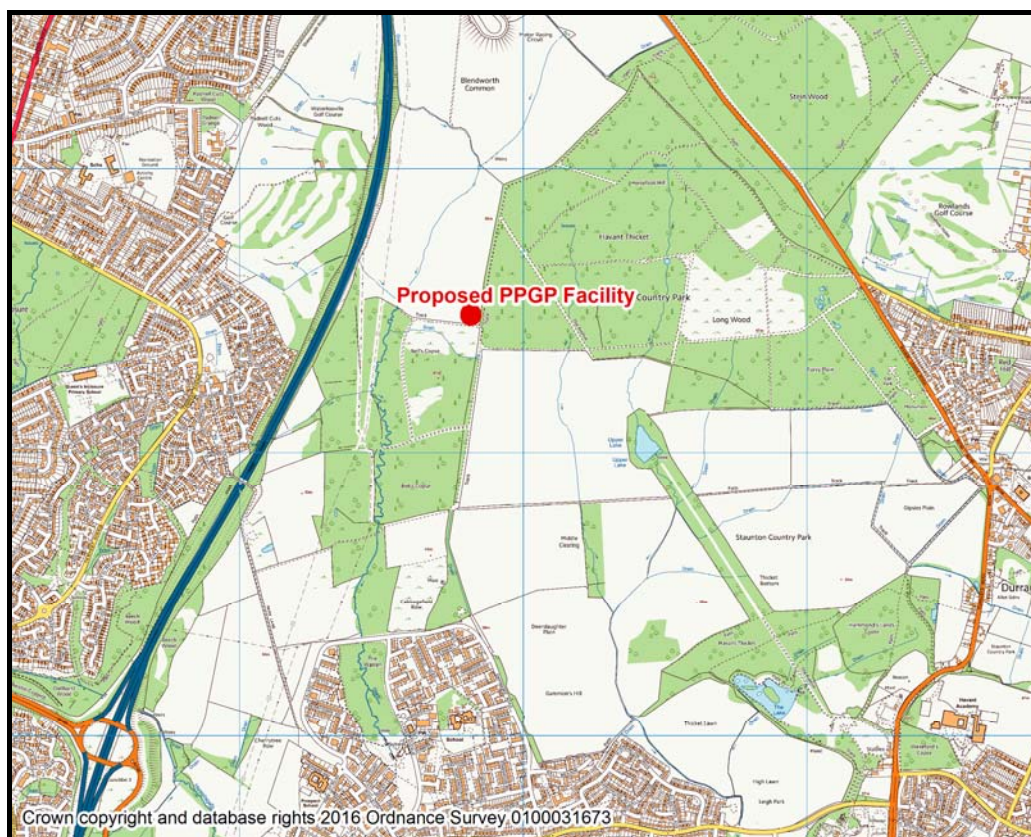


AIR QUALITY ASSESSMENT FOR A PEAKING POWER GENERATION PLANT:

BLENDWORTH



September 2016

Report Reference: C85-P02-R06



Independent Air
Quality & Odour
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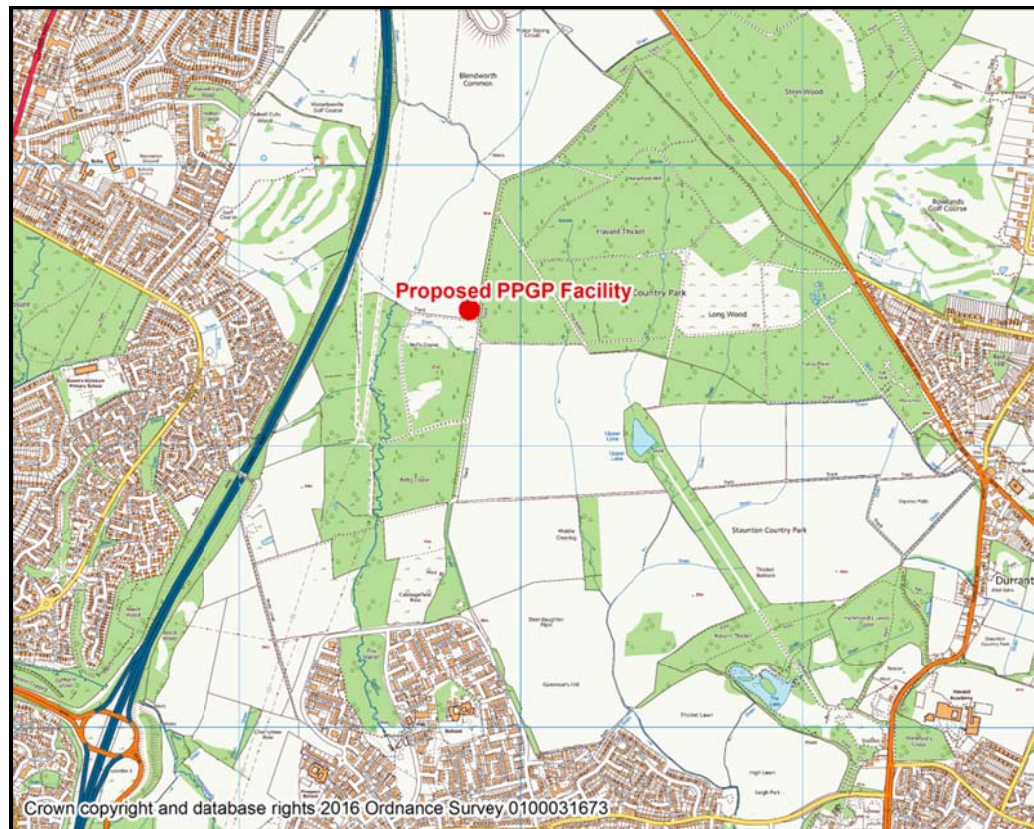
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1.1 PURPOSE OF THE ASSESSMENT

Gair Consulting Ltd has been commissioned by Rydberg Development Company Ltd to undertake an assessment of potential local air quality impacts associated with the proposed development of a Peaking Power Generation Plant (PPGP) at a site at Blendworth, near Waterlooville, Hampshire (Figure 1.1). The site is located to the north and west of woodlands and within 400 m of the A3(M) motorway. The site, including the access, straddles the administrative boundary between Havant Borough Council (HBC) and East Hampshire District Council (EHDC), so that planning applications have been submitted to both authorities for the development.

FIGURE 1.1 LOCATION OF THE PROPOSED DEVELOPMENT



An increasing proportion of electricity generating capacity is coming from renewable sources. Therefore, in order to manage short term fluctuations in demand and supply, the national grid has access to a number of reserve power generators, which can be used at short notice to cover any gaps in demand and supply.

The PPGP facility at the Blendworth site comprises of ten generating units with a total electricity generating capacity of 20 MWe. However, for this

assessment a larger scheme of twelve generating units (24 MWe) was assumed. Therefore, the results of the assessment will overestimate the impact of the PPGP facility and will represent worst-case conditions.

It is proposed that the generating units would be used for up to 2,000 hours per annum during periods of high demand. Generally, these would be at peak demands during the winter and during the hours 07:00 to 11:00 and 15:00 to 20:00 but the facility could operate at any time of the day or night.

1.2 SCOPE OF THE ASSESSMENT

The impact of dust generated during the construction phase of the proposed PPGP facility has the potential to give rise to off-site annoyance and health impacts associated with fine particles. Therefore, the impact of construction activities has been assessed using the methodology described by the Institute of Air Quality Management (IAQM) in their Construction Dust Guidance ¹.

Guidance is provided by IAQM and Environmental Protection UK (EPUK) ² on indicative criteria for requiring a traffic-related air quality assessment in their land-use planning development control: planning for air quality (May 2015). For sites that are not located within an air quality management area (AQMA), these are 500 light duty vehicles (LDVs) annual average daily traffic (AADT) and/or 100 HGVs. Where there is an AQMA this is reduced to 100 LDVs and 25 HDVs as the AADT.

The numbers of vehicles associated with construction are not predicted to be significant in terms of total emissions or construction duration. The proposed PPGP facility would be run automatically, with intermittent maintenance visits. Therefore, on the basis of the IAQM/EPUK screening criteria, it is concluded that a detailed assessment of the impact of traffic associated with the development is not required.

Principal emissions from the PPGP facility include the oxides of nitrogen (NO_x) and carbon monoxide (CO) which have the potential to affect human health. Therefore, these have been included in the air quality assessment. Emissions of NO_x also have the potential to affect habitats sites. There are numerous ancient woodlands within 2 km of the site including Bell's Copse and the Forest of Bere which are immediately adjacent to the site for the PPGP facility. In addition, there are a number of European sites within 10 km of the site. Therefore, the impact of emissions from the generating units on sensitive habitats has also been considered.

1 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, February 2014.

2 Land-Use Planning & Development Control: Planning for Air Quality, EPUK and IAQM (May 2015)

There is the potential for odours to be released from the units. Odours can include fugitive releases of natural gas containing odorous compounds or the presence of odorous volatile organic compounds in the exhaust gases due to incomplete combustion of the gas particularly at start-up. However, fugitive releases of gas would be extremely rare and the duration of start-ups would be short. Therefore, it is considered that the facility would have a negligible impact on off-site odour and has been screened out of the assessment.

Therefore, the potential air quality impacts arising from the construction and operation of the PPGP facility are as follows:

- construction activities giving rise to dust and airborne particles; and
- emissions to air from the operation of the generating units;

1.3

STRUCTURE OF THE REPORT

The remainder of this report is presented as follows:

- *Section 2* presents an assessment of baseline conditions for the air quality assessment.
- *Section 3* provides a description of the assessment methodology for the air quality assessment.
- *Section 4* provides an assessment of construction dust impacts on local air quality.
- *Section 5* presents an assessment of the operational impact of emissions on human health and local air quality.
- *Section 6* presents an assessment of the operational impact of emissions on sensitive habitat sites.
- *Section 7* summarises and concludes the odour assessment.

2.1 INTRODUCTION

This section of the report defines the baseline environment for the assessment and provides the following:

- a discussion of appropriate ambient air quality assessment criteria;
- a review of background monitoring data for the local area;
- a description of local conditions that will affect the dispersion and dilution of emissions arising from the proposed development.

In relation to impacts on humans, the pollutants of interest emitted from the generating units are the products of combustion (NO_x and CO). The construction of the development may also give rise to fine particles (referred to as PM₁₀).

2.2 ASSESSMENT CRITERIA

2.2.1 Oxides of Nitrogen (NO_x)

The oxides of nitrogen comprise principally of nitric oxide (NO) and nitrogen dioxide (NO₂). The oxides of nitrogen (NO_x) in combustion processes may be formed from the oxidation of nitrogen in the fuel or from the reaction of nitrogen and oxygen at high temperatures. The majority of NO_x is emitted from combustion processes as NO (typically over 90%), a relatively innocuous substance that rapidly oxidises to NO₂ in ambient air. Health based standards for NO_x generally relate to NO₂.

A new Directive (2008/50/EC of the European Parliament and of the Council of 21st May 2008, on ambient air quality and cleaner air for Europe) was adopted in June 2008. 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.

Directive 2008/50/EC retains the existing air quality standards for NO₂, but provides greater clarity on where to assess air quality, so that the focus is on areas of potential public exposure. The Directive has been transposed into the UK Air Quality Standards Regulations 2010, which came into force on the 11th June 2010.

Air quality limits and objectives for the oxides of nitrogen in the UK are summarised in *Table 2.1*

TABLE 2.1 AIR QUALITY OBJECTIVES AND LIMIT VALUES FOR NITROGEN DIOXIDE

Set In 2010 UK Regulations? (a)	Description	Averaging Period	Value (µg m ⁻³)
Air Quality Strategy (b)			
Yes	Objective for the protection of human health	1-hour mean, not to be exceeded more than 18 times a year (c)	200
		Annual mean	40
EC Directive on Ambient Air Quality (d)			
Yes	Limit Value	1-hour mean, not to be exceeded more than 18 times a year (c)	200
		Annual mean	40
(a) Air Quality Standards Regulations 2010, (SI 2010/2001) Environmental Protection			
(b) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007			
(c) This corresponds to the 99.8 th percentile of hourly means			
(d) Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe.			

2.2.2 Carbon Monoxide (CO)

Air quality limits and objectives for CO are summarised in *Table 2.2*.

TABLE 2.2 AIR QUALITY OBJECTIVES AND LIMIT VALUES FOR CARBON MONOXIDE

Set In 2010 UK Regulations? (a)	Description	Averaging Period	Value ($\mu\text{g m}^{-3}$)
Air Quality Strategy (b)			
Yes	Objective for the protection of human health	Maximum daily running 8-hour mean	10,000
EC Directive on Ambient Air Quality (c)			
Yes	Limit Value	Maximum daily running 8-hour mean	10,000
(a) Air Quality Standards Regulations 2010, (SI 2010/2001) Environmental Protection (b) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007 (c) Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe.			

2.2.3 Fine Particles (PM₁₀)

Air quality standards for particulate matter generally refer to particles of less than 10 micrometres in diameter, termed PM₁₀ and particles of less than 2.5 micrometres in diameter, termed PM_{2.5}. The smaller fraction (PM_{2.5}) is generally associated with combustion emissions, particularly solid and liquid fuels. In relation to construction impacts, PM₁₀ is a more appropriate metric. Current air quality objectives and limit values for PM₁₀ applicable to the assessment are summarised in *Table 2.3*.

TABLE 2.3 **AIR QUALITY OBJECTIVES AND LIMIT VALUES FOR PM₁₀**

Pollutant	Description	Averaging Period	Value (µg m ⁻³)
Air Quality Standards (a)			
Fine particles (PM ₁₀)	Objective for the protection of human health	24-hour mean, not to be exceeded more than 35 times a year (b)	50
		Annual mean	40
Directive on Ambient Air Quality (c)			
Fine particles (PM ₁₀)	Limit value	24-hour mean, not to be exceeded more than 35 times a year (b)	50
		Annual mean	40
(a) Air Quality Standards Regulations 2010			
(b) This corresponds to the 90.4 th percentile of 24-hour means.			
(c) Directive 2008/50/EC of the European Parliament			

2.2.4 Critical Levels for the Oxides of Nitrogen

Critical levels are thresholds of airborne pollutant concentrations above which damage may be sustained to sensitive plants and animals. High concentrations of pollutants in ambient air directly cause harm to leaves and needles of forests and other plant communities.

The 2008 Air Quality Directive set limit values for the protection of vegetation and ecosystems and these have been adopted by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (July 2007), but are not currently set in Regulations. The current critical levels, limit values and objectives are summarised in *Table 2.4*.

TABLE 2.4 **CRITICAL LEVELS, LIMIT VALUES AND OBJECTIVES FOR THE PROTECTION OF VEGETATION AND ECOSYSTEMS**

	Description	Averaging Period	Concentration (µg m ³)
Nitrogen Oxides			
Air Quality Strategy (a)	Objective	Annual mean	30
EU Directive on Ambient Air Quality / 2010 Air Quality Standards Regulations (b) (c)	Critical Level / Limit Value	Annual mean	30
Environment Agency Risk Assessment Guidance	Critical Level (d)	Daily mean	75
(a) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007			
(b) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008			
(c) The Air Quality Standards Regulations 2010, SI 1001 Environmental Protection.			
(d) WHO (2000) Air Quality Guidelines for Europe, 2 nd Edition, WHO Regional Publications, European Series No. 91.			

The critical levels for NO_x prescribed in the Air Quality Regulations are based on monitoring criteria for the EU limit values and only apply in the following areas:

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

The deposition of pollutants to soils and plant surfaces can also adversely affect habitat sites and critical loads are provided for assessing the impact of nitrogen deposition and acidification. These are site and habitat specific and discussed in more detail in *Section 6.1.3*.

2.3 LOCAL CONDITIONS

2.3.1 The Dispersion and Dilution of Emissions

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. In the UK, all of these sites are quality controlled by the Met Office.

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

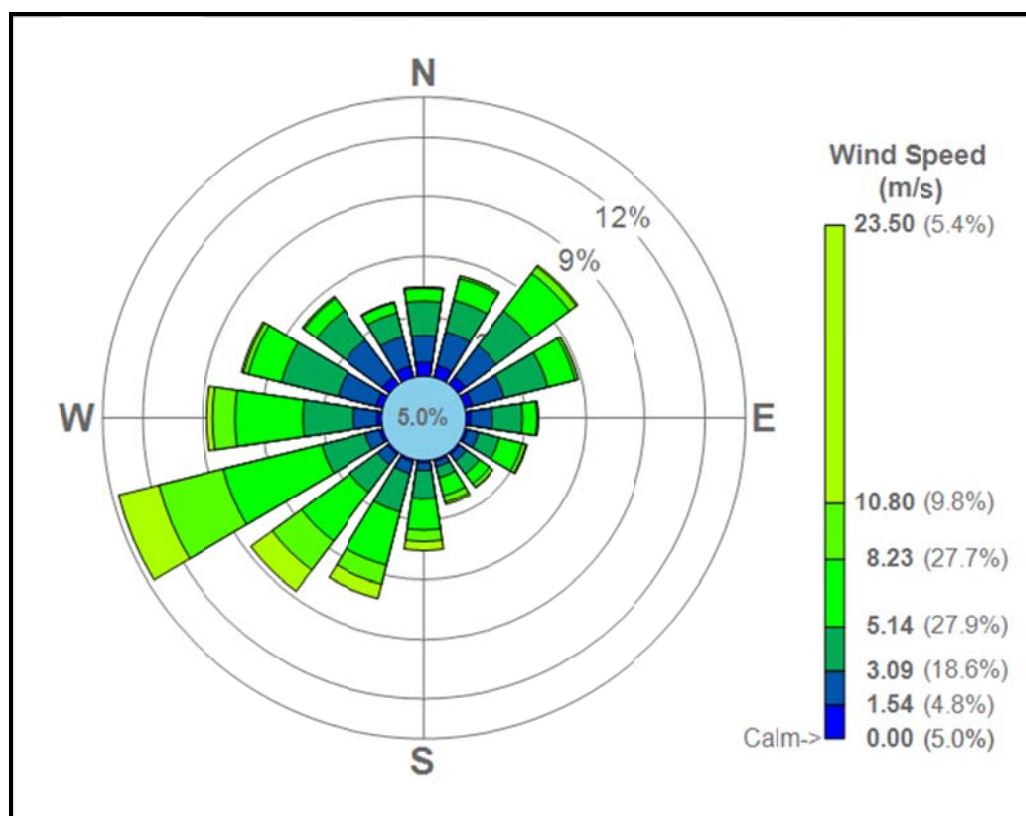
- **Wind direction** determines the broad transport of the emission and the sector of the compass into which the emission is dispersed.
- **Wind speed** will affect low-level emissions by increasing the initial dilution of pollutants in the emission.
- **Atmospheric stability** is a measure of the turbulence, particularly of the vertical motions present.

2.3.2 Local Wind Climate

Met Office observing stations are limited and the nearest station to the site with full data suitable for dispersion modelling is located at Thorney Island, approximately 9 km to the southeast of the proposed development. Five years of meteorological data for this observing station have been obtained (2011 to 2015) and a wind rose for the five years is presented in *Figure 2.1*.

The predominant wind directions are from the west-southwest (13.7%) and calm winds occur for 5.0% of the time.

FIGURE 2.1 WIND ROSE FOR THORNEY ISLAND FOR 2011 TO 2015



2.4 BACKGROUND AIR QUALITY

2.4.1 Local Authority Review and Assessment

Local authorities are required to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met within the relevant time period, the authority must designate an Air Quality Management Area (AQMA) and produce a local action plan.

The proposed development is located within the Havant Borough Council (HBC) administrative area. The most recent air quality management and review report available from HBC is the Updating and Screening Assessment (USA) for 2015³ although this has not been formally approved by Defra it was made available by HBC to provide up to date monitoring data for the location.

The council has not been required to declare any air quality management areas within the administrative area of HBC. East Hampshire District Council has declared one AQMA within Bordon but this is 26 km to the north-northeast of the proposed PPGP site and would not be affected by emissions from the proposed development.

³ 2015 Updating and Screening Assessment for Havant Borough Council (draft)

2.4.2

Background Pollutant Concentrations

Nitrogen Dioxide

HBC do not carry out any continuous monitoring within their administrative area. However, HBC has a network of 23 nitrogen dioxide diffusion tube monitoring sites where monthly mean concentrations of NO₂ are obtained. All of these sites are located within urban areas and the majority are located at roadside or kerbside locations. Therefore, these would not be representative of the air quality at the proposed development site.

As there is limited monitoring data for the development site, ambient background concentrations of NO₂ for 2016 have been obtained from the Defra UK Background Air Pollution Maps ⁴. 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. For NO₂, mapped data for the nine 1 km² grids around the site have been obtained. Annual mean concentrations for the development site range between 11.8 and 15.4 µg m⁻³ with an average of 13.6 µg m⁻³. As a worst-case it is assumed that the background NO₂ concentration is 15.4 µg m⁻³. This is well below the air quality objective of 40 µg m⁻³.

Carbon Monoxide

There is no continuous automatic monitoring of CO within the HBC administrative area. Therefore, ambient background concentrations of CO for 2016 have also been obtained from the Defra UK Background Air Pollution Maps. Mapped background data for CO is not available for the recent mapping data and the 2001 mapping data has been used and data has been projected to 2016 using a factor of 0.431.

For CO, mapped data for the nine 1 km² grids around the site have been obtained. The maximum annual mean CO concentration for these nine 1 km² grids is 164 µg m⁻³ and this is assumed to be the background CO concentration at the development site.

Fine Particles (PM₁₀ and PM_{2.5})

As there is limited data for PM₁₀ at the PPGP site, ambient background concentrations of PM₁₀ for 2016 have also been obtained from the Defra UK Background Air Pollution Maps. Annual mean concentrations of PM₁₀ for the development site range between 13.8 and 15.3 µg m⁻³ with an average of 14.6 µg m⁻³ and are well below the air quality objective of 40 µg m⁻³. As a

⁴ <https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013>

worst-case it is assumed that the background PM₁₀ concentration is 15.3 µg m⁻³.

Summary of Background Concentrations

A summary of the annual mean background concentrations that have been used in the assessment is presented in *Table 2.6*. Short-term concentrations have been derived based on guidance provided by the Environment Agency (EA) in their guidance on 'risk assessment for your environmental permit'.

TABLE 2.6 SUMMARY OF BACKGROUND CONCENTRATIONS FOR THE ASSESSMENT

Pollutant	Averaging Period	Concentration
Nitrogen Dioxide (NO ₂)	Annual	15.4 µg m ⁻³
	1-Hour	30.8 µg m ⁻³ (a)
Carbon Monoxide (CO)	Annual	164 µg m ⁻³
	8-Hour	230 µg m ⁻³ (a)(c)
Particles (PM ₁₀)	Annual	15.3 µg m ⁻³
	24-Hour	18.1 µg m ⁻³ (a)(b)
(a) 1-hour mean background concentration estimated by multiplying the annual mean by a factor of 2 in accordance with EA Guidance. (b) 24-hour mean background concentration estimated by multiplying the 1-hour mean by a factor of 0.59 in accordance with EA Guidance. (c) 8 hour mean background concentration estimated by multiplying the 1-hour mean by a factor of 0.70 in accordance with EA Guidance.		

3.1 INTRODUCTION

Construction dust impacts have been assessed using guidance provided by the IAQM. Emissions to air from the PPGP facility have been modelled using the US AERMOD dispersion model (US EPA 15181) and a five year meteorological data set from Thorney Island (2011 to 2015).

3.2 SENSITIVE RECEPTORS

The air quality assessment has considered the impact of emissions from the PPGP facility at a number of discrete receptors. The locations of these receptors are provided in *Figure 3.1* and described in *Table 3.1*. The nearest receptors surrounding the facility in all directions have been selected for the assessment.

FIGURE 3.1 LOCATIONS OF POTENTIALLY SENSITIVE RECEPTORS CONSIDERED FOR THE AIR QUALITY ASSESSMENT

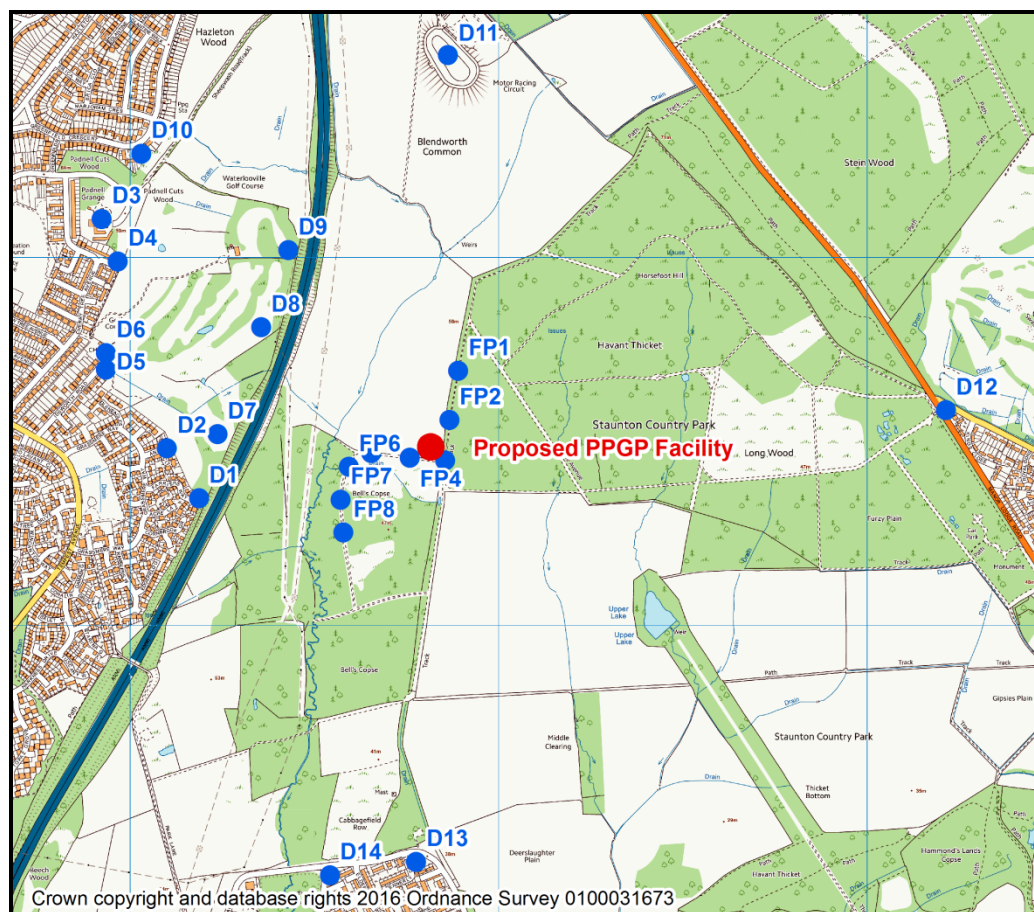


TABLE 3.1 DESCRIPTION OF SENSITIVE RECEPTORS FOR THE AIR QUALITY ASSESSMENT

Ref.	Name	Type	Grid Reference	
			Easting	Northing
D1	Farrier's Way	Residential	470187	110346
D2	Anvil Close	Residential	470100	110482
D3	Padnall Grange	Residential	469923	111104
D4	Cherry Tree Avenue	Residential	469967	110989
D5	Idsworth Road	Residential	469935	110695
D6	Golf Club House	Leisure	469935	110740
D7	Golf Course 1	Leisure	470237	110520
D8	Golf Course 2	Leisure	470356	110811
D9	Golf Course 3	Leisure	470429	111019
D10	Greenfield Crescent	Residential	470030	111281
D11	Motor Racing Circuit	Leisure	470863	111549
D12	Red Hill	Residential	472214	110585
D13	Pennerley Court	Residential	470776	109360
D14	St Clare's Avenue	Residential	470542	109324
FP1	Footpath receptor 1	Leisure	470891	110692
FP2	Footpath receptor 2	Leisure	470867	110558
FP3	Footpath receptor 3	Leisure	470856	110449
FP4	Footpath receptor 4	Leisure	470759	110456
FP5	Footpath receptor 5	Leisure	470655	110469
FP6	Footpath receptor 6	Leisure	470593	110432
FP7	Footpath receptor 7	Leisure	470571	110343
FP8	Footpath receptor 8	Leisure	470579	110253

3.3

SENSITIVE HABITAT SITES

The Environment Agency's Risk Assessment guidance ⁵ 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 Directive;

⁵ <https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit>

- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive; and
- Ramsar Sites designated under the Convention on Wetlands of International Importance.

Within 2 km of the source:

- 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
- ancient woodland.

Within 2 km of the proposed site there are no SSSI, NNR or LNR. However, there are numerous ancient woodlands within 2 km of the proposed site (refer *Figure 3.2*) including Bell's Copse immediately south of the site and the Forest of Bere immediately to the east of the site. Due to the close proximity of the Bell's Copse and the Forest of Bere to the site, concentrations are predicted over the entire area of the habitat sites in order to determine the maximum predicted impact. For other receptors, concentrations are predicted for the nearest point to the proposed site (as provided in *Table 3.2*).

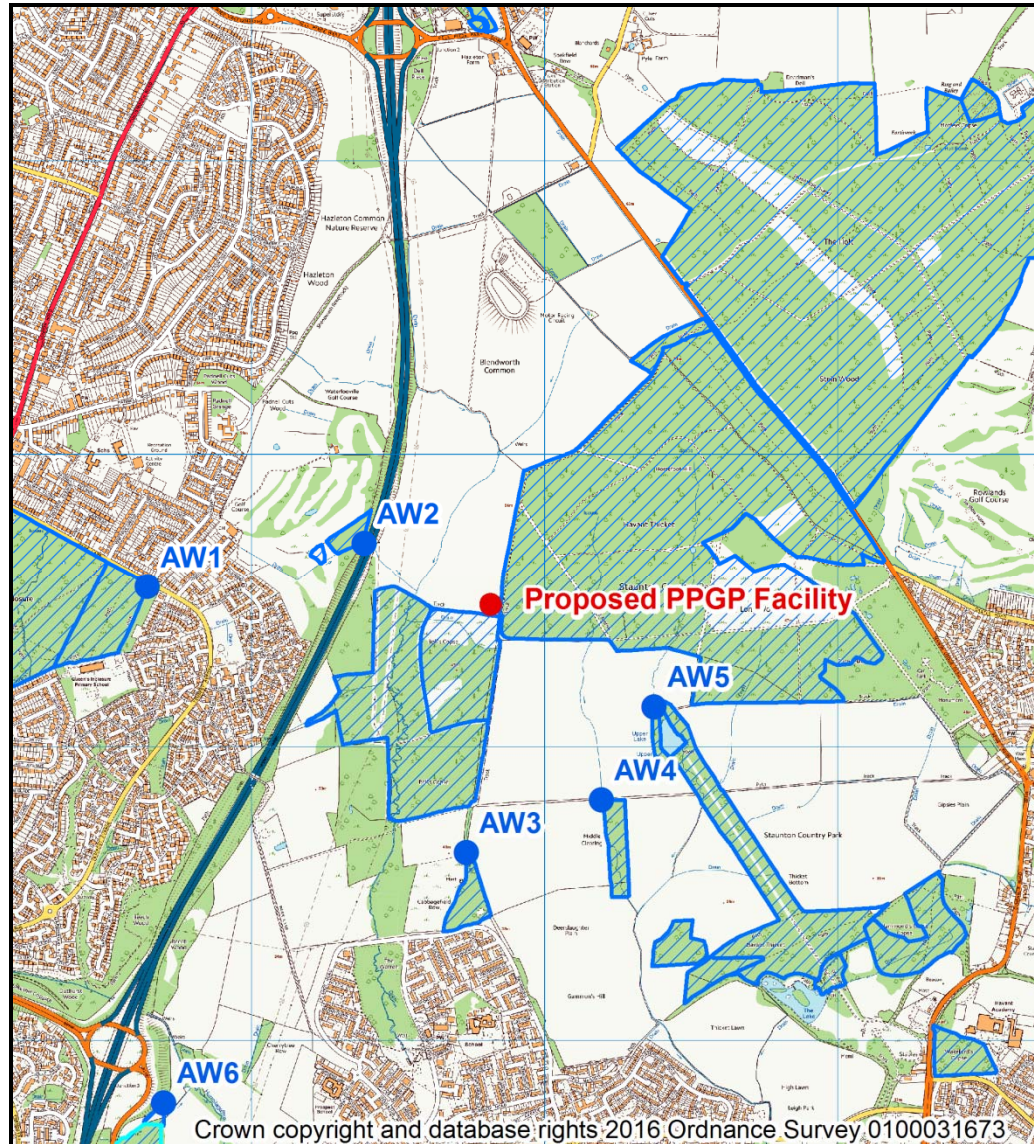
TABLE 3.2 DESCRIPTION OF SENSITIVE HABITAT RECEPTORS

Ref.	Name	Grid Reference	
		Easting	Northing
AW1	The Queen's Inclosure Ancient Woodland	469647	110547
AW2	Ancient woodland	470385	110696
AW3	Cabbagefield Row Ancient Woodland	470735	109639
AW4	Ancient woodland	471195	109819
AW5	Ancient woodland	471375	110136
AW6	Ancient woodland	469703	108787
H1	Portsmouth Hoarbour Ramsar/SPA	470438	105369
H2	Chichester Langstone Harbours Ramsar/SPA	472467	105285
H3	Solent & Isle of Wight Lagoons SAC	468204	104084
H4	Butser Hill SAC	471447	118130

There are also a number of European sites (Ramsar, SPA or SAC) within 10 km of the PPGP site including the Portsmouth Harbour Ramsar/SPA and Chichester Langstone Harbours Ramsar/SPA. Therefore, the predicted impact of NO_x emissions from the PPGP facility on the ancient woodlands and

European sites has been assessed. The assessment has considered the impact of airborne concentrations of NO_x on the ancient woodland habitat sites. For the European sites, the impact of the PPGP facility emissions on nutrient nitrogen deposition and acidification has also been assessed.

FIGURE 3.2 LOCATIONS OF ANCIENT WOODLANDS CONSIDERED FOR THE AIR QUALITY ASSESSMENT



Information on local wildlife sites within 2 km of the site have not been specifically assessed but the impact of airborne emissions of NO_x on the site and surroundings are assessed against the annual mean and 24-hour critical levels (refer Section 6.3.2).

3.4 CONSTRUCTION DUST IMPACTS

3.4.1 Methodology

The impact of dust generated during the construction phase of the Development has been assessed using the methodology described by the Institute of Air Quality Management (IAQM) Construction Dust Guidance ⁶.

The most common air quality impacts relating to construction activities are as follows:

- dust deposition, resulting in the soiling of surfaces;
- visible dust plumes, which are evidence of dust emissions;
- elevated PM₁₀ concentrations, as a result of dust generating activities on site; and
- an increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment used on site (non-road mobile machinery, NRMM) and vehicles accessing the site.

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or health or ecological impact is related to:

- the activities being undertaken;
- the duration of these activities;
- the size of the site;
- the meteorological conditions (wind speed, direction and rainfall);
- the proximity of receptors to the activities;
- the adequacy of the mitigation measures applied to reduce or eliminate dust; and
- the sensitivity of the receptors to dust.

The IAQM methodology considers four aspects that may give rise to dust emissions:

- demolition of existing structures;
- construction of the new facilities;
- earthworks; and
- 'trackout' of dust on vehicles.

⁶ Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, February 2014.

The potential for dust emissions is assessed for each activity that is likely to take place. If an activity is not taking place (e.g. demolition) then it does not need to be assessed. The assessment methodology considers three separate dust impacts as follows:

- annoyance due to dust soiling;
- the risk of health effects due to an increase in exposure to PM₁₀; and
- harm to ecological receptors.

Step 1 of the IAQM Guidance is to screen the requirement for a more detailed assessment. An assessment will normally be required where there is a human receptor within:

- 350 m of the construction site boundary; or
- 50 m of a road used by construction traffic up to 500 m from the site entrance.

For ecological receptors, an assessment will be required where a sensitive habitat site is within:

- 50 m of the boundary of the site; or
- 50 m of a road used by construction traffic up to 500 m from the site entrance.

It should be noted that the criteria are deliberately conservative and detailed assessments are required for most proposed developments, recognising that dust arising from construction activities within urban areas is a significant source of airborne particles.

Where appropriate, the four potential sources of dust and PM₁₀ (demolition, construction, earthworks and track-out) are considered individually, adopting the methodology in the IAQM guidance to assess the risk of dust annoyance (soiling), adverse impact on human health due to elevated PM₁₀ concentrations and adverse impact on habitat sites from dust deposition.

In Step 2, a site is allocated a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large; and
- the sensitivity of the area to dust impacts which is defined as low, medium or high sensitivity.

The dust emission magnitude is based on the scale of the anticipated works and example definitions are presented in *Table 3.3*.

TABLE 3.3 **POTENTIAL DUST EMISSION MAGNITUDE**

Activity	Large	Medium	Small
Demolition	Building volume >50,000 m ³ , potentially dusty construction materials, demolition at above 20 m in height	Building volume 20,000 to 50,000 m ³ , potentially dusty construction materials, demolition height 10-20 m in height	Building volume <20,000 m ³ , material with low potential for dust release, demolition height <10 m
Earthworks	Site area >10,000 m ² , potentially dusty soil type, >10 heavy earth moving vehicles, bunds >8 m in height, total material moved >100,000 tonnes	Site area of 2,500 to 10,000 m ² , moderately dusty soil type, 5-10 heavy earth moving vehicles, bunds 4-8 m in height, total material moved 20,000 to 100,000 tonnes	Site area <2,500 m ² , low dust potential soil type, <5 heavy earth moving vehicles, bunds <4 m in height, total material moved <20,000 tonnes
Construction	Total building volume >100,000 m ³ , on site concrete batching, sandblasting	Total building volume 25,000 to 100,000 m ³ , potentially dusty construction material	Total building volume <25,000 m ³ , material with low potential for dust release
Trackout	>50 outbound HGV movements in any day, potentially dust surface material, unpaved road length >100 m	10-50 outbound HGV movements in any day, moderately dusty surface material, unpaved road length 50 to 100 m	<10 outbound HGV movements in any day, surface material with low potential for dust, unpaved road length <50 m

The sensitivity of the area takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM₁₀, the local background concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The IAQM document provides guidance on the categorisation of receptors into high, medium and low sensitivities for dust soiling, health effects and ecological effects. For dust soiling, the sensitivity of people and their property to soiling will depend on the level of amenity and the appearance aesthetics and value of property. For health effects from exposure to PM₁₀, sensitivity will depend on whether or not the receptor is likely to be exposed over relevant timescales to elevated concentrations over a 24-hour period. For ecological effects, the sensitivity will depend on the type of the habitat designation (e.g. European site, national or local designations) and the sensitivity of the habitat to dust deposition effects.

3.5 DISPERSION MODELLING OF EMISSIONS

3.5.1 The Dispersion Model

The potential impact of emissions from the PPGP facility has been assessed using a dispersion model to predict airborne ground level concentrations of pollutants emitted from the generating unit stacks.

The operational impact from PPGP facility emissions has been assessed using the AERMOD dispersion model. This is one of a 'newer generation' of dispersion models which describe the atmospheric boundary layer properties. AERMOD allows for the modelling of dispersion under convective meteorological conditions using a skewed Gaussian concentration distribution. It is able to simulate the effects of terrain and building downwash simultaneously. It can also calculate concentrations for direct comparison with air quality standards or guidelines. It is used extensively in the UK for assessing the air quality impacts of industrial and other polluting processes.

3.5.2 Building Downwash

Structures associated with the construction of the PPGP facility may affect the dispersion of emissions from the generating units. Building downwash affects occur where buildings are greater than one third of the stack height. Details of building structures that have been included in the dispersion model to allow for building downwash effects are presented in *Table 3.4*. For a stack height of 6 m, buildings in excess of 2 m should be considered. The principal structures are the containers in which the generating units are located.

It should be noted that twelve containers and twelve generators have been modelled but the proposals are for ten generators only.

3.5.3 Grid Size

In addition to assessing the impact of emissions on the discrete receptors identified in *Section 3.2*, the maximum predicted off-site concentration is also determined. Predicted concentrations are calculated across a 4 km by 4 km grid with a 50 m grid resolution and a smaller nested grid of 1 km by 1 km with a grid resolution of 50 m, providing an overall grid resolution of 25 m.

TABLE 3.4 BUILDINGS INCLUDED IN THE DISPERSION MODEL

Building	Height (m)	Location of Building	X Length (m)	Y Width (m)	Angle (°)
Container 1	3.4	470807, 110526	3.3	15.2	97
Container 2	3.4	470806, 110519	3.3	15.2	97
Container 3	3.4	470805, 110513	3.3	15.2	97
Container 4	3.4	470805, 110506	3.3	15.2	97
Container 5	3.4	470804, 110501	3.3	15.2	97
Container 6	3.4	470803, 110494	3.3	15.2	97
Container 7	3.4	470832, 110529	3.3	15.2	97
Container 8	3.4	470832, 110523	3.3	15.2	97
Container 9	3.4	470831, 110517	3.3	15.2	97
Container 10	3.4	470830, 110510	3.3	15.2	97
Container 11	3.4	470830, 110505	3.3	15.2	97
Container 12	3.4	470829, 110498	3.3	15.2	97

3.5.4 Significance Criteria

Planning

The Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) 2015 guidance⁷ has been used to determine the significance of any impacts. The impact descriptors for individual receptors is presented in *Table 3.5*.

TABLE 3.5 IMPACT DESCRIPTION FOR INDIVIDUAL RECEPTORS

Concentration with Development	Percentage Change in Air Quality Relative to the Air Quality Assessment Level (AQAL)			
	< 1%	1 to 5%	6 to 10%	>10%
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 to 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 to 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 to 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

⁷ Land-Use Planning & Development Control: Planning for Air Quality, EPUK and IAQM (May 2015)

The assessment of significance is principally left to professional opinion and guidance is provided on the factors that need to be considered when judging significance and include the following:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to impacts;
- the worst-case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the proposed development has adopted best practice to eliminate and minimise emissions.

In relation to short-term impacts, the IAQM/EPUK guidance states:

'6.38 Where such peak short term concentrations from an elevated source are in the range 10-20% of the relevant AQAL, then their magnitude can be described as small, those in the range 20-50% medium and those above 50% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. That is not to say that background concentrations are unimportant, but they will, on an annual average basis, be a much smaller quantity than the peak concentration caused by a substantial plume and it is the contribution that is used as a measure of the impact, not the overall concentration at a receptor. This approach is intended to be a streamlined and pragmatic assessment procedure that avoids undue complexity.'

Therefore, the following descriptors for assessing the impact magnitude resulting from short term impacts are applied in this assessment:

- <10%: negligible;
- 10-20%: small;
- 20-50%: medium; and
- >50% large.

Environmental Permitting

The Environment Agency's Environmental Management guidance for risk assessments specifies criteria to enable the potential significance of an impact to be determined⁸. For the process contribution (PC), the impact is deemed insignificant if the annual mean PC is less than 1% of the environmental assessment level (EAL) and the short term PC is less than 10% of the EAL. If either of these criteria is exceeded, they are potentially significant and it is

⁸ <https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit>

then necessary to consider the total predicted environmental concentration (PEC, which is the PC plus the ambient background concentration).

For the annual mean, if the PEC is below 70% of the assessment criterion then it is considered unlikely that an exceedence of the limit will occur and there should be no adverse impact. For short term concentrations, more detailed assessments are required where the short term PC is greater than 20% of the short term standard minus twice the long term background concentration.

Habitat Sites

The Environment Agency's risk assessment guidance⁸ specifies criteria to enable the potential significance of an impact to be determined. For the process contribution (PC), the impact is deemed insignificant if the annual mean PC is less than 1% of the critical level (or air quality objective) and the short term PC is less than 10% of the critical level (or air quality objective). If either of these criteria is exceeded, they are not necessarily significant however, it is then necessary to consider the total predicted environmental concentration or deposition (PC plus the background contribution) as discussed above.

For local wildlife sites (SINCs, SLINC's, NNRs, LNRs and ancient woodland), a process contribution (PC) is considered not significant if:

- the long term PC < 100% of the long-term critical level;
- the short term PC < 100% of the short-term critical level.

3.6 EMISSION PARAMETERS

Details of the emission parameters for the generating units are provided in *Table 3.6*.

For assessing short-term concentrations (hourly and 8-hourly), worst-case emissions have been assumed for the purposes of the modelling assessment and the plant is assumed to be operating at full load, 100% of the time. This is clearly an extreme worst-case but allows for the fact that the plant may be operating during worst-case meteorological conditions. For long-term concentrations (annual mean and 24-hourly mean concentrations), emissions are reduced based on the number of operational hours (assumed to be 2,000 hours per year).

Environment Agency guidance has been used in relation to the input data for the prediction of annual average impacts from an intermittent process. On this basis the model has been run on the assumption that it will operate for the entire year. However the emissions have been reduced by a factor of 4.4 (8760/2000) in order that the same total mass emission is released that would be the case for only 2,000 hours per year.

TABLE 3.6 SUMMARY OF THE STACK EMISSIONS DATA FOR DISPERSION MODELLING

Parameter	2.0 MWe Generating Unit
Number of sources	12 (d)
Stack height (m)	9
Temperature of emission (°C)	400
Actual flow rate (m ³ s ⁻¹)	5.5
Emission velocity at stack exit (m s ⁻¹)	27.9
Normalised flow rate (Nm ³ s ⁻¹) (a)	2.0
Pollutant	Emission Concentration (mg Nm ⁻³) (b)
NO _x	250
CO	1,000
	Emission Concentration (g s ⁻¹)
NO _x – annual mean	0.11 (c)
NO _x – hourly mean concentrations	0.5
CO	2.0
(a) Reference conditions of 273K, 1 atmosphere, dry and 5% oxygen	
(b) Emission concentrations expressed as mg Nm ⁻³ (at reference conditions)	
(c) Assuming the facility operates for 2,000 hours per year	
(d) Twelve generators were modelled but only ten are proposed	

3.6.1 Meteorological Data

Dispersion modelling has been carried out for five years of hourly sequential data from the Thorney Island meteorological station. The model utilises hourly meteorological data to define conditions for the dispersion of emissions, transport and diffusion. Predicted concentrations are estimated for each year and the maximum concentration at each receptor is provided. Therefore, predicted concentrations represent worst-case for the five year period.

3.6.2 Topography

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

The area surrounding the proposed facility is gently undulating and unlikely to affect the dispersion of emissions from the facility. However, for completeness, topographical data has been included within the model.

4.1 INTRODUCTION

Dust in the community is normally perceived as an accumulated deposit on surfaces such as washing, window ledges, paintwork and other light coloured horizontal surfaces, e.g. car roofs. When the rate of accumulation is sufficiently rapid to cause noticeable fouling, discoloration or staining (and thus decrease the time between cleaning) then the dust is generally considered to be an annoyance. However, the point at which an individual makes a complaint regarding dust is highly subjective.

Smaller particles (less than 10 μm) are of concern due to their potential impact on human health. Particles are also frequently referred to as PM_{10} (aerodynamic diameter of less than 10 μm), these include the coarse (greater than 2 μm in diameter) and the fine fraction. Particles larger than PM_{10} are mainly associated with annoyance impacts and tend to be generated by mechanical processes. A large proportion of the particle releases from construction activities will comprise this larger fraction (i.e. larger than PM_{10}), particularly from handling and processing of construction materials. Finer particles may also arise from on-site mobile and fixed construction plant.

Any form of demolition or construction activity has the potential to generate dust emission and thereby cause annoyance or health impacts to people in the vicinity of the site.

4.2 SCREENING OF IMPACTS

There are no major structures requiring demolition on the site and the impact of demolition can be screened out of the assessment. There are no sensitive human receptors within 350 m of the site boundary and within 50 m of the route used by construction traffic. Therefore, the impact of earthworks, construction and trackout will not be required for assessing the impact of construction activities on human receptors.

There are ecological receptors within 50 m of the boundary of the site and the impact of construction dust on habitats will need to be assessed. In addition, the site is located within a Site of Interest for Nature Conservation (Blendworth Common). However, as these are ancient woodland and locally designated sites they will be deemed to have a low sensitivity.

Therefore, the risk assessment has focussed on the following:

- construction activities on habitat receptors;
- earthworks (soil stripping, ground-levelling, excavation, piling and landscaping) on habitat receptors; and
- 'trackout' of dust on vehicles on habitat receptors.

4.3 DESCRIPTION OF THE DEVELOPMENT

The proposed development site is relatively small with an overall area of approximately 0.5 hectare (ha). It is located within a rural setting with woodland to the south and east. The nearest sensitive receptors are residential receptors located in Cowplain over 500 m to the west.

Construction activities are likely to be limited to levelling of the site, provision of hardstanding, and the installation of the generating units and associated infrastructure.

4.4 ASSESSMENT OF IMPACTS

4.4.1 Dust Emission Magnitude

The assessment has considered the overall construction of the development such that any mitigation measures can be focussed where required for each activity. The development is small and there will be limited earthworks required. Construction would be limited to the generating units and the associated infrastructure. Therefore, for earthworks, construction and trackout, activities would be assessed as having a 'small' dust emission magnitude.

For earthworks, construction and trackout the assessment of the potential dust emission magnitude is summarised in *Table 4.1*.

TABLE 4.1 SUMMARY OF DUST EMISSION MAGNITUDE

Demolition	Earthworks	Construction	Trackout
None	Small	Small	Small

4.4.2 Define the Sensitivity of the Area

Ecological Impacts

Using the IAQM methodology, the two ancient woodlands adjacent to the site and the SINC would be classed as low sensitivity as these are not statutory designated site. The ancient woodlands are both located less than 20 m from

the boundary of the proposed development site and the site is located within the SINC. However, using the matrix in *Table 4.2*, the sensitivity of the area to ecological impacts would be assessed as 'low'.

TABLE 4.2 **METHODOLOGY FOR ASSESSING THE SENSITIVITY OF THE AREA TO ECOLOGICAL IMPACTS**

Receptor Sensitivity	Distance from the Source	
	< 20 m	<50 m
High	High	Medium
Medium	Medium	Low
Low	Low	Low

4.4.3 Define the Risk of Impacts

The dust emission magnitude and sensitivity of the area are combined to determine the risk of impacts using Table 7 (earthworks), Table 8 (construction) and Table 9 (trackout) of the IAQM guidance. A summary of the risks are presented in *Table 4.4*. These are defined on the basis of no mitigation beyond that required by legislation. Where the risk is assessed as 'negligible' no additional mitigation is considered necessary.

TABLE 4.4 **SUMMARY OF DUST SOILING RISK AND HUMAN HEALTH RISK TO DEFINE SITE-SPECIFIC MITIGATION**

Impact	Earthworks	Construction	Trackout
Ecological impacts	Negligible	Negligible	Negligible

For ecological impacts, the risk is identified as negligible for earthworks, construction and trackout and no further mitigation would be required. Therefore, it is concluded that the use of good housekeeping practices during construction will be sufficient to minimise construction dust impacts.

4.5 MITIGATION

The impact of the site on construction activities has been assessed as negligible. Therefore, it is concluded that the use of good housekeeping practices during construction will be sufficient to minimise construction dust impacts.

5.1 INTRODUCTION

The predicted impact of emissions to air from the PPGP facility is presented. Results are presented as the maximum predicted across the dispersion modelling domain. In addition, predicted concentrations for the discrete receptors are presented.

For each averaging period (e.g. annual mean, maximum hourly mean etc.), the result presented is the maximum for the five years of meteorological data used for dispersion modelling purposes.

A number of assumptions have been made to characterise the various emission sources and the surrounding environment into which these emissions are emitted. Worst-case assumptions have been adopted to avoid underestimating the predicted impact of emissions on air quality. In particular, for short-term impacts it is assumed that the PPGP facility operates continuously and results are presented for the worst-case meteorological year.

5.2 PREDICTED IMPACT ON HUMAN HEALTH

5.2.1 Nitrogen Dioxide

Predicted annual and hourly mean ground level concentrations of NO₂ arising as a result of emissions from the PPGP facility are presented in *Table 5.1* and *Table 5.2*, respectively. Maximum predicted concentrations are provided along with predicted concentrations for the identified receptor locations. The significance of the impacts is assessed with regard to the significance criteria for planning. The results are presented for the process contribution (PC) and the predicted environmental concentration (PEC) which is the PC plus the background concentration.

Guidance issued by the Environment Agency's Air Quality Assessment and Modelling Unit (AQMAU) ⁹ indicates that an initial screening approach would be to assume that 100% of annual average and 50% of peak hourly average concentrations of NO_x are in the form of NO₂. For a more detailed worst-case assessment such as this, the guidance recommends a conversion rate of 70% and 35% for annual and hourly concentrations respectively.

⁹ Conversion Ratios for NO_x and NO₂, Air Quality Modelling and Assessment Unit of the Environment Agency (undated)

TABLE 5.1

PREDICTED ANNUAL MEAN GROUND LEVEL CONCENTRATIONS OF NO₂ AT SENSITIVE RECEPTORS ARISING FROM THE PPGP FACILITY EMISSIONS

Label	Receptor	Annual Mean PC ($\mu\text{g m}^{-3}$) (a)	Annual Mean PC as %age of AQS	Annual Mean PEC as %age of AQS (b)	Impact Descriptor
Max	Maximum predicted	10.4	26%	64%	Moderate Adverse
D1	Farrier's Way	0.4	1%	40%	Negligible
D2	Anvil Close	0.3	1%	39%	Negligible
D3	Padnall Grange	0.1	0%	39%	Negligible
D4	Cherry Tree Avenue	0.1	0%	39%	Negligible
D5	Idsworth Road	0.2	0%	39%	Negligible
D6	Golf Club House	0.1	0%	39%	Negligible
D7	Golf Course 1	0.3	1%	39%	Negligible
D8	Golf Course 2	0.3	1%	39%	Negligible
D9	Golf Course 3	0.2	0%	39%	Negligible
D10	Greenfield Crescent	0.1	0%	39%	Negligible
D11	Motor Racing Circuit	0.1	0%	39%	Negligible
D12	Red Hill	0.2	1%	39%	Negligible
D13	Pennerley Court	0.1	0%	39%	Negligible
D14	St Clare's Avenue	0.1	0%	39%	Negligible
	Maximum footpath	7.9	20%	58%	Moderate adverse
(a) As a worst-case, assumes 70% conversion of NO to NO ₂					
(b) Assuming a background concentration of 15.4 $\mu\text{g m}^{-3}$					

As a maximum at any location, the contribution for the PPGP facility to annual mean concentrations is 10.4 $\mu\text{g m}^{-3}$ and is 26% of the air quality objective (AQO) of 40 $\mu\text{g m}^{-3}$. This represents worst-case conditions as discussed in *Section 5.1*. At this location, the impact would be described as 'negligible' and predicted total concentrations (PEC) are well below the AQO. Furthermore, there is no relevant long-term public exposure (i.e. residential receptors) at this location. Similarly, there is no relevant public exposure at the footpath receptors. At all of the sensitive receptors considered, where there is relevant public exposure, the impact is also assessed as 'negligible'. Therefore, the impact of the PPGP facility on annual mean NO₂ is assessed as 'not significant'.

For the short-term objective (99.8th percentile of hourly means), the maximum predicted impact of the PPGP facility is 76% of the AQO and would be described as having a 'large' impact. However, there is no exposure at this location and as demonstrated by the contour plots in *Figure 5.2*, these impacts are very localised. Predicted concentrations for the footpath receptors are also

assessed as 'large'. However, exposure is likely to be very infrequent for these transient receptors. For the residential and leisure receptors the impact are described as 'small' or 'negligible'.

TABLE 5.2 PREDICTED 99.8TH PERCENTILE OF HOURLY MEAN CONCENTRATIONS OF NO₂ AT SENSITIVE RECEPTORS ARISING FROM THE PPGP FACILITY EMISSIONS

Label	Receptor	Hourly PC ($\mu\text{g m}^{-3}$) (a)	Hourly PC as %age of AQS	PEC as %age of AQS (b)	Impact Descriptor
Max	Maximum predicted	151.6	76%	91%	Large
D1	Farrier's Way	23.4	12%	27%	Small
D2	Anvil Close	21.1	11%	26%	Small
D3	Padnall Grange	10.7	5%	21%	Negligible
D4	Cherry Tree Avenue	12.8	6%	22%	Negligible
D5	Idsworth Road	13.5	7%	22%	Negligible
D6	Golf Club House	13.3	7%	22%	Negligible
D7	Golf Course 1	25.5	13%	28%	Small
D8	Golf Course 2	23.3	12%	27%	Small
D9	Golf Course 3	17.6	9%	24%	Negligible
D10	Greenfield Crescent	9.4	5%	20%	Negligible
D11	Motor Racing Circuit	10.0	5%	20%	Negligible
D12	Red Hill	10.6	5%	21%	Negligible
D13	Pennerley Court	10.8	5%	21%	Negligible
D14	St Clare's Avenue	9.9	5%	20%	Negligible
	Maximum footpath	150.2	75%	91%	Large
(a) As a worst-case, assumes 35% conversion of NO to NO ₂					
(b) Assuming a background concentration of 30.8 $\mu\text{g m}^{-3}$					

Therefore, the results show that the short term process contribution for NO₂ is high relative to the short term NO₂ air quality objective at some sensitive receptors. However, the PPGP is highly unlikely to operate for the extended period modelled and these predicted concentrations are representative of the extreme worst-case conditions. It should be noted that combined with the background concentration, the predicted environmental concentration (PEC) is well below the AQO of 200 $\mu\text{g m}^{-3}$ at all locations.

Predicted annual mean and predicted hourly mean (as the 99.8th percentile) ground level concentrations are also presented as contour plots in *Figure 5.1* and *Figure 5.2*, respectively. For both averaging periods, maximum predicted concentrations occur close to the PPGP site and decrease with distance from the site. Maximum concentrations occur to the north east of the site over the ancient woodland.

FIGURE 5.1 PREDICTED ANNUAL MEAN NO₂ CONCENTRATIONS ($\mu\text{g m}^{-3}$)

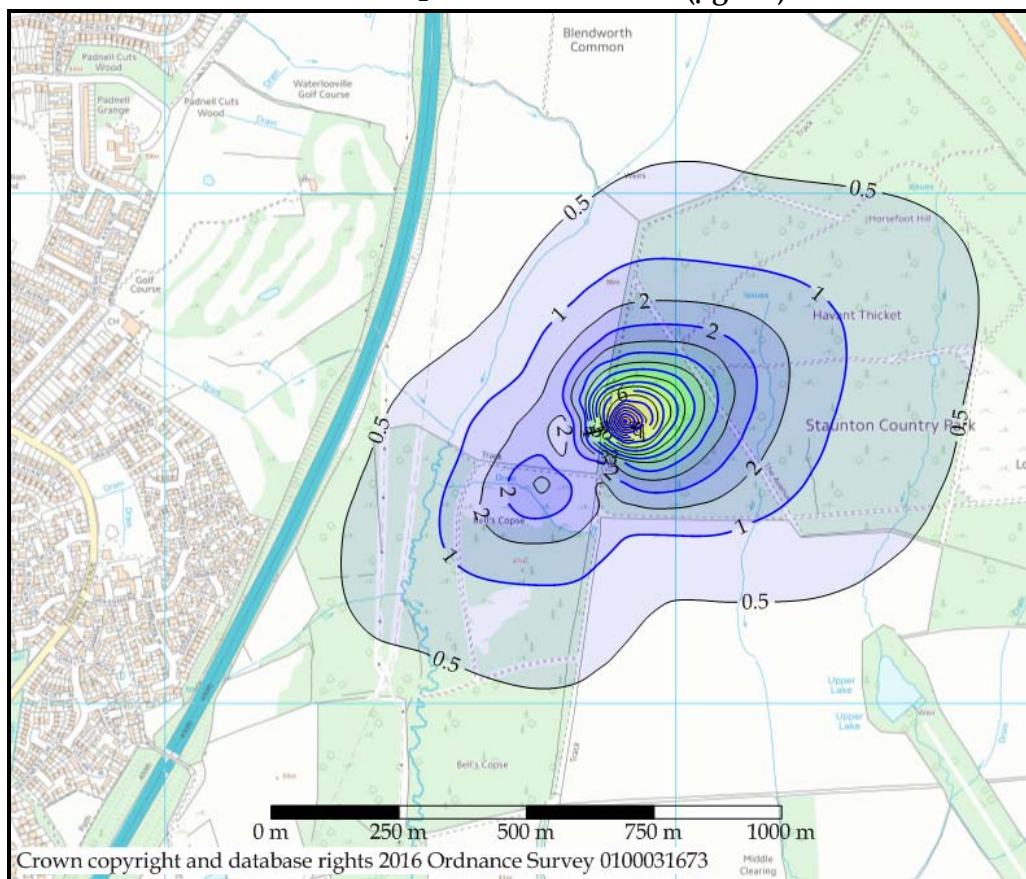
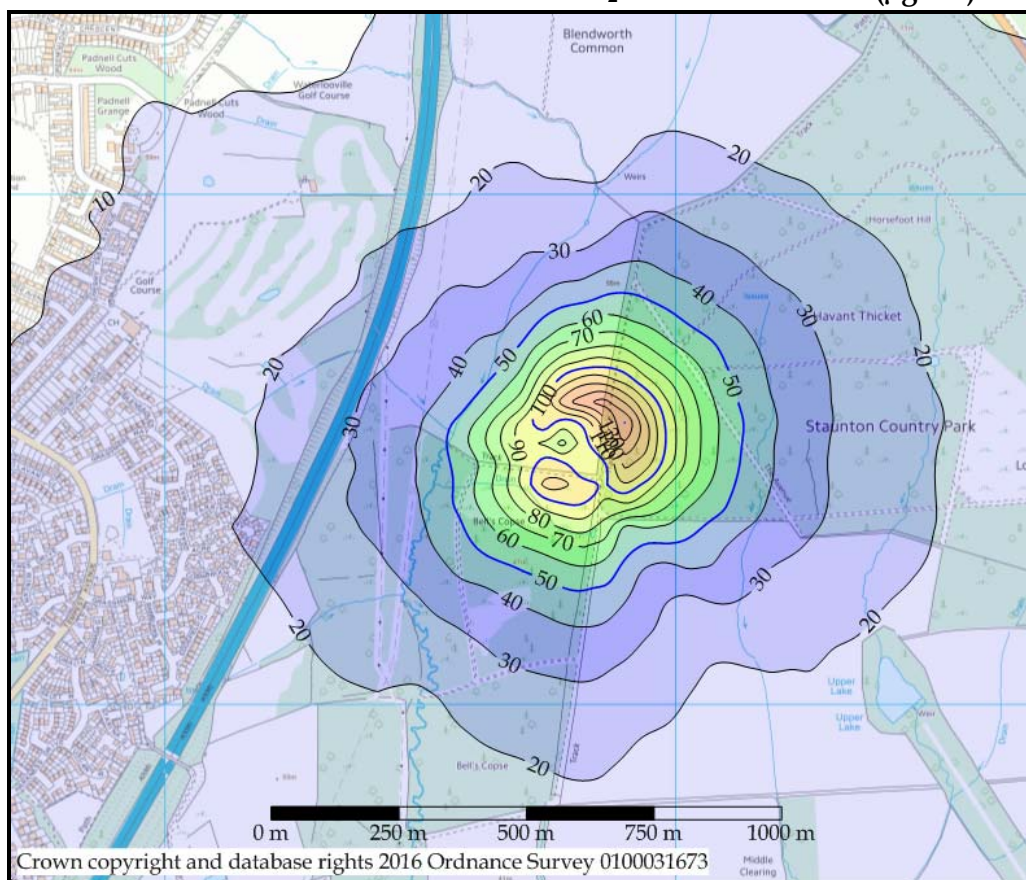


FIGURE 5.2 PREDICTED 99.8TH PERCENTILE OF HOURLY NO₂ CONCENTRATIONS ($\mu\text{g m}^{-3}$)



5.2.2

Carbon Monoxide

Predicted 8-hourly mean ground level concentrations of CO arising as a result of emissions from the PPGP facility are presented in *Table 5.3*. The maximum predicted concentration is provided along with concentrations predicted for sensitive receptors. The significance of the impact is assessed using the planning criteria provided by the IAQM. The results are presented for the process contribution (PC) and the predicted environmental concentration (PEC) which is the PC plus the background concentration.

TABLE 5.3 PREDICTED MAXIMUM 8-HOURLY MEAN CONCENTRATIONS OF CO AT SENSITIVE RECEPTORS ARISING FROM THE PPGP FACILITY EMISSIONS

Label	Receptor	Hourly PC ($\mu\text{g m}^{-3}$) (a)	Hourly PC as %age of AQS	PEC as %age of AQS (b)	Impact Descriptor
Max	Maximum predicted	1670	17%	19%	Small
D1	Farrier's Way	207	2%	4%	Negligible
D2	Anvil Close	204	2%	4%	Negligible
D3	Padnall Grange	90	1%	3%	Negligible
D4	Cherry Tree Avenue	90	1%	3%	Negligible
D5	Idsworth Road	106	1%	3%	Negligible
D6	Golf Club House	105	1%	3%	Negligible
D7	Golf Course 1	231	2%	5%	Negligible
D8	Golf Course 2	180	2%	4%	Negligible
D9	Golf Course 3	142	1%	4%	Negligible
D10	Greenfield Crescent	60	1%	3%	Negligible
D11	Motor Racing Circuit	97	1%	3%	Negligible
D12	Red Hill	83	1%	3%	Negligible
D13	Pennerley Court	81	1%	3%	Negligible
D14	St Clare's Avenue	92	1%	3%	Negligible
	Maximum footpath	1602	16%	18%	Small
(a) Assuming a background concentration of $230 \mu\text{g m}^{-3}$					

The maximum predicted concentration anywhere within the model domain ($1,670 \mu\text{g m}^{-3}$) is 17% of the AQO of $10,000 \mu\text{g m}^{-3}$ and would be assessed as a 'small' impact in accordance with the IAQM planning guidance. For sensitive receptor locations the impact of CO emissions would also be described as 'negligible' except at the footpath where this is assessed as 'small'. However, exposure at this location will be transient and very unlikely to occur for the exposure period of 8-hours. Therefore, it is concluded that the impact of the PPGP on short-term concentrations of CO is 'not significant'.

PREDICTED IMPACT OF SHORT-TERM NO₂ AT TYPICAL OPERATING CONDITIONS

Predicted concentrations presented in *Section Error! Reference source not found.* and *Table 5.2* have been calculated on the basis that the PPGP operates continuously at full load. As this is a peaking plant this is clearly an extreme worst-case scenario. The plant will operate for a maximum of 2,000 hours per year, normally when there is peak demand. Therefore, an assessment has been carried out for the typical operation of the plant which will give a more realistic assessment of impacts. Short-term concentrations have been predicted assuming the PPGP facility operates for six hours per day (07:00 to 09:00 and 16:00 to 20:00) and would be equivalent to 2,190 hours per year. Predicted concentrations at the sensitive receptors as the 99.8th percentile of hourly means are presented in *Table 5.4*.

TABLE 5.4 PREDICTED 99.8TH PERCENTILE OF HOURLY MEAN CONCENTRATIONS OF NO₂ AT SENSITIVE RECEPTORS ARISING FROM THE PPGP FACILITY EMISSIONS – TYPICAL OPERATION

Label	Receptor	Hourly PC ($\mu\text{g m}^{-3}$) (a)	Hourly PC as %age of AQS	PEC as %age of AQS (b)	Impact Descriptor
D1	Farrier's Way	14.1	7%	22%	Negligible
D2	Anvil Close	10.8	5%	21%	Negligible
D3	Padnall Grange	5.3	3%	18%	Negligible
D4	Cherry Tree Avenue	6.1	3%	18%	Negligible
D5	Idsworth Road	8.5	4%	20%	Negligible
D6	Golf Club House	7.5	4%	19%	Negligible
D7	Golf Course 1	13.7	7%	22%	Negligible
D8	Golf Course 2	10.0	5%	20%	Negligible
D9	Golf Course 3	7.4	4%	19%	Negligible
D10	Greenfield Crescent	4.6	2%	18%	Negligible
D11	Motor Racing Circuit	6.1	3%	18%	Negligible
D12	Red Hill	6.5	3%	19%	Negligible
D13	Pennerley Court	6.3	3%	19%	Negligible
D14	St Clare's Avenue	6.1	3%	18%	Negligible
	Maximum footpath	144.5	72%	88%	Large
(a) As a worst-case, assumes 35% conversion of NO to NO ₂					
(b) Assuming a background concentration of 30.8 $\mu\text{g m}^{-3}$					

Short term emissions are described as having a 'negligible' impact at all receptors except for the footpath users. In addition, predicted concentrations at all sensitive receptors are well below the short term AQO of 200 $\mu\text{g m}^{-3}$. For the footpath receptors, exposure is likely to be transient and infrequent.

Therefore, it is concluded that the impact of the PPGP on short-term concentrations of NO₂ is 'not significant'.

6.1 CRITICAL LEVELS AND CRITICAL LOADS

6.1.1 Introduction

There are many impacts on ecosystems associated with elevated levels of atmospheric nitrogen and its deposition to sensitive habitats. The most important of these are ¹⁰:

- short-term direct effects of nitrogen gases and aerosols on individual species;
- soil mediated effects;
- increased susceptibility to secondary stress factors, such as drought or frost; and
- changes in (competitive) relationships between species, resulting in loss of biodiversity.

In order to provide benchmark levels, below which significant harmful effects to the environment do not occur, critical levels and critical loads have been developed referring to gaseous airborne concentrations of pollutants and deposition of pollution to land and water, respectively.

6.1.2 Critical Levels

Critical levels are thresholds of airborne pollutant concentrations above which damage may be sustained to sensitive plants and animals. High concentrations of pollutants in ambient air directly cause harm to leaves and needles of forests and other plant communities. Critical levels for NO_x are provided in *Section 2.2.4*.

6.1.3 Critical Loads

Introduction

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.).

¹⁰ Air Quality Guidelines for Europe, Second Edition, WHO Regional publications European Series No. 91, Chapter 11: Effects of nitrogen-containing air pollutants: critical levels, Chapter 14 : Effects of airborne nitrogen pollutants on vegetation: critical loads (2000)

The issue for ecosystems is the risk that the deposition rate of acid (acidification) or nutrient nitrogen (eutrophication) may be in excess of the amount that the ecosystem can tolerate. The point at which this occurs is the 'critical load'.

Eutrophication

Critical loads for nutrient nitrogen are determined largely on the basis of the species or habitat type affected. Critical loads have been determined for a number of habitat types at the European level and reflect the way different plants have adapted to differing availabilities of nutrient. Those in nutrient deficient environments, e.g. coastal sand dunes, will be less tolerant of excess nitrogen from aerial deposition.

Where there are SSSI's within 2 km and/or European sites within 10 km, critical loads for eutrophication at the identified sensitive habitat receptors, obtained from the Air Pollution Information System (APIS) ¹¹ are summarised in *Table 6.1*.

TABLE 6.1 **CRITICAL LOADS FOR EUTROPHICATION**

Habitat Site	Most Sensitive Habitat Type	Critical Load (kg N ha ⁻¹ a ⁻¹)
Portsmouth Harbour Ramsar/SPA	Littoral sediment for wintering birds	20 - 30
Chichester Langstone Harbour Ramsar/SPA	Coastal stable dune grasslands for breeding birds	8 - 10
Solent Maritime SAC	Coastal stable sand dunes	8 - 15
Solent & Isle of Wight Lagoons SAC	Pioneer, low-mid, mid-upper saltmarshes	20 - 30
Butser Hill SAC	Coniferous woodland	5 - 15

Acidification

For acidification, the critical load of a habitat site is determined mostly by the underlying geology and soils. Alkaline soils have an innate capacity for neutralising acidic deposition, whereas acidic soils do not. The level of acidification depends on the donation of hydrogen ions to the soil arising primarily from deposition of:

- sulphur dioxide, which reacts with water to produce sulphuric acid;
- nitrogen oxides, which react with water to produce nitric acid; and
- acid gases such as hydrogen chloride.

¹¹ www.apis.co.uk

The critical load of acidification is defined by a critical load function 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.

There are no significant emissions of sulphur from the PPGP facility. Therefore, the critical level for nitrogen only is considered. Where there are SSSI's within 2 km and/or European sites within 10 km, the values of this parameter (as provided by APIS) for the selected habitat receptors are presented in *Table 6.2*.

TABLE 6.2 CRITICAL LOADS FOR ACIDIFICATION (keq ha⁻¹a⁻¹)

Habitat Site	Most Sensitive Habitat Type	ClmaxN
Portsmouth Harbour Ramsar/SPA	Not sensitive to acidification	-
Chichester Langstone Harbour Ramsar/SPA	Acid grassland for wintering	4.588
Solent Maritime SAC	Acid grassland	4.680
Solent & Isle of Wight Lagoons SAC	Not sensitive to acidification	-
Butser Hill SAC	Unmanaged broadleaved/coniferous woodland	11.486

6.2 BACKGROUND DEPOSITION FLUXES AND AIRBORNE CONCENTRATIONS

6.2.1 Introduction

Information on background nutrient nitrogen deposition, acidification and airborne concentrations of NO_x has been obtained from information provided by the Centre for Ecology and Hydrology (CEH) and available from the Air Pollution Information System (APIS) website.

6.2.2 Airborne Concentrations

Background NO_x concentrations for the area surrounding the site have been obtained from the APIS and are summarised in *Table 6.3*.

TABLE 5.3 **AIRBORNE CONCENTRATIONS OF NO_x AT SENSITIVE HABITAT SITES**

Habitat Site	Annual Mean NO _x (µg m ⁻³)	24-hour Mean NO _x (µg m ⁻³) (a)
Portsmouth Harbour Ramsar/SPA	34.6	40.8
Chichester Langstone Harbour Ramsar/SPA	18.6	21.9
Solent Maritime SAC	18.6	21.9
Solent & Isle of Wight Lagoons SAC	14.8	17.5
Butser Hill SAC	14.6	17.2
<i>Critical level</i>	30	75
(a) Derived from the annual by multiplying by 2 to generate an hourly mean and 0.59 to convert to a 24-hour mean		

Except for Portsmouth Harbour Ramsar/SPA, background concentrations of NO_x are below the annual mean and 24-hour mean critical levels of 30 µg m⁻³ and 75 µg m⁻³, respectively.

6.2.3 Nutrient Nitrogen Deposition (Eutrophication) and Acidification

APIS is able to provide an indication of background nutrient nitrogen deposition and acidification by geographical location and habitat type. The estimates are made from 5 km resolution mapped data, which are derived from a combination of modelling studies and measured deposition and acidification rates¹². There is an inherent level of uncertainty resulting from this process, particularly in areas with significant emissions sources. However in the absence of local measurements, the APIS data provides a useful benchmark for comparison with deposition and acidification rates predicted by the dispersion model. Where there are SSSI's within 2 km and/or European sites within 10 km, a summary of the background fluxes provided by APIS for habitat sites selected for the assessment is presented in *Table 6.4*.

Except for Portsmouth Harbour Ramsar/SPA and Solent & Isle of Wight Lagoons SAC, background nutrient nitrogen exceeds the relevant critical loads for the most sensitive habitat site.

¹² Transboundary Air Pollution: Acidification, Eutrophication, and Ground Level Ozone in the UK, NEG-TAP, EPG 1/3/153, 2001

TABLE 6.4 BACKGROUND NITROGEN DEPOSITION AND ACIDIFICATION FLUXES

Habitat Site	Background Nutrient Nitrogen Flux (kg N ha ⁻¹ a ⁻¹)	Background Acidification Flux N (keq ha ⁻¹ a ⁻¹)
Portsmouth Harbour Ramsar/SPA	13.56	Not sensitive
Chichester Langstone Harbour Ramsar/SPA	11.29	0.81
Solent Maritime SAC	11.32	0.81
Solent & Isle of Wight Lagoons SAC	10.03	Not sensitive
Butser Hill SAC	29.75	2.13

6.2.4 Calculation of Acid and Nutrient Nitrogen Deposition

The deposition of acid and nutrient nitrogen is not directly modelled but is derived from the concentration predicted at each sensitive ecological receptor for each pollutant of interest. The derivation is based upon Environment Agency guidance¹³ and uses the conversion factors set out in *Table 6.5*. The factors take into account the difference in deposition velocity and mechanisms experienced in woodlands, and grasslands and other non-arboreal areas.

TABLE 6.5 FACTORS FOR CONVERSION OF ANNUAL MEAN CONCENTRATIONS TO NUTRIENT NITROGEN AND ACID DEPOSITION

Pollutant	Deposition Velocity (m s ⁻¹)	Conversion Factor (µg m ⁻² s ⁻¹ to kg ha ⁻¹ year ⁻¹)	Conversion Factor (kg ha ⁻¹ year ⁻¹ to keq ha ⁻¹ year ⁻¹)
NO _x as NO ₂	0.0015 (grassland) 0.003 (woodland)	96	0.0714

6.3 PREDICTED IMPACT OF EMISSIONS ON HABITAT SITES

6.3.1 Airborne Concentrations of NO_x

Predicted concentrations of NO_x at the habitat sites are presented in *Table 6.6* and compared to the relevant critical levels.

For NO_x, predicted annual mean concentrations at the Bell's Copse and Forest of Bere ancient woodlands are high given the close proximity of these habitat sites to the proposed PPGP facility location. However, the predicted concentration at all ancient woodlands is less than 100% of the critical level. For the European sites, predicted annual mean concentrations are less than 1%

13 AQTAG06 – Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, Environment Agency, produced (March 2014)

of the critical level for all sites. Therefore, it is concluded that the likely impact of emissions on all habitats would be 'not significant'.

TABLE 6.6 PREDICTED AIRBORNE NO_x CONCENTRATIONS AT HABITAT SITES

Habitat	Annual Mean PC NO _x (µg m ⁻³)	Annual Mean PC as %age of Critical Level	24 Hour Mean PC NO _x (µg m ⁻³)	24 Hour Mean PC as %age of Critical Level
AW1	0.19	0.6%	2.81	3.7%
AW2	0.53	1.8%	7.80	10.4%
AW3	0.26	0.9%	4.39	5.9%
AW4	0.20	0.7%	2.15	2.9%
AW5	0.58	1.9%	5.32	7.1%
AW6	0.09	0.3%	0.93	1.2%
Bell's Copse AW	3.66	12.2%	52.65	70.2%
Forest of Bere AW	11.70	39.0%	65.78	87.7%
Portsmouth Harbour Ramsar/SPA	0.03	0.1%	0.35	0.5%
Chichester Langstone Harbour Ramsar/SPA	0.02	0.1%	0.43	0.6%
Solent Maritime SAC	0.02	0.1%	0.43	1.4%
Solent & Isle of Wight Lagoons SAC	0.02	0.1%	0.31	0.4%
Butser Hill SAC	0.01	0.0%	0.09	0.1%
<i>Critical Level</i>	<i>30</i>	<i>30</i>	<i>75</i>	<i>75</i>

For the 24-hour mean, impacts on all ancient woodlands are assessed as 'not significant' as the PC is less than 100% of the critical level. Similarly, at the European sites predicted concentrations are less than 10% of the critical level and would also be assessed as 'not significant'.

6.3.2 Impact on Local Wildlife Sites

The impact of emissions on local wildlife sites (LWS) has not been assessed specifically. In accordance with Environment Agency guidance, impacts are assessed as significant where the predicted impact is greater than 100% of the critical level or critical load. Contour plots of annual mean and 24-hour mean NO_x are presented in *Figures 6.1* and *6.2*, respectively.

The site is located within a Site of Importance for Nature Conservation (SINC) referred to by Hampshire Council as Blendworth Common. The contour plots demonstrate that predicted concentrations do not exceed the annual mean critical level of 30 µg m⁻³ or the 24-hour mean critical level of 75 µg m⁻³ at any location within the model domain.

FIGURE 6.1 **PREDICTED ANNUAL MEAN NO_x CONCENTRATIONS (µg m⁻³)**

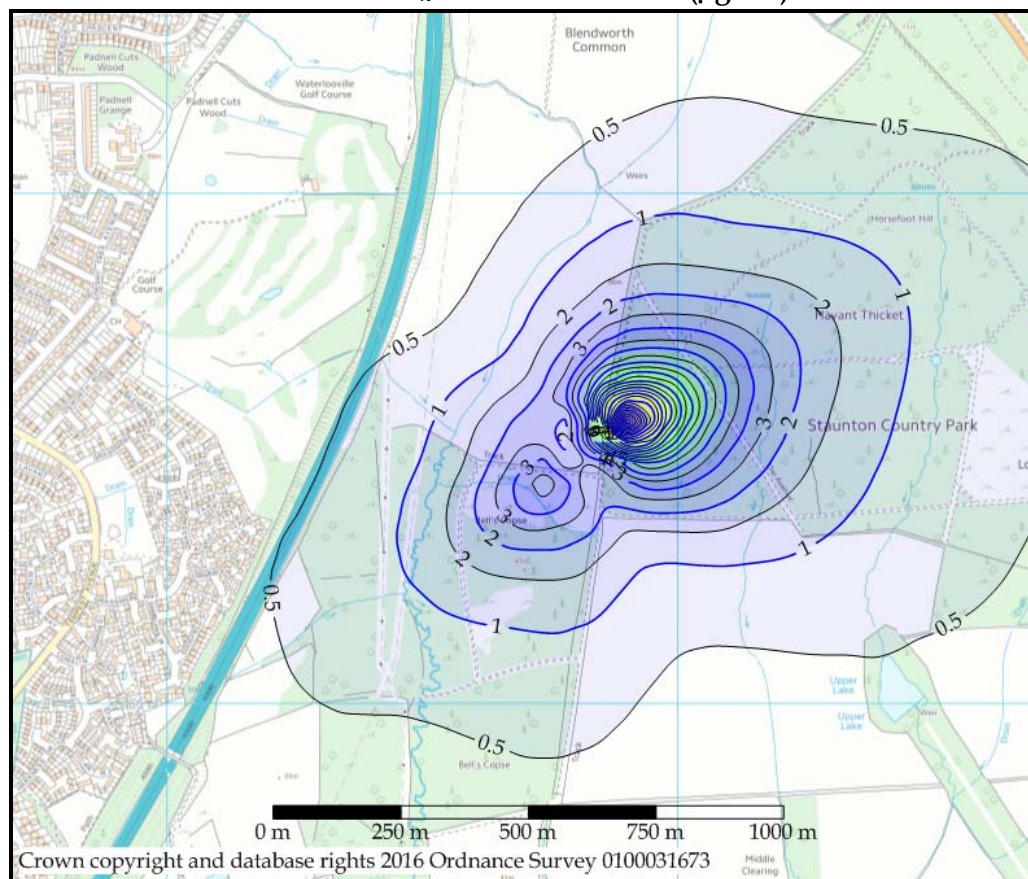
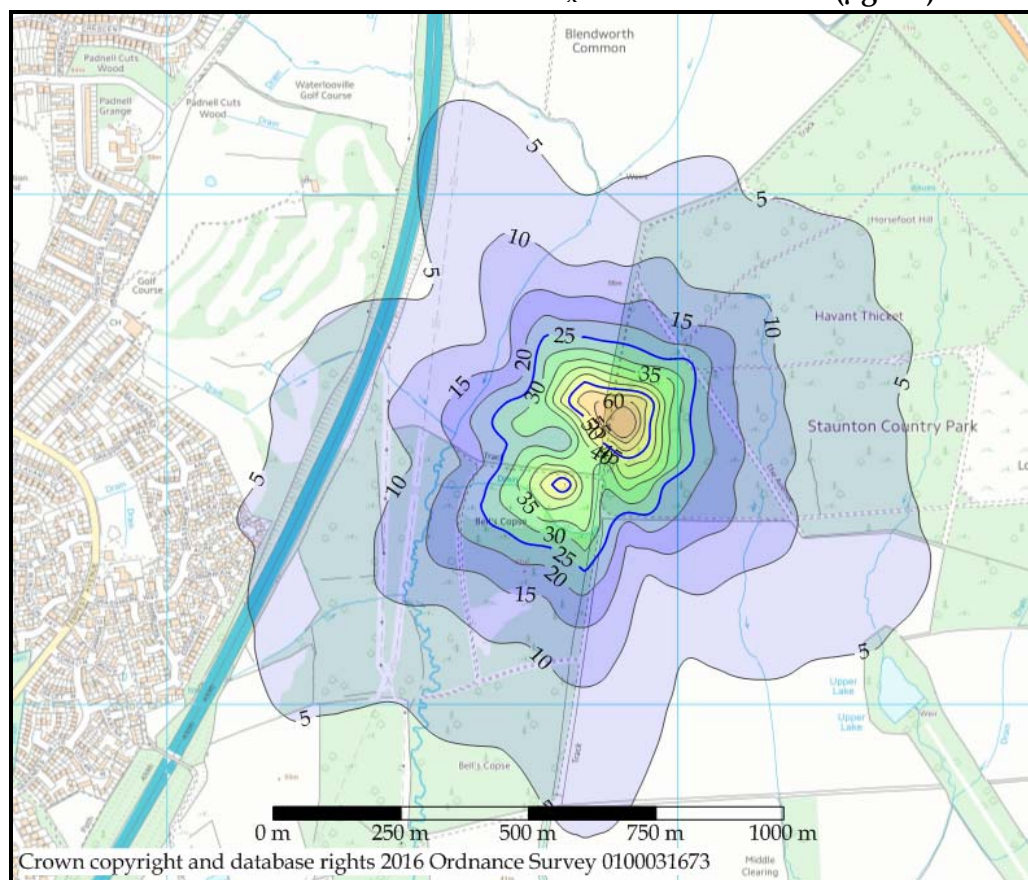


FIGURE 6.2 **PREDICTED MAXIMUM 24-HOUR MEAN NO_x CONCENTRATIONS (µg m⁻³)**



Highest concentrations are predicted over the Forest of Bere ancient woodland as discussed in *Section 6.3.1*. For the SINC predicted concentrations are lower and less than 100% of the relevant critical levels.

6.3.3 Nutrient Nitrogen Deposition

Deposition of nitrogen compounds causes eutrophication and has been taken into account in assessing the acidification impacts of the PPGP facility on the SSSI. A summary of the predicted PC and PEC is provided in *Table 6.8* along with the predicted exceedence and deposition as a proportion of the critical load.

TABLE 6.8 MAXIMUM PREDICTED PCs AND PECs FOR NUTRIENT NITROGEN DEPOSITION

Habitat	PC N (kgN ha ⁻¹ a ⁻¹)	PC %age of Critical Load	PEC N (kgN ha ⁻¹ a ⁻¹)	PEC %age of Critical Load
Portsmouth Harbour Ramsar/SPA	<0.01	<0.1%	13.56	68%
Chichester Langstone Harbour Ramsar/SPA	<0.01	<0.1%	11.29	141%
Solent Maritime SAC	<0.01	<0.1%	11.32	142%
Solent & Isle of Wight Lagoons SAC	<0.01	<0.1%	10.03	50%
Butser Hill SAC	<0.01	<0.1%	29.75	595%

For all habitats, the PC represents less than 0.1% of the relevant site-specific critical loads and it is concluded that the PPGP facility would not have a significant impact on the habitat sites. The PEC exceeds the relevant critical loads at some sites due to elevated background nutrient nitrogen deposition.

6.3.4 Acidification

Deposition of nitrogen compounds causes acidification and has been taken into account in assessing the acidification impacts of the PPGP facility on the SSSI. The predicted acidification rate for the habitat sites is presented in *Table 6.9*.

TABLE 6.9 **MAXIMUM PREDICTED ACIDIFICATION DEPOSITION AT HABITAT SITES**

Habitat	PC (keq ha ⁻¹ a ⁻¹)	PC %age of Critical Load	PEC (keq ha ⁻¹ a ⁻¹)	PEC %age of Critical Load
Chichester Langstone Harbour Ramsar/SPA	<0.01	<0.01 %	0.81	18%
Solent Maritime SAC	<0.01	<0.01 %	0.81	17%
Butser Hill SAC	<0.01	<0.01 %	2.13	19%

At the three habitat sites sensitive to acidification impacts, the PC represents <0.01% of the relevant critical load. Therefore, it is concluded that the impact of the PPGP facility emissions on these habitats would be not significant.

7.1 SUMMARY

An air quality assessment for the proposed PPGP facility has been carried out to support the planning application for the proposed site activities. The assessment has considered both construction and operational impacts. The PPGP facility is designed to generate a total of 20 MWe and would operate for up to 2,000 hours per year. It should be noted that this assessment was based on 24 MWe capacity and represents a worst-case assessment of impacts.

The impact of construction activities has been carried out in accordance with guidance provided by the Institute of Air Quality Management (IAQM).

The assessment of operational impacts has focussed on emissions from the PPGP facility and emissions of the oxides of nitrogen (NO_x) and carbon monoxide (CO). The impact of emissions on human health and habitats has been assessed. The air quality assessment has been carried out in accordance with guidance produced by the Institute of Air Quality Management (IAQM) for planning.

Where there is relevant long-term public exposure (e.g. residential properties), the predicted long-term impact of nitrogen dioxide (NO₂) emissions on sensitive receptors would be described as 'negligible' in accordance with the IAQM criteria.

For typical operating conditions, predicted short-term concentrations of NO₂ at residential receptors would be described as 'negligible' and predicted environmental concentrations (PPGP facility contribution plus background) are well below the air quality objective. For transient footpath receptors, the impact would be described as 'large' but frequent and prolonged exposure is very unlikely for these receptors.

Predicted maximum 8-hour concentrations of CO arising from the PPGP facility are less than 10% of the air quality objective at sensitive receptors and in accordance with the IAQM planning guidance would be assessed as 'negligible'.

The assessment has also considered the impact of the PPGP facility on sensitive habitat sites and in particular ancient woodland within 2 km and European sites within 10 km. The assessment has considered airborne concentrations of NO_x for the ancient woodland. The potential impact of airborne NO_x emissions on local wildlife sites (LWS) has also been considered.

For NO_x, predicted annual mean and 24-hour mean concentrations at the ancient woodlands were less than 100% of the critical levels and there is no

predicted exceedance of the critical levels at the habitat sites. Predicted concentrations at the European sites were less than 1% of the critical level. The PPGP site is located within the Blendworth Common SINC. However, predicted concentrations throughout the model domain were less than the annual mean critical level for NO_x of 30 µg m⁻³ and the 24-hour mean critical level of 75 µg m⁻³. Therefore, the impact on the SINC is considered to be 'not significant'.

For acidification and nutrient nitrogen deposition at the European sites, the contribution of the PPGP facility is less than 1% of the relevant critical loads and these impacts would be assessed as 'not significant'.

7.2

CONCLUSIONS

Therefore, based on the quantitative assessment carried out, it is concluded that the impact of the PPGP facility on human health and sensitive habitat sites would be not significant. Therefore, it is considered that there are no constraints to the development as proposed.



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