of the EAL, therefore the significance of the impact is considered to be negligible.

5.32 At the sensitive locations within the Proposed Development (receptors D1 to D5), the hourly mean HCl concentrations are well below the relevant objective level, therefore the impact with regard to exposure is also considered to be negligible.

Mercury (Hg)

5.33 Predicted annual mean ground-level Hg concentrations are presented in Table 5.8.



Table 5.8: Predicted Hg Concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	Annual Mean		1-Hour Mean	
	PC	PC (% AQAL)	PC	PC (% AQAL)
Maximum GLC	-	-	0.02	0.22
R1: Stone Quarry Cottage	0.000003	0.001	0.001	0.02
R2: Cottages at Tulleys Farm	0.000003	0.001	0.002	0.02
R3: House at Tulleys Farm	0.000003	0.001	0.002	0.02
R4: Worth Hall Farm	0.000001	0.000	0.001	0.01
R5: Residential properties on Turners Hill Road	0.000001	0.000	0.001	0.01
R6: 40 Wallage Lane	0.000003	0.001	0.001	0.01
R7: Oak Cottage, Turners Hill Road	0.000008	0.003	0.001	0.01
R8: 1 Miswells Cottage	0.000017	0.007	0.001	0.02
R9: Hope Cottage	0.000016	0.006	0.001	0.02
R10: Mantlemas Heath Cottage	0.000015	0.006	0.001	0.02
R11: The Old Vicarage, Church Rd	0.000010	0.004	0.003	0.03
R12: Turners Hill C of E Primary School	0.000007	0.003	0.002	0.02
R13: Vicarage, Turners Hill Road	0.000017	0.007	0.006	0.08
R14: Selsfield Road	0.000004	0.001	0.001	0.02
R15: Bramblehill	0.000002	0.001	0.001	0.01
R16: Grove Farmhouse	0.000003	0.001	0.001	0.01
R17: Pumpstreet Farmhouse	0.000006	0.003	0.001	0.02
R18: 40 Grove Buildings	0.000007	0.003	0.002	0.02
R19: South Hill Lodge	0.000003	0.001	0.001	0.02
ST1: St Leonards Church	0.000024	0.010	0.008	0.10
ST2: Tulleys Escape Rooms & Tea Rooms	0.000001	0.000	0.001	0.01
ST3: Commercial Building	0.000002	0.001	0.001	0.01
D1: Chapel	0.000362	0.145	0.016	0.21
D2: Reception	0.000598	0.239	0.024	0.32



Receptor	Annual Mean		1-Hour Mean	
	PC	PC (% AQAL)	PC	PC (% AQAL)
D3: Staff Room	0.000574	0.230	0.020	0.27
D4: Waiting Room	0.000551	0.220	0.028	0.38
D5: Garden of Remembrance	0.000192	0.077	0.019	0.25
AQAL	0.25		7.5	
Background	0.0015		0.003	
Maximum PEC at a location of relevant exposure	0.001517		0.031	
Maximum PEC (% AQAL)	0.61%		0.42%	
Notes				
<ul style="list-style-type: none">No long term exposure at receptors ST1, ST2, ST3, D1, D2, D3, D4 and D5 or at max location within the grid, therefore annual mean standard not applicable at these locations				

5.34 The results indicate that there will be no exceedances of the relevant AQALs, which are the annual and hourly mean EALs of $0.25\mu\text{g}/\text{m}^3$ and $7.5\mu\text{g}/\text{m}^3$ respectively, as a result of the operation of the Proposed Development.

5.35 In accordance with the significance criteria provided in the EPUK / IAQM guidance the impact of the operation of the Proposed Development on long and short-term Hg concentration is considered to be of negligible significance.

5.36 At the sensitive locations within the Proposed Development (receptors D1 to D5), the hourly mean Hg concentrations are well below the relevant objective level, therefore the impact with regard to exposure is also considered to be negligible.

Dioxins and Furans

5.37 The predicted annual mean ground-level dioxin and furan process concentrations at identified sensitive receptor locations are presented in Table 5.9. The results are presented in femtograms (fg) per cubic metre ($10^{-15} \text{g}/\text{m}^3$).



Table 5.9: Predicted Dioxin and Furan Concentrations (fg/m³)

Receptor	Annual Mean	
	PC	PC (% Background)
Maximum GLC	-	-
R1: Stone Quarry Cottage	0.007	0.2
R2: Cottages at Tulleys Farm	0.007	0.2
R3: House at Tulleys Farm	0.006	0.2
R4: Worth Hall Farm	0.002	0.1
R5: Residential properties on Turners Hill Road	0.002	0.0
R6: 40 Wallage Lane	0.007	0.2
R7: Oak Cottage, Turners Hill Road	0.016	0.5
R8: 1 Miswells Cottage	0.033	1.0
R9: Hope Cottage	0.032	1.0
R10: Mantlemas Heath Cottage	0.031	0.9
R11: The Old Vicarage, Church Rd	0.020	0.6
R12: Turners Hill C of E Primary School	0.013	0.4
R13: Vicarage, Turners Hill Road	0.033	1.0
R14: Selsfield Road	0.007	0.2
R15: Bramblehill	0.003	0.1
R16: Grove Farmhouse	0.007	0.2
R17: Pumpstreet Farmhouse	0.013	0.4
R18: 40 Grove Buildings	0.013	0.4
R19: South Hill Lodge	0.006	0.2
ST1: St Leonards Church	0.048	1.5
ST2: Tulleys Escape Rooms & Tea Rooms	0.002	0.1
ST3: Commercial Building	0.005	0.1
D1: Chapel	0.724	21.9
D2: Reception	1.197	36.3
D3: Staff Room	1.148	34.8
D4: Waiting Room	1.102	33.4
D5: Garden of Remembrance	0.383	11.6
Background	3.3 fg/m³	
Notes		
<ul style="list-style-type: none"> No long term exposure at receptors ST1, ST2, ST3, D1, D2, D3, D4 and D5 or at max location within the grid, therefore annual mean standard not applicable at these locations 		



5.38 There are no assessment criteria for dioxins and furans. The predicted maximum contribution from the Proposed Development at a location with relevant exposure is 1% of the average background concentration measured at rural monitoring sites in the UK.

Ecological Impacts

Airborne Concentrations of NO_x and SO₂

5.39 Predicted maximum ground level concentrations of NO_x and SO₂ are compared with the relevant critical levels (C_L) at the locations of the maximum predicted concentrations in the nearby sensitive ecological habitat in Tables 5.10 and 5.11. The results are presented for the worst-case receptor within each sensitive habitat.

Table 5.10: Predicted Airborne NO_x Concentrations as a Percentage of the Critical Level (µg/m³)

Habitat Site	Annual Mean			Daily Mean		
	PC	PC (as % CL)	PEC	PC	PC (as % CL)	PEC
Maximum (Local Wildlife Sites)	1.67	5.58	14.97			
Ashdown Forest SAC / SPA / SSSI	0.005	0.02	10.91	0.47	0.62	22.27
Wakehurst & Chiddingly Woods SSSI	0.015	0.05	12.12	0.89	1.19	25.09
Butchers Wood	1.462	4.87	14.76	33.05	44.06	59.65
Tulleys Farm Wood	0.085	0.28	13.38	6.65	8.87	33.25
Quarry Wood	0.055	0.18	13.36	3.50	4.66	30.10
Critical Level		30			75	

Table 5.11: Predicted Annual Mean SO₂ Concentrations as a Percentage of the Critical Level (µg/m³)

Habitat Site	PC	PC (as % CL)	PEC
Maximum (Local Wildlife Sites)	0.24	1.19	2.94
Ashdown Forest SAC / SPA / SSSI	0.0008	0.004	2.60



Wakehurst & Chiddingly Woods SSSI	0.0021	0.011	2.50
Butchers Wood	0.2080	1.040	2.91
Tulleys Farm Wood	0.0121	0.060	2.71
Quarry Wood	0.0078	0.039	2.71
Critical Level	20		

5.40 The significance criteria provided by the EA states that for Ramsar Sites, SPAs, SACs and SSSIs sites, the impact can be considered to be insignificant if the long-term PC is less than 1% of the long-term critical level and the short-term PC is less than 10% of the short-term critical level. The impact of the operation of the Proposed Development at these locations is therefore considered to be insignificant.

5.41 The significance criteria provided for by the EA guidance states that for LWSs and ancient woodlands the impact can be considered to be insignificant if both the long and short-term PC is less than 100% of the relevant critical level. The impact on LWSs is therefore also considered to be insignificant.

5.42 The impact arising from emissions from road vehicles associated with the operation of the Proposed Development on the airborne NO_x concentrations within the Ashdown Forest SAC / SPA and SSSI is presented in Table 5.12 below. Concentrations were predicted within a transect at 1m, 5m, 10m and 20m from the kerbside. The results below are provided for the worst-case location i.e. 1m from the kerbside. The results include the contribution from the proposed crematoria plant at these locations.

Table 5.12: Predicted Airborne NO_x Concentrations as a Percentage of the Critical Level (µg/m³)

Transect Location	Annual Mean	
	PC	PC (as % CL)
E14 (1m from kerbside)	0.11	0.37
E15 (1m from kerbside)	0.06	0.20
E16 (1m from kerbside)	0.11	0.36
E17 (1m from kerbside)	0.17	0.55
E18 (1m from kerbside)	0.11	0.37
Critical Level	30	



5.43 The impact of the emissions from the proposed plant and road traffic generated by the Proposed Development through the Ashford Forest SAC / SPA / SSSI is less than 1% of the relevant critical level, therefore the combined impact of the road traffic and plant is considered to be insignificant.

Eutrophication

5.44 Predicted maximum nutrient nitrogen deposition rates are compared with the critical load for eutrophication in Table 5.13.

Table 5.13: Predicted Eutrophication Rates (kg N/ha/yr)

Habitat Site	Critical Load (C _{Ld})	PC	PC (as a %age of C _{Ld})
Ashdown Forest SAC / SPA / SSSI	5 to 15	0.002	0.03
Wakehurst & Chiddingly Woods SSSI	10 to 20	0.088	0.88

5.45 The maximum predicted nitrogen deposition rate due to emissions from the Proposed Development within the Ashdown Forest SAC / SPA / SSSI and within the Wakehurst & Chiddingly Woods SSSI are less than 1% of the relevant lower critical loads identified for these statutory habitat sites, therefore the impact is considered to be insignificant.

5.46 The impact arising from emissions from road vehicles associated with the operation of the Proposed Development on the nitrogen deposition rates within the Ashdown Forest SAC / SPA and SSSI is presented in Table 5.14 below. The results include the contribution from the proposed crematoria plant at these locations.

Table 5.14: Predicted Eutrophication Rates (kgN/ha/yr)

Transect Location	Critical Load (CL)	PC	PC (as % C _{Ld})
E14 (1m from kerbside)	5 to 15	0.013	0.3
E15 (1m from kerbside)	5 to 15	0.007	0.1
E16 (1m from kerbside)	5 to 15	0.016	0.3
E17 (1m from kerbside)	5 to 15	0.016	0.3



5.47 The combined impact on nitrogen deposition levels of the emissions from the proposed plant and road traffic generated by the Proposed Development through the Ashford Forest SAC / SPA / SSSI is less than 1% of the critical load, therefore the impact is considered to be insignificant.

5.48 Predicted maximum acidification rates are compared with the relevant critical load functions (C_{LF}) in Table 5.15.

Table 5.15: Predicted Acidification Rates (keq/ha/yr)

Habitat Site	PC	PC (as a %age of the C_{LF})	PEC	PEC (as a %age of the C_{LF})
Ashdown Forest SAC / SPA / SSSI	0.00054	0	1.9	128.3
Wakehurst & Chiddingly Woods SSSI	0.00744	0.3	1.88	60.6

5.49 Within the Ashdown Forest SAC / SPA / SSSI and the Wakehurst & Chiddingly Woods SSSI, the maximum predicted acidification rate due to emissions from the Proposed Development is effectively 0% and 0.3% respectively, of the critical load function at the most sensitive habitat within the identified statutory habitat sites and therefore the impact is considered to be of negligible significance.

5.50 The impact arising from emissions from road vehicles associated with the operation of the Proposed Development on the acidification rates within the Ashdown Forest SAC / SPA and SSSI is presented in Table 5.16 below. The results include the contribution from the proposed crematoria plant at these locations.

Table 5.16: Predicted Acidification Rates (keq/ha/yr)

Habitat Site	PC	PC (as a %age of the C_{LF})	PEC	PEC (as a %age of the C_{LF})
E14 (1m from kerbside)	0.00039	0	1.9	128.3
E15 (1m from kerbside)	0.00038	0	1.9	128.3
E16 (1m from kerbside)	0.00045	0	1.9	128.3
E17 (1m from kerbside)	0.00050	0	1.9	128.3



5.51 The impact of the emissions from the proposed plant and road traffic generated by the Proposed Development through the Ashford Forest SAC / SPA / SSSI is effectively 0% of the critical load function at the most sensitive habitat, therefore the combined impact is considered to be insignificant.



6 MITIGATION AND RESIDUAL EFFECTS

6.1 Air quality impacts associated with emissions from the crematorium are predicted to be negligible at the human and habitat receptor locations examined, therefore further mitigating measures are not considered necessary.



7 CONCLUSIONS

7.1 An assessment has been carried out to determine the local air quality impacts associated with the operation of the proposed crematorium.

7.2 Detailed air quality modelling using the AERMOD 7 dispersion model has been undertaken to predict the impacts associated with stack emissions from the cremator. In order to provide a conservative assessment of potential impacts, pollutant emissions have been assumed to occur at the Environment Agency's emission limits for abated cremators.

7.3 Predicted maximum process concentrations at sensitive receptor locations are well within the relevant air quality standards for all pollutants considered. The significance of the impacts has been assessed as negligible in accordance with the significance criteria outlined in the EPUK / IAQM planning guidance.

7.4 At nearby sensitive habitat sites, the predicted process contributions are insignificant compared with the critical levels for airborne pollutant concentrations and critical loads for nutrient nitrogen deposition and acidification.

7.5 It is considered that air quality does not pose a constraint to the development of the Site as proposed.



APPENDIX A - AIR QUALITY TERMINOLOGY

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedence	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO₂	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O₃	Ozone.
Percentile	The percentage of results below a given value.
PM₁₀	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
ppb parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10 ⁹) units of air, there is one unit of pollutant present.
ppm parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10 ⁶) units of air, there is one unit of pollutant present.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
µg/m³ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1 µg/m ³ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.



Term	Definition
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.



APPENDIX B – ENVIRONMENTAL ASSESSMENT LEVELS

Table B1: Air Quality Standards and Environmental Assessment Levels

Pollutant	Averaging Period	EAL / AQS ($\mu\text{g}/\text{m}^3$)	Comments
Nitrogen Dioxide (NO_2)	annual	40	UK AQO and EU Limit Value
	1-hour	200	UK AQO and EU Limit Value, not to be exceeded more than 18 times per annum, equivalent to the 99.8 th percentile of 1-hour means
Sulphur Dioxide (SO_2)	24-hour	125	UK AQO and EU Limit Value, not to be exceeded more than 3 times per annum, equivalent to the 99.2 nd percentile of 24-hour means
	1-hour	350	UK AQO and EU Limit Value, not to be exceeded more than 24 times per annum, equivalent to the 99.7 th percentile of 1-hour means
	15-minute	266	UK AQO, not to be exceeded more than 35 times per annum, equivalent to the 99.9 th percentile of 15-minute means
Carbon Monoxide (CO)	8-hour	10,000	UK AQO and EU Limit Value
	1-hour	30,000	EAL
Particulate Matter (as PM_{10})	annual	40	UK AQO and EU Limit Value
	24-hour	50	UK AQO and EU Limit Value, not to be exceeded more than 35 times per annum, equivalent to the 90.4 th percentile of 24-hour means
Particulate Matter (as $\text{PM}_{2.5}$)	annual	25 (a)	EU Limit Value
Benzene (C_8)	annual	5	AQO (England and Wales) and EU Limit Value
	1-hour	195	EAL
Hydrogen Chloride (HCl)	1-hour	750	EAL
Mercury (Hg)	annual	0.25	EAL
	1-hour	7.5	EAL
(a) Reducing to 20 $\mu\text{g}/\text{m}^3$ in 2020			



APPENDIX C – STACK EMISSION PARAMETERS

Table C1: Emission Parameters

Source ID	Main Stack	
Stack Height (m)	7.0	
Stack diameter (m)	0.35	
Temperature of release (K)	403.15	
Actual flow rate (Am ³ /s)	1.281 (a)	
Emission velocity at stack exit (m/s)	13.32	
Normalised flow rate (Nm ³ /s)	0.591 (b)	
Emission Concentration (mg/Nm³) (b)		
HCl	30	
CO	100	
PM	20	
Hg	0.05	
TOC	20	
NO _x	350	
SO ₂	50	
PCDD/Fs	1.0 x 10 ⁻⁷	
Emission Rate (g/s)	Long-Term (c)	Short-Term
HCl	0.0042	0.0177
CO	0.0140	0.0591
PM	0.0028	0.0118
Hg	0.000007	0.00003
TOC	0.0028	0.0118
NO _x	0.0492	0.2070
SO ₂	0.0070	0.0296
PCDD/Fs	1.4 x 10 ⁻¹¹	-
(a) Actual flow rate at 403.15 K and 13.23% O _{2(dry)} , 101.3 kPa, 12.02% H ₂ O		
(b) Reference conditions: 273 K and 11% O ₂ , 101.3 kPa, dry gas		
(c) Assuming 2.080 operational hours per annum.		

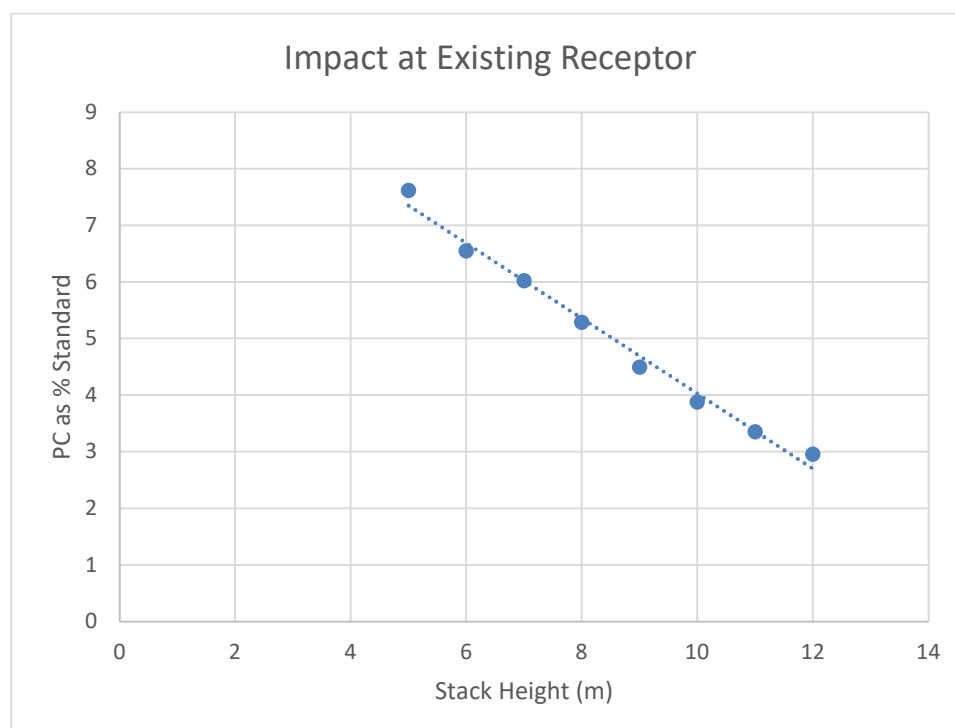


APPENDIX D – STACK HEIGHT

Detailed modelling has been undertaken to determine the effect of altering the stack height on the impact on local air quality at the existing receptors and on the exposure at the proposed receptors.

Concentrations of hourly mean NO₂ were predicted with stack heights from 5m to 15m at the receptor experiencing the highest impact as a result of the Proposed Development (Receptor ST1: St Leonards Church). The results are presented in Figure D1 below.

Figure D1: Impact at the Existing Receptor predicted to experience the highest impact

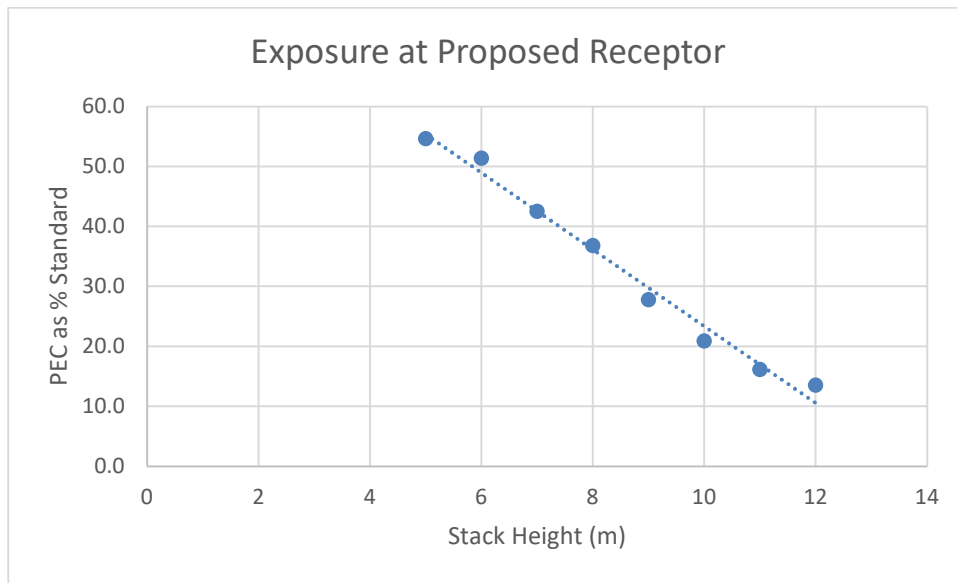


The guidance indicates that an impact would be considered to be insignificant if the process contribution (PC) is less than 10% of the relevant Air Quality Standard. For all of the stack heights modelled the PC is less than 10% of the relevant standard.

Concentrations were also predicted at sensitive locations within the Proposed Development itself. The receptor predicted to experience the highest hourly mean NO₂ concentrations as a result of the Proposed Development is Receptor D4: Waiting Room. The results of the predicted environmental concentrations (PEC) are presented in Figure D2 below:



Figure D2: Impact at the Proposed Receptor predicted to experience the highest concentrations



As illustrated in Figure D2, the PEC falls below 50% of the relevant Air Quality Standard with a stack of height 7m. It is therefore considered that a stack of height 7m will result in appropriate dispersion of the emissions.

APPENDIX E – WIND ROSES (SHOREHAM AIRPORT)

Figure E1: 2014

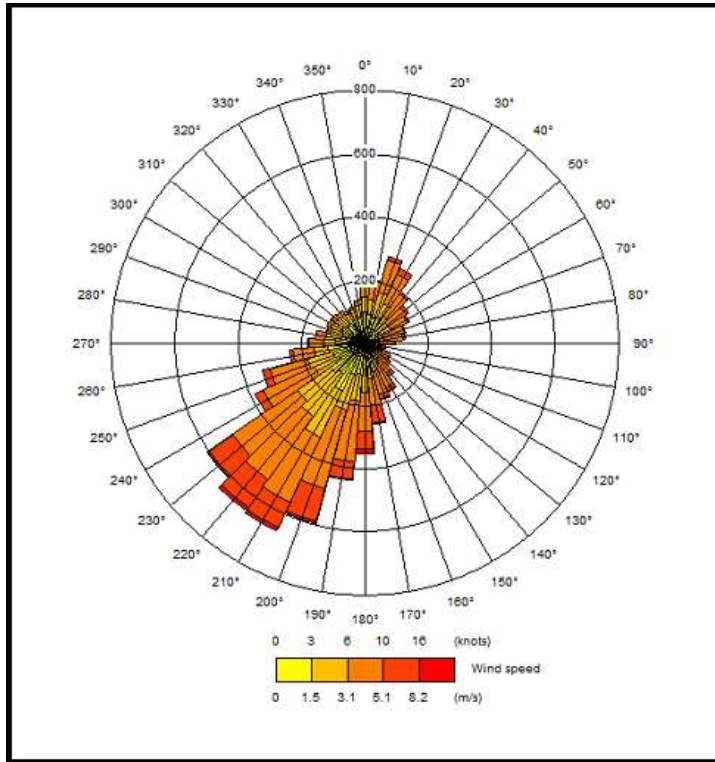


Figure E2: 2015

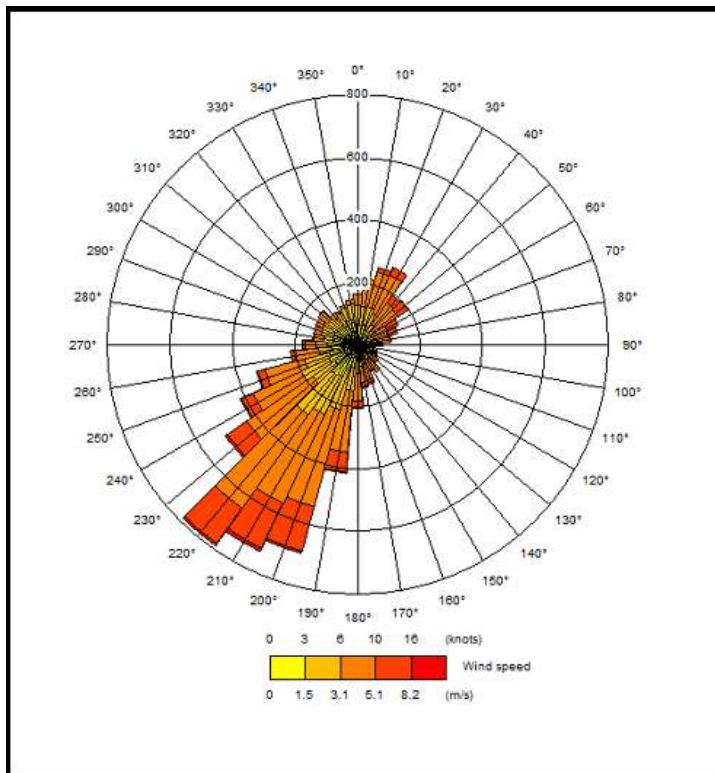


Figure E3: 2016

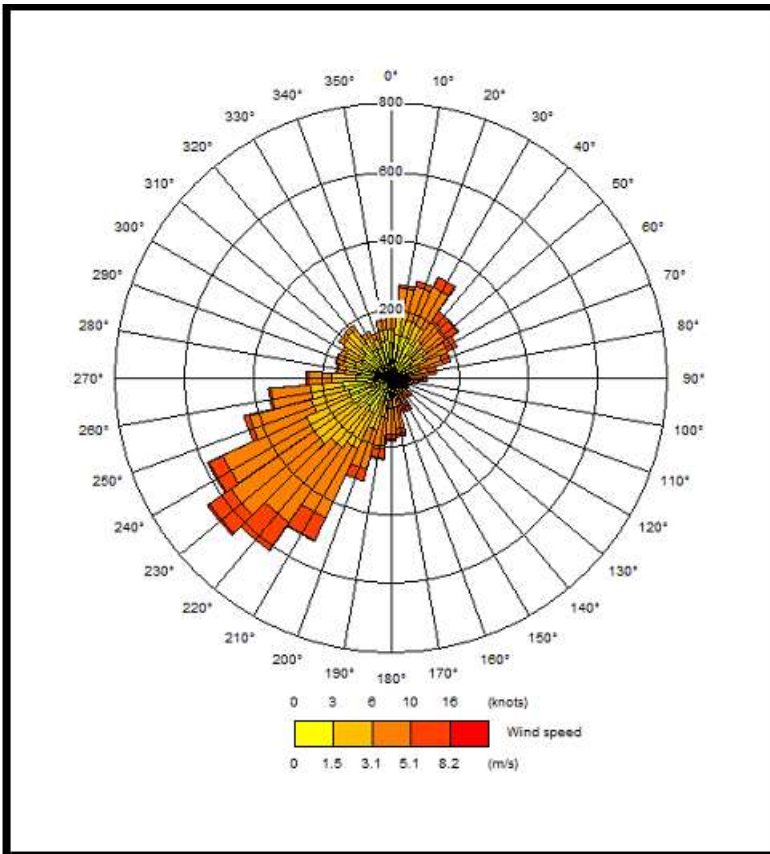


Figure E4: 2017

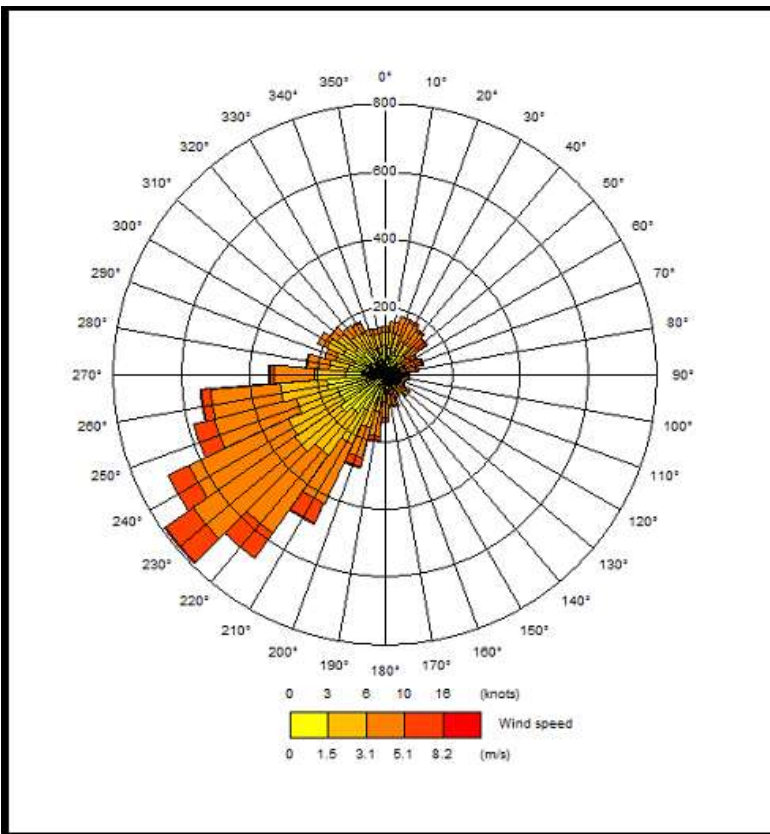
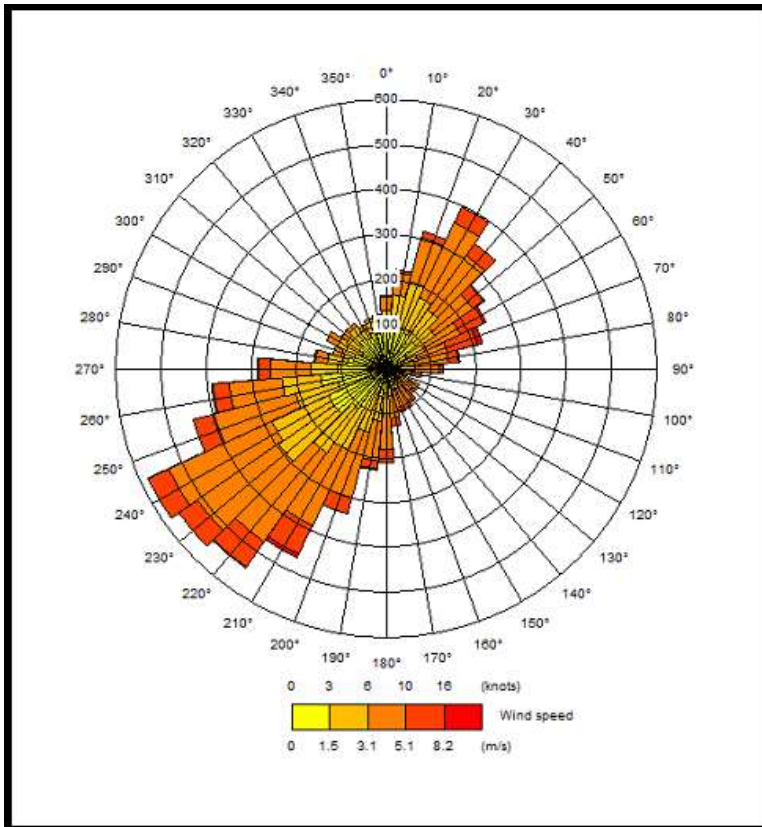




Figure E5: 2018





APPENDIX F - ENVIRONMENTAL ASSESSMENT LEVELS FOR THE PROTECTION OF VEGETATION AND ECOSYSTEMS

Critical Levels

Critical levels are thresholds of airborne pollutant concentrations above which damage may be sustained to sensitive plants and animals.

The critical levels for the protection of vegetation and ecosystems as defined by the EU Directive 2008/50/EC and the 2010 UK Air Quality Standards Regulations are summarised in Table F1.

Table F1: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Averaging Period	Concentration ($\mu\text{g}/\text{m}^3$)
Oxides of Nitrogen (NO _x)	Annual Mean	30
	Daily Mean	75
Sulphur Dioxide (SO ₂)	Annual Mean	10 (sensitive habitats with lichen and bryophytes)
		20 (all other habitats)

Background NO_x and SO₂ concentrations for the identified habitat sites have been obtained from the Defra Background Maps and are summarised in Table F2.

Table F2: Annual Mean Background NO_x and SO₂ Concentrations ($\mu\text{g}/\text{m}^3$)

Habitat Site	NO _x	SO ₂
Ashdown Forest SAC / SPA / SSSI	10.9	2.6
Wakehurst & Chiddingly Woods SSSI	12.1	2.5
Butchers Wood (ancient woodland)	13.3	2.7
Tulleys Farm Wood (ancient woodland)	13.3	2.7
Quarry Wood (ancient woodland)	13.3	2.7
Local Wildlife Sites	13.3	2.7

Critical Loads

Critical loads refer to the threshold beyond which deposition of pollutants to water or land results in measurable damage to vegetation and habitats. This takes the form of either gravitational settling of particulate matter (dry deposition) or wet deposition, where atmospheric pollutants dissolve in water vapour and then precipitate to the ground (e.g. as rain, snow, fog etc.).

Critical loads for eutrophication (nutrient nitrogen deposition) and background nutrient nitrogen deposition rates have been obtained from APIS and are summarised in Table F3 for the identified habitat sites.



Table F3: Critical Loads (Eutrophication) and Background Nutrient Nitrogen Deposition

Habitat Site	Most Sensitive Habitat Type	Critical Load (kg N/ha/a)	Background N Deposition (kg N/ha/a)
Ashdown Forest SAC / SPA / SSSI	Coniferous Woodland	5 to 15	23.3
Wakehurst & Chiddingly Woods SSSI	Fagus Woodland	10 to 20	23.2

The background nutrient nitrogen deposition rates exceed the critical loads at the identified habitat sites.

For acidic deposition, the critical load of a habitat site is largely determined by the underlying geology and soils. The critical load of acidification is defined by a critical load function (CLF), which describes the relationship between the relative contributions of sulphur (S) and nitrogen (N) to the total acidification.

The critical load function is defined by the following parameters:

- CLmaxS, the maximum critical load of acidity for S, assuming there is no N deposition;
- CLminN, is the critical load of acidity due to nitrogen removal processes in the soil only (i.e. independent of deposition); and
- CLmaxN, is the maximum critical load of acidity for N, assuming there is no S deposition.

The critical loads for acidification for the most sensitive habitat type within the identified ecological habitats are presented in Table F4.

Table F4: Critical Loads (Acidification) and Background Nitrogen and Sulphur Acidification Rates

Habitat Site	Critical Load (keq/ha/a)			Background Acidification (keq/ha/a)		Background (as a %age of CLF)
	Max S	Min N	Max N	N	S	
Ashdown Forest SAC / SPA / SSSI	1.196	0.142	1.481	1.69	0.21	128.3
Wakehurst & Chiddingly Woods SSSI	2.96	0.142	3.102	1.67	0.20	60.3

The background acidification rates are within the relevant CLFs at the identified habitat site.



APPENDIX G – TRAFFIC DATA SUMMARY

Table G1 : Traffic Data for 2018 Verification

Road Link	Description	Average Speed (mph)	Traffic Data				
			AADT Traffic Flows	HDV (%)	Emission Rate (g/km/s)		
					NO _x	PM ₁₀	PM _{2.5}
1	A22 north of A275 (40mph section)	40	16804	4.13	0.07274	0.00547	0.00340
2	A22 north of A275 (60mph section) through SAC	60	16804	4.13	0.08425	0.00565	0.00359
3	A22 north of A275 (40mph section) north of SAC	40	16804	4.13	0.07274	0.00547	0.00340
4	A22 north of A275 (30mph section) into Forest Row	30	16804	4.13	0.07965	0.00554	0.00348
5	A22 north of A275 (reduced speed section through Forest Row)	20	16804	4.13	0.09543	0.00573	0.00367
6	A22 north of A275 (30mph section) north of Forest Row	30	16804	4.13	0.07965	0.00554	0.00348
7	A22 north of A275 (50mph section) south of Will Hill Road	50	16804	4.13	0.07348	0.00551	0.00345
8	A22 of A275 (30mps section) south of East Grinstead	30	16031	3.49	0.07477	0.00518	0.00325



Table G2: Traffic Data for 2023 Opening Year Without Development

Road Link	Description	Average Speed (mph)	Traffic Data				
			AADT Traffic Flows	HDV (%)	Emission Rate (g/km/s)		
					NO _x	PM ₁₀	PM _{2.5}
1	A22 north of A275 (40mph section)	40	17,327	4.14	0.07501	0.00564	0.00351
2	A22 north of A275 (60mph section) through SAC	60	17,327	4.14	0.08688	0.00583	0.00370
3	A22 north of A275 (40mph section) north of SAC	40	17,327	4.14	0.07501	0.00564	0.00351
4	A22 north of A275 (30mph section) into Forest Row	30	17,327	4.14	0.08214	0.00571	0.00358
5	A22 north of A275 (reduced speed section through Forest Row)	20	17,327	4.14	0.09842	0.00591	0.00378
6	A22 north of A275 (30mph section) north of Forest Row	30	17,327	4.14	0.08214	0.00571	0.00358
7	A22 north of A275 (50mph section) south of Will Hill Road	50	17,327	4.14	0.07577	0.00568	0.00356
8	A22 of A275 (30mps section) south of East Grinstead	30	16,813	3.49	0.07842	0.00543	0.00341



Table G3: Traffic Data for 2023 Opening Year With Development

Road Link	Description	Average Speed (mph)	Traffic Data					
			AADT Traffic Flows	HDV (%)	Emission Rate (g/km/s)			
					NO _x	PM ₁₀	PM _{2.5}	
1	A22 north of A275 (40mph section)	40	17,354	4.13	0.07512	0.00564	0.00351	
2	A22 north of A275 (60mph section) through SAC	60	17,354	4.13	0.08701	0.00584	0.00371	
3	A22 north of A275 (40mph section) north of SAC	40	17,354	4.13	0.07512	0.00564	0.00351	
4	A22 north of A275 (30mph section) into Forest Row	30	17,354	4.13	0.08226	0.00572	0.00359	
5	A22 north of A275 (reduced speed section through Forest Row)	20	17,354	4.13	0.09856	0.00592	0.00379	
6	A22 north of A275 (30mph section) north of Forest Row	30	17,354	4.13	0.08226	0.00572	0.00359	
7	A22 north of A275 (50mph section) south of Will Hill Road	50	17,354	4.13	0.07589	0.00569	0.00356	
8	A22 of A275 (30mps section) south of East Grinstead	30	16,840	3.48	0.07853	0.00544	0.00342	



APPENDIX H – VERIFICATION AND ADJUSTMENT OF MODELLED CONCENTRATIONS

Nitrogen Dioxide (NO₂)

Most nitrogen dioxide (NO₂) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

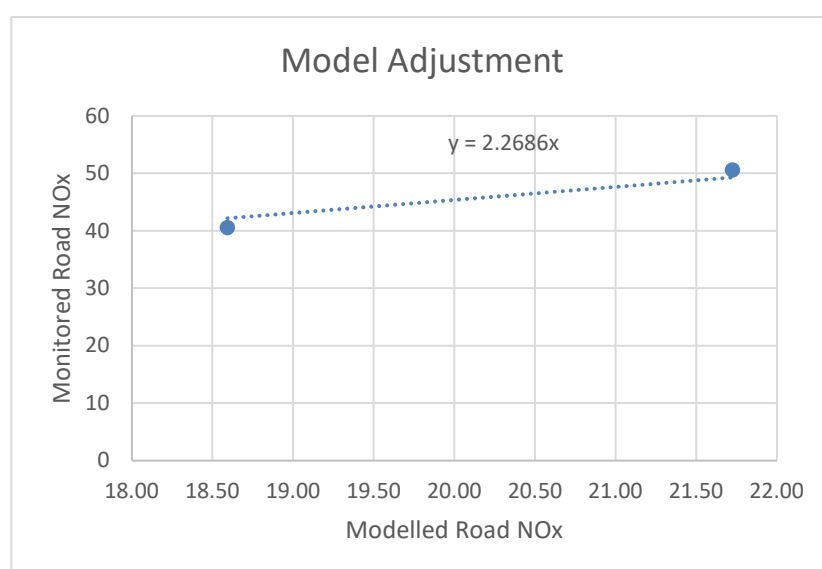
The model has been run to predict annual mean road-NO_x concentrations at two monitoring site, (MSAQ5 and W10).

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared to the 'measured' road-NO_x (Table H1). The 'measured' road NO_x has been calculated from the measured NO₂ concentrations by using the Defra NO_x to NO₂ calculator available on the UK-AIR website.

Table H1: Comparison of Modelled and Monitored NO_x concentrations

Monitoring Location	Total Monitored NO ₂	Background NO ₂	Background NO _x	Monitored Road NO _x	Modelled Road NO _x	Ratio
MSAQ5	30	9.7	13.0	40.61	18.59	2.18
W10	34.6	9.8	13.2	50.63	21.73	2.33

Figure H1: Comparison of Modelled and Monitored Road NO_x concentrations





The results in Table H1 indicate that the ADMS model under-predicted the road NO_x concentrations at the selected monitoring site. An adjustment factor was therefore determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x (2.27). This factor has then been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO₂ concentration was determined using the Defra NO_x:NO₂ spread sheet calculation tool and added to the background NO₂ concentration to produce a total adjusted NO₂ concentration.

Model Uncertainty

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG(16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. These include root mean square error (RMSE); fractional bias (FB) and correlation coefficient (CC). These parameters estimate how the model results agree or diverge from the observations. The simplest parameter to calculate and to interpret is the RMSE, which has therefore been used in this assessment to understand the model uncertainty.

The RMSE value calculated after verification was 0.7. Guidance provided in LAQM.TG(16) indicates that for RMSE values higher than 25% of the objective level, that the model should be revisited. Ideally an RMSE value should be within 10% of the air quality objective level. For annual mean NO₂, which has an objective level of 40µg/m³, this equates to 4µg/m³. The RMSE value calculated for this assessment is therefore considered to fall within the acceptable limits, therefore the final predictions can be considered to be robust.