5 Air Quality

5.1 Introduction

5.1.1 This Chapter assesses the likely significant air quality effects resulting from the K3 and WKN Proposed Developments.

5.2 Regulatory and Policy Framework

5.2.1 There are three main aspects to the regulatory framework affecting potentially-polluting developments; the planning process determines whether and where the development can be located; building regulations control the design and construction of developments; and once built, regulation of pollution from the operation of certain prescribed processes is by the Environmental Permitting Regulations or by nuisance provisions for premises not operating prescribed processes. The relevant parts of the framework of pollution regulation, planning policy and relevant guidance are summarised below.

Industrial Emissions Directive Limits

5.2.2 K3 and the WKN Proposed Development has been/will be designed and operated in accordance with the requirements of the Industrial Emissions Directive (2010/75/EU) [Ref 5.1], known hereafter as the IED, which requires adherence to emission limits for a range of pollutants.

5.2.3 Emission limits in the IED are specified in the form of half-hourly mean concentrations; daily-mean concentrations; mean concentrations over a period of between 30 minutes and 8 hours; or, for dioxins and furans, mean concentrations evaluated over a period of between 6 and 8 hours.

5.2.4 For the purposes of this assessment for those pollutants having only one emission limit (for a single averaging period), the K3 and WKN Proposed Developments have been assumed to operate at that limit. Where more than one limit exists for a pollutant, the half-hourly mean emission concentration limit has been used to calculate short-term (less than 24-hour average) peak ground-level concentrations (Scenario 1). The daily mean emission concentration limit has been used for these pollutants to calculate long-term (greater than 24-hour average) mean ground-level concentrations (Scenario 2). The IED emission limit values are provided in Table 5.1.

Pollutant	Scenario 1 Short-Term Emission Limits ($mg.Nm^{-3}$)	Scenario 2 Daily-Mean Emission Limits ($mg.Nm^{-3}$)
Particles	30	10
Hydrogen chloride (HCl)	60	10
Hydrogen fluoride (HF)	4	1
Sulphur dioxide (SO_2)	200	50
Nitrogen oxides (NO_x)	400	200
Carbon monoxide (CO)	-	50
Group 1 metals [a]	-	0.05 [d]
Group 2 metals [b]	-	0.05 [d]
Group 3 metals [c]	-	0.5 [d]
Dioxins and furans	-	0.0000001 [e]

Table 5.1: Relevant Industrial Emission Directive Limit Values

5.2.5 The following notes accompany Table 5.1:

- All concentrations referenced to temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas.
- (a) Cadmium (Cd) and thallium (Tl).
- (b) Mercury (Hg).
- (c) Antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), and vanadium (V).
- (d) All average values over a sample period of a minimum of 30 minutes and a maximum of 8 hours.
- (e) Average values over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence (TEQ).

5.2.6 Ammonia (NH_3), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) are not specifically regulated under the IED. For the purposes of this assessment, the emission concentrations in Table 5.2 have been used for these pollutants to calculate long-term (greater than 24-hour average) mean ground-level concentrations (Scenario 2).

Pollutant	Scenario 2 Emission Concentrations ($mg.Nm^{-3}$)
NH_3	5
PCBs	0.005
PAHs (as B[a]P equivalent)	0.001

Table 5.2 Modelled Emission Concentrations for non-IED Regulated Pollutants

5.2.7 The following notes accompany Table 5.2:

- All concentrations referenced to temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas.
- Emission limits obtained from the IPPC Reference Document on the Best Available Techniques for Waste Incineration (August 2006)

Waste Framework Directive

5.2.8 Directive 2008/98/EC of the European Parliament and Council on Waste requires member states to ensure that waste is recovered or disposed of without harm to human health and the environment. It requires member states to impose certain obligations on all those dealing with waste at various stages. Operators of waste disposal and recovery facilities are required to obtain a permit or register a permit exemption. Retention of the permit requires periodic inspections and documented evidence of the activities in respect of waste.

5.2.9 The Waste Framework Directive (WFD) requires member states to take appropriate measures to establish an integrated and adequate network of disposal installations. The WFD also promotes environmental protection by optimising the use of resources, promoting the recovery of waste over its disposal (the "waste hierarchy").

5.2.10 Annex I and II of the WFD provide lists of the operations which are deemed to be "disposal" and "recovery", respectively. The terms are mutually exclusive, and an operation cannot be a disposal and recovery operation simultaneously. Where the operation is deemed to be a disposal operation, the permit will contain more extensive conditions than for a recovery operation.

5.2.11 The principal objective of a recovery operation is to ensure that the waste serves a useful purpose, replacing other substances which would have been used for that purpose. Where the combustion of waste is used to provide a source of energy, the operation is deemed to be a recovery operation.

5.2.12 The proposed development is deemed to be a recovery operation on the basis that the operation falls under the description of the first operation listed under Annex II:

"R 1 Use principally as a fuel or other means to generate energy"

5.2.13 The Environmental Permitting Regulations 2018 (EPR) [Ref 5.2] implement the WFD in the UK. As such, the EA is responsible for implementing the obligations set out in the WFD.

Ambient Air Quality Criteria

5.2.14 There are several EU Air Quality Directives and UK Air Quality Regulations [Ref 5.3] that will apply to the operation of the K3 and WKN Proposed Developments. These provide a series of statutory air quality limit values, target values and objectives for pollutants, emissions of which are regulated through the IED.

5.2.15 There are some pollutants whose emission levels are regulated by the IED but which do not have statutory ambient air quality standards prescribed under current legislation. For these pollutants, a number of non-statutory ambient air quality objectives and guidelines exist which have been applied within this assessment. The EA provides further assessment criteria in its online guidance.

Air Quality Directive and Air Quality Standards Regulations

5.2.16 The 2008 Ambient Air Quality Directive (2008/50/EC) [Ref 5.4] aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants; it sets legally binding concentration-based limit values, as well as target values. There are also information and alert thresholds for reporting purposes. These are to be achieved for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. This Directive replaced most of the previous EU air quality legislation and in England was transposed into domestic law by the Air Quality Standards (England) Regulations 2010 [Ref 5.3], which in addition incorporates the 4th Air Quality Daughter Directive (2004/107/EC) that sets targets for ambient air concentrations of certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs). Member states must comply with the limit values (which are legally binding on the Secretary of State) and the Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values. The statutory ambient limit values are listed in Table 5.3.

Pollutant	Averaging Period	Limit Values	Not to be Exceeded More Than
Nitrogen Dioxide (NO_2)	1 hour	200 $\mu g.m^{-3}$	18 times pcy
	Annual	40 $\mu g.m^{-3}$	-
Particulate Matter (PM_{10})	24 hour	50 $\mu g.m^{-3}$	35 times pcy
	Annual	40 $\mu g.m^{-3}$	-
Particulate Matter ($PM_{2.5}$)	Annual	25 $\mu g.m^{-3}$	-
Carbon Monoxide	Maximum daily running 8 hour mean	10,000 $\mu g.m^{-3}$	-
Sulphur Dioxide (SO_2)	15 minute	266 $\mu g.m^{-3}$	> 35 times pcy
	1 hour	350 $\mu g.m^{-3}$	> 24 times pcy
	24 hour	125 $\mu g.m^{-3}$	> 3 times pcy
Lead	Annual	0.25 $\mu g.m^{-3}$	-
Arsenic (As)	Annual	0.006 $\mu g.m^{-3}$	-
Cadmium (Cd)	Annual	0.005 $\mu g.m^{-3}$	-
Nickel (Ni)	Annual	0.02 $\mu g.m^{-3}$	-

Table 5.3 Statutory Air Quality Limit Values

Non-Statutory Air Quality Objectives and Guidelines

5.2.17 The Environment Act 1995 established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and has been revised several times since, with the latest published in 2007 [Ref 5.5]. The Strategy sets UK air quality standards and objectives for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the EU Directives.

5.2.18 The 1995 Environment Act also established the UK system of Local Air Quality Management (LAQM), that requires local authorities to go through a process of review and assessment of air quality in their areas, identifying places where objectives are not likely to be met, then declaring Air Quality Management Areas (AQMAs) and putting in place Air Quality Action Plans to improve air quality. These plans also contribute, at local level, to the achievement of EU limit values.

5.2.19 Non-statutory ambient air quality objectives and guidelines also exist within the World Health Organisation Guidelines [Ref 5.6] and the Expert Panel on Air Quality Standards Guidelines (EPAQS) [Ref 5.7]. The non-statutory ambient objectives and guidelines are presented in Table 5.4.

Pollutant	Averaging Period	Guideline
Particulate Matter ($PM_{2.5}$)	Annual	Target of 15% reduction in concentrations at urban background locations
	Annual	25 $\mu g.m^{-3}$
PAHs (as B[a]P equivalent)	Annual (a)	0.00025 $\mu g.m^{-3}$
Sulphur Dioxide (SO_2)	Annual (b)	50 $\mu g.m^{-3}$
Hydrogen Chloride	1 hour (c)	750 $\mu g.m^{-3}$
Hydrogen Fluoride	1 hour (c)	160 $\mu g.m^{-3}$

Table 5.4: Non-Statutory Air Quality Objectives and Guidelines

5.2.20 The following notes accompany Table 5.4:

- (a) Target date set in UK Air Quality Strategy 2007
- (b) World Health Organisation Guidelines
- (c) EPAQS recommended guideline values

Environmental Assessment Levels

5.2.21 The EA online guidance entitled *'Environmental management – guidance, Air emissions risk assessment for your environmental permit'* [Ref 5.8] provides further assessment criteria in the form of Environmental Assessment Levels (EALs).

5.2.22 Table 5.5 presents all available EALs for ambient concentrations of the pollutants relevant to this assessment.

Pollutant	Long-term EAL, µg.m^{-3}	Short-term EAL, µg.m^{-3}
Nitrogen dioxide (NO_2)	40 (a)	200
Carbon monoxide (CO)	-	10,000
Sulphur dioxide (SO_2)	50	267
Particulates (PM_{10})	40 (a)	50
Particulates ($PM_{2.5}$)	25	-
Hydrogen chloride (HCl)	-	750
Hydrogen fluoride (HF)	16 (monthly average)	160
Arsenic (As)	0.003	-
Antimony (Sb)	5	150
Cadmium (Cd)	0.005	-
Chromium (Cr)	5	150
Chromium VI (oxidation state in the PM_{10} fraction)	0.0002	-
Cobalt (Co)	0.2 (a)	6 (a)
Copper (Cu)	10	200
Lead (Pb)	0.25	-
Manganese (Mn)	0.15	1500
Mercury (Hg)	0.25	7.5
Nickel (Ni)	0.02	-
Thallium (Tl)	1 (a)	30 (a)
Vanadium (V)	5	1
PAHs (as B[a]P equivalent)	0.00025	-
Ammonia	5	-

Table 5.5: Environmental Assessment Levels (EALs)

5.2.23 In Table 5.5, (a) refers to EALs obtained from the EA's earlier Horizontal Guidance Note EPR H1 guidance note [Ref 5.9], as no levels are provided in the current guidance.

5.2.24 Within the assessment, the statutory ambient air quality limit and target values (as presented in Table 5.3) are assumed to take precedent over objectives, guidelines and the EALs. In addition, for those pollutants which do not have any statutory air quality standards, the assessment assumes the lower of either the EAL or the non-statutory air quality objective or guideline where they exist.

Environmental Protection Legislation

Environmental Permitting

5.2.25 Certain industrial installations are regulated under the Environmental Permitting Regulations (England and Wales) (Amendment) Regulations 2018, which implement the EU Directive 2008/1/EC concerning Integrated Pollution Prevention and Control ("the IPPC Directive"). The EPR define activities that require the operator to obtain an Environmental Permit from the EA.

5.2.26 EPR is a regulatory system to control the environmental and health impacts across all environmental media (using an integrated approach) of certain listed industrial activities, via a single permitting process. To gain a permit, operators have to demonstrate in their applications, in a systematic way, that the techniques they are using or are proposing to use for their installation are the Best Available Techniques (BAT) to prevent or minimise the effects of the activity on air, land and water taking account of relevant local factors. The permitting process also places a duty on the regulating body to ensure that the requirements of the IPPC Directive are included for permitted sites to which these apply.

5.2.27 It is a mandatory requirement of EPR that the Agency ensures that no single industrial installation regulated is the sole cause of a breach of a UK air quality objective. Additionally, the Agency has committed to guarantee that no installation will contribute significantly to a breach of a UK air quality objective.

5.2.28 To do this the Agency will ensure that BAT is used to deliver the maximum improvements to air quality where UK air quality objectives are in danger of being breached.

5.2.29 Section 5.2 of the Overarching National Policy Statement for Energy (EN-1) Air quality and emissions sets out the potential impacts associated with infrastructure development, what should be included in an ES and the role of the IPC in decision making and mitigation. It states *"The ES should describe:*

- *any significant air emissions, their mitigation and any residual effects distinguishing between the project stages and taking account of any significant emissions from any road traffic generated by the project;*
- *the predicted absolute emission levels of the proposed project, after mitigation methods have been applied;*
- *existing air quality levels and the relative change in air quality from existing levels; and*
- *any potential eutrophication impacts."*

Planning Policies

National Policy Statements (NPS)

5.2.30 Section 5.2 of the Overarching National Policy Statement for Energy (EN-1) *Air quality and emissions* sets out the potential impacts associated with infrastructure development, what should be included in an ES and the role of the IPC in decision making and mitigation. It states "*The ES should describe:*

- *any significant air emissions, their mitigation and any residual effects distinguishing between the project stages and taking account of any significant emissions from any road traffic generated by the project;*
- *the predicted absolute emission levels of the proposed project, after mitigation methods have been applied;*
- *existing air quality levels and the relative change in air quality from existing levels; and*
- *any potential eutrophication impacts."*

National Planning Policy Framework (NPPF)

5.2.31 The NPPF sets out three overarching objectives to achieve sustainable development. The relevant objective in the context of this air quality assessment is:

*"**an environmental objective** – 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 adapting to climate change, including moving to a low carbon economy*" (Paragraph 8c)

5.2.32 Under the heading 'Promoting sustainable transport', the NPPF states:

"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making." (Paragraph 103)

5.2.33 Under the heading 'Conserving and enhancing the natural environment', the NPPF states:

Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) 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, taking into account relevant information such as river basin management plans; …" (Paragraph 170)

"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." (Paragraph 181)

<u>National Planning Practice Guidance (NPPG)</u>

5.2.34 The NPPG was issued on-line in March 2014 and is updated periodically by government as a live document. The Air Quality section of the NPPG describes the circumstances when air quality, odour and dust can be a planning concern, requiring assessment.

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

5.2.36 The NPPG states that when deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

- *"Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.*

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area;*

- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*

- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*

- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

5.2.37 The NPPG provides advice on how air quality impacts can be mitigated and notes "Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation to ensure the new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met."

Swale Borough Council's Development Plan

5.2.38 The Bearing Fruits 2031: The Swale Borough Local Plan was formally adopted by the council on 26 July 2017. In relation to air quality, the plan states that "Transport and industry are the Borough's main air pollution emitters". It refers to the need for assessment where developments could have an impact on air quality levels within the AQMAs.

5.2.39 There are no specific policies in the plan guiding industrial development in relation to air quality impacts; the policies generally focus on managing and controlling the impacts of development arising from traffic emissions. In particular, in relation to managing traffic impacts, policy DM6 states that air quality management and environmental quality should be integrated "into the location and design of, and access to, development and, in so doing, demonstrate that proposals do not worsen air quality to an unacceptable degree especially taking into account the cumulative impact of development schemes within or likely to impact on Air Quality Management Areas".

5.2.40 In the case, the key pollutants from the development are oxides of nitrogen which are also a key concern for traffic emissions. While policy DM6 is not strictly relevant to this development, the assessment has regard for the cumulative impact of the development on the surrounding area including the designated AQMAs.

5.3 Methodology

Scoping and Consultation

5.3.1 The formal scoping exercise is summarised in Chapter 3.

5.3.2 Neither the NPPF, the NPS nor the NPPG is prescriptive on the methodology for assessing air quality effects or describing significance; practitioners use guidance provided by Defra and non-governmental organisations, including Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM). However, the NPPG does advise that:

> *"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific. The scope and content of supporting information is therefore best discussed and agreed between the local planning authority and applicant before it is commissioned."*

5.3.3 It lists a number of areas that might be usefully agreed at the outset.

5.3.4 This air quality assessment covers the elements recommended in the NPPG. The approach is consistent with the EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document [Ref 5.10], the IAQM Guidance on the assessment of dust from demolition and construction [Ref 5.11] and, where relevant, Defra's Local Air Quality Management Technical Guidance: LAQM.TG16 [Ref 5.12]. It includes the key elements listed below:

- *Establishing the background Ambient Concentration (AC).*
- *Qualitative assessment of likely construction-phase impacts with mitigation and controls in place.*
- *Quantitative assessment of the effects from the completed development on local air quality from stack emissions utilising a "new generation" Gaussian dispersion model, ADMS 5. The assessment has considered both the Process Contributions (PC) from the facility in isolation, and the resultant Predicted Environmental Concentrations (PEC) that includes the AC.*

5.3.5 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team members involved at various stages of this assessment have professional affiliations that include Fellow and Member of the Institute of Air Quality Management, Chartered Chemist, Chartered Scientist, Chartered Environmentalist and Member of the Royal Society of Chemistry and have the required academic qualifications for these professional bodies. In addition, the Director responsible for authorising all deliverables has over 20 years' experience.

Establishing Baseline Conditions

5.3.6 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sections.

5.3.7 The atmospheric pollutant concentrations depend not only on local sources, but also on regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources.

5.3.8 Where it has been necessary to consider background pollution levels, these have been derived from consideration of Air Quality Review & Assessment findings and assessment of existing local air quality through a review of available air quality monitoring and Defra background map data in the vicinity of the K3/WKN Sites.

Assessment of Effects

5.3.9 This assessment covers the WKN and K3 Proposed Developments including all works (No 1-7) set out in Chapter 2.

Construction Phase

5.3.10 Dust is the generic term used to describe particulate matter in the size range 1-75 μm in diameter [Ref 5.12]. Particles greater than 75 μm in diameter are termed grit rather than dust. Dusts can contain a wide range of particles of different sizes. The normal fate of suspended (i.e. airborne) dust is deposition. The rate of deposition depends largely on the size of the particle and its density; together these influence the aerodynamic and gravitational effects that determine the distance it travels and how long it stays suspended in the air before it settles out onto a surface. In addition, some particles may agglomerate to become fewer, larger particles; whilst others react chemically.

5.3.11 The effects of dust are linked to particle size and two main categories are usually considered:

5.3.12 PM10 particles, those up to 10 μm in diameter, remain suspended in the air for long periods and are small enough to be breathed in and so can potentially impact on health; and

5.3.13 Dust, generally considered to be particles larger than 10 μm which fall out of the air quite quickly and can soil surfaces (e.g. a car, window sill, laundry). Additionally, dust can potentially have adverse effects on vegetation and fauna at sensitive habitat sites.

5.3.14 The IAQM Guidance on the assessment of dust from demolition and construction [Ref 5.11] sets out 350 m as the distance from the site boundary and 50 m from the site traffic route(s) up to 500 m of the entrance, within which there could potentially be nuisance dust and PM_{10} effects on human receptors. For sensitive ecological receptors, the corresponding distances are 50 m in both cases. (In this particular application, there are no ecological receptors within the distances and ecological effects have been scoped out). These distances are set to be deliberately conservative. These distances are set to be deliberately conservative.

5.3.15 Concentration-based limit values and objectives have been set for the PM_{10} suspended particle fraction, but no statutory or official numerical air quality criterion for dust annoyance has been set at a UK, European or World Health Organisation (WHO) level. Construction dust assessments have tended to be risk based, focusing on the appropriate measures to be used to keep dust impacts at an acceptable level.

5.3.16 The IAQM dust guidance aims to estimate the impacts of both PM_{10} and dust through a risk-based assessment procedure. The IAQM dust guidance document states: *"The impacts depend on the mitigation measures adopted. Therefore, the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified."*

5.3.17 The IAQM dust guidance provides a methodological framework but notes that professional judgement is required to assess effects: "This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also, a wide range of factors affect the amount of dust that may arise, and these are not readily quantified."

5.3.18 Consistent with the recommendations in the IAQM dust guidance, a risk-based assessment has been undertaken for the development, using the well-established source-pathway-receptor approach:

5.3.19 The dust impact (the change in dust levels attributable to the development activity) at a particular receptor will depend on the magnitude of the dust source and the effectiveness of the pathway (i.e. the route through the air) from source to receptor.

5.3.20 The effects of the dust are the results of these changes in dust levels on the exposed receptors, for example annoyance or adverse health effects. The effect experienced for a given exposure depends on the sensitivity of the particular receptor to dust. An assessment of the overall dust effect for the area as a whole has been made using professional judgement taking into account both the change in dust levels (as indicated by the Dust Impact Risk for individual receptors) and the absolute dust levels, together with the sensitivities of local receptors and other relevant factors for the area.

5.3.21 The detail of the dust assessment methodology is provided in Appendix 5.1.

5.3.22 The assessment methodology does not consider the air quality impacts of dust from any contaminated land or buildings; the issue of contamination is dealt with in Chapter 9: Ground Conditions.

Decommissioning Phase

5.3.23 The risk of dust impacts during the decommissioning phase, including demolition, will be the same or similar to the risk of impacts during the construction phase. A Demolition Construction Management Plan will be produced prior to decommissioning.

5.3.24 Decommissioning-related traffic is expected to be lower than the construction phase and the impacts of decommissioning-vehicle exhaust emissions have not been assessed specifically. The impact of construction-vehicle exhaust emissions is considered to be negligible and therefore the impacts of decommissioning-vehicle exhaust emissions is also considered to be negligible.

Operation of the K3 and WKN Proposed Developments

Summary of Key Pollutants Considered

5.3.25 The following effects have been assessed in this Chapter.

- Residual emissions from the flue gas treatment system and their effects on human health and ecological receptors
- Fugitive emissions of dust, odour and bio-aerosols during the operational phase
- Emissions from vehicle movements generated by the operation of the developments.

5.3.26 The assessment methodology for the stack emissions are described in the following sections. The assessment methodology for vehicle emissions is described in Appendix 5.5.

Dispersion Model Selection

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

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

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

- A number of complex modules including the effects of plume rise, complex terrain, coastlines, concentration fluctuations and buildings; and

- A facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes and radioactivity, and percentiles of hourly mean concentrations, from either statistical meteorological data or hourly average data.

Meteorological Data

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

- Wind direction determines the sector of the compass into which the plume is dispersed;

- Wind speed affects the distance that the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise; and

- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

5.3.30 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.

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

5.3.32 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 5.1.

Surface Roughness

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

5.3.34 A surface roughness length of 0.5 m has been used within the model to represent the average surface characteristics across the study area.

Terrain

5.3.35 A complex terrain file has been included within the model to ensure that the relative height between receptors and the source of emissions is taken into account.

Building Wake Effects

5.3.36 The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. Where building heights are greater than about 30 - 40% of the stack height, downwash effects can be significant. Chapter 2 provides a site layout plan. The buildings associated with the Proposed Development that have been included within the modelling are provided in Table 5.6. The predictions presented in this report therefore include building wake effects.

5.3.37 The exact locations of the stack and building dimensions for WKN are not fixed; however, where possible, worse case assumptions have been made. For example, the dimensions presented in Table 5.6 include a +10% buffer. If the buildings are smaller than this then the predicted concentrations are likely to be lower. The assessment therefore presents the worst case in terms of building wake effects.

5.3.38 There is potential for the location of all buildings for WKN to vary by 5 m. Downwash effects caused by buildings near the stack can affect ground level concentrations. Low pressure on the leeward side of buildings can bring the plume to the ground closer than would be the case for no building. The impact of a change in building locations will be a change in the location of the maximum impact over the short-term, rather than a significant change in the magnitude of the maximum prediction. Similarly, slight variations in the stack locations are more likely to affect the location of maximum impact rather than the magnitude. On that basis movement of the buildings by up to 5m is not expected to be significant.

	Building Name	Approx. location of centre (x,y)	Length (m)	Width (m)	Height (m)
K3 Proposed Development	Air Cooled Condenser	592098, 166589	29	80	27
	Turbine Hall	592150, 166634	40	27	23
	Flue Gas Treatment	592166, 166599	16	44	23
	Flue Gas Treatment	592181, 166615	24	43	31
	Boiler Hall	592192, 166639	30	61	50
	Bunker Hall	592223, 166662	40	72	36
	Tipping Hall	592253, 166692	46	51	21
	Bottom Ash Hall	592193, 166697	16	32	21
WKN Proposed Development	FGT	592066, 166715	45	35	44
	Substation	592043, 166665	45	30	15
	ACC	592076, 166680	45	30	40
	Stores next to Pond	592234, 166775	40	35	15
	Admin	592172, 166715	30	15	30
	Turbine	592145, 166706	40	25	30
	Stores next to Turbine	592123, 166702	20	10	15
	Boiler	592118, 166727	50	36	58
	Bunker	592155, 166737	35	36	44
	Tipping Hall	592192, 166745	45	36	30

Table 5.6 Buildings Included Within the Model

Stack Parameters and Emissions Rates Used in Model

5.3.39 Stack and emissions characteristics modelled are provided in Table 5.7. For the purposes of modelling, it has been assumed that pollutant emission concentrations are at the limit set in the IED. As this is the maximum concentration that could be permitted, this is a worst-case assumption. The locations of the stacks are shown in Figure 5.2.

Parameter	Unit	K3 as consented	K3 Proposed Development	WKN Proposed Development
Grid coordinates	x,y	592135, 166569	592135, 166569	592043, 166710
Stack height	m	90	90	90
Internal diameter	m	3.25	3.25	4.0
Efflux velocity	$m.s^{-1}$	19.06	22.81	15.3
Efflux temperature	^oC	140	140	130
Actual Volumetric flow	$m^3.s^{-1}$	158.42	189.2	192.3

Parameter	Unit	K3 as consented		K3 Proposed Development		WKN Proposed Development	
O_2	%	8.1		8.1		8	
Water	%	17.8		17.8		19	
Normalised Volumetric Flow (0°C, dry, 11% O_2)	$Nm^3.s^{-1}$	110.98		132.9		137.5	
Pollutants		**Short**	**Long**	**Short**	**Long**	**Short**	**Long**
Particles	$g.s^{-1}$	3.33	1.11	3.99	1.33	4.12	1.37
HCl	$g.s^{-1}$	6.66	1.11	7.98	1.33	8.25	1.37
HF	$g.s^{-1}$	0.44	0.11	0.53	0.13	0.55	0.14
SO_2	$g.s^{-1}$	22.20	5.55	26.59	6.65	27.49	6.87
NO_x	$g.s^{-1}$	44.39	22.20	53.18	26.59	54.99	27.49
CO	$g.s^{-1}$	11.10	5.55	13.29	6.65	13.75	6.87
Group 1 Metals Total (b)	$g.s^{-1}$	-	5.55E-03	-	6.65E-03	-	6.87E-03
Group 2 Metals (c)	$g.s^{-1}$	-	5.55E-03	-	6.65E-03	-	6.87E-03
Group 3 Metals Total (d)	$g.s^{-1}$	-	5.55E-02	-	6.65E-02	-	6.87E-02
Dioxins and furans	$g.s^{-1}$	-	1.11E-08	-	1.33E-08	-	1.37E-08
PCBs	$g.s^{-1}$	-	5.55E-04	-	6.65E-04	-	6.87E-04
PAHs – B[a]P	$g.s^{-1}$	-	1.11E-04	-	1.33E-04	-	1.37E-04
NH_3	$g.s^{-1}$	-	5.55E-01	-	6.65E-01	-	6.87E-01

Table 5.7 Stack and Emissions Characteristics – Main Stacks

Modelled Scenarios

5.3.40 The K3 Proposed Development has been modelled and compared with the future baseline (i.e. K3 operating in accordance with its existing planning consent) to demonstrate the practical effect of the K3 Proposed Development.

5.3.41 For WKN, the model has been used to predict the PC for the following scenarios:

- WKN Proposed Development;
- WKN Proposed Development and K3 as consented; and
- WKN Proposed Development and K3 Proposed Development.

Stack Height Determination

5.3.42 There is a need to discharge the flue gases through an elevated stack to allow dispersion and dilution of the residual combustion emissions. The stack needs to be of sufficient height to ensure that pollutant concentrations are acceptable by the time they reach ground level. The stack also needs to be high enough to ensure that releases are not within the aerodynamic influence of nearby buildings, or else wake effects can quickly bring the undiluted plume down to the ground.

5.3.43 A stack height determination has been undertaken to identify the stack height required to overcome the wake effects of nearby buildings and to establish the height at which there is minimal additional environmental benefit associated with the cost of further increasing the stack. The EA removed its detailed guidance, Horizontal Guidance Note EPR H1 [Ref 5.9], for undertaking risk assessments on 1 February 2016; however, in the absence of any other guidance, the approach used here by RPS is consistent with that EA guidance which required the identification of "an option that gives acceptable environmental performance but balances costs and benefits of implementing it."

5.3.44 The stack height determination involved running a series of atmospheric dispersion modelling simulations to predict the ground-level concentrations with the stack at different heights. The results of the stack height determination for the WKN Proposed Development are provided in Appendix 5.2. For K3 a stack height determination was undertaken in the 2010 ES (see Document 3.3 submitted in support of the application).

NOx to NO_2 Assumptions for Annual-Mean Calculations

5.3.45 Total conversion (i.e. 100%) of NO to NO_2 is sometimes used for the estimation of the absolute upper limit of the annual mean NO_2. This technique is based on the assumption that all NO emitted is converted to NO_2 before it reaches ground level. However, in reality the conversion is an equilibrium reaction and even at ambient concentrations a proportion of NOx remains in the form of NO. Total conversion is, therefore, an unrealistic assumption, particularly in the near field [Ref 5.15]. While this approach is useful for screening assessments, it is not appropriate for detailed assessments.

5.3.46 Historically, the EA has recommended that for a 'worse case scenario', a 70% conversion of NO to NO_2 should be considered for calculation of annual average concentrations. If a breach of the annual average NO_2 objective/limit value occurs, the EA requires a more detailed assessment to be carried out with operators asked to justify the use of percentages lower than 70%.

5.3.47 Following the withdrawal of the EA's H1 guidance document, there is no longer an explicit recommendation; however, for the purposes of this detailed assessment, a 70% conversion of NO to NO_2 has been assumed for annual average NO_2 concentrations in line with the EA's historic recommendations.

NO_x to NO_2 Assumptions for Hourly-Mean Calculations

5.3.48 An assumed conversion of 35% follows the EA's recommendations [Ref 5.16] for the calculation of 'worse case' scenario short-term NO_2 concentrations.

Modelling of Long-term and Short-term Emissions

5.3.49 Long-term (annual-mean) NO_2 has been modelled for comparison with the relevant annual mean objectives.

5.3.50 For short-term NO_2, the objective is for the hourly-mean concentration not to exceed 200 $\mu g.m^{-3}$ more than 18 times per calendar year. As there are 8,760 hours in a non-leap year, the hourly-mean concentration would need to be below 200 $\mu g.m^{-3}$ in 8,742 hours, i.e. 99.79% of the time. Therefore, the 99.79th percentile of hourly NO_2 has been modelled.

Significance Criteria

Construction and Decommissioning Phase

5.3.51 Dust impact risk categories have been determined for demolition, earthworks, construction and trackout. These have been used to define the appropriate site-specific mitigation measures based on those described in the IAQM dust guidance. The guidance states that provided the mitigation measures are successfully implemented, the resultant effects of the dust exposure will normally be "not significant".

Completed Development

5.3.52 The on-line EA guidance for risk assessments [Ref 5.8] provides details for screening out substances for detailed assessment. In particular, it states that:

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

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

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

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

5.3.53 The PEC refers to the Predicted Environmental Concentration calculated as the PC added to the ambient concentration. The on-line EA guidance continues by stating that:

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

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

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

5.3.55 On that basis:

- *The impacts are not considered significant if the short-term PC is less than 10 % of the short-term Environmental Assessment Level (EAL);*
- *The impacts are not considered significant if the long-term PC is less than 1 % of the long-term EAL; or*
- *The impacts are not considered significant if the PEC is below the EAL.*

5.3.56 For the purposes of this assessment, impacts that are not considered significant are described as negligible.

Limitations and Assumptions

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

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

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

5.3.60 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 5.8.

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of current baseline air quality conditions	The background concentration used within the assessment is the most conservative value from a comparison of measured and Defra mapped concentration estimates.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the development does not proceed)	The future background concentration used in the assessment is the same as the current background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	the model should lead to a forecast concentration that is towards the top of the uncertainty range, rather than a central estimate.
Model Input/Output Data	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for 5 full years of meteorological conditions.	The modelled fraction is likely to contribute to the result being between a central estimate and the top of the uncertainty range.
	Receptors	The model has been run for a grid of receptors. In addition, receptor locations have been identified where concentrations are highest or where the greatest changes are expected.	

Table 5.8 Summary of Main Components of Uncertainty

5.3.61 The analysis of the component uncertainties indicates that, notwithstanding the limitations of the assessment, the predicted total concentration is likely to be conservative. The actual concentrations that will be found when the development is completed are unlikely to be higher than those presented within this report and are more likely to be lower.

5.4 Existing Baseline Conditions

5.4.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the background concentration selected for the assessment is realistic. The NPPG and EPUK & IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality. LAQM.TG16 [Ref 5.13] recommends that Defra mapped concentration estimates are used to inform background concentrations in air quality modelling and states that: *"Where appropriate these data can be supplemented by and compared with local measurements of background, although care should be exercised to ensure that the monitoring site is representative of background air quality".*

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

- Defra maps [Ref 5.14], which show estimated pollutant concentrations across the UK in 1 km grid squares; and
- Published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies.

5.4.3 A detailed description of how the baseline air quality has been derived for the key combustion related pollutants (NO_2 and PM_{10}) for the K3 and WKN Proposed Developments is summarised in the following paragraphs.

Review and Assessment Process

5.4.4 Swale Borough Council (SBC), has designated four areas as AQMAs due to high levels of NO_2 attributable to road traffic:

- AQMA 1 – Newington AQMA, 6 km west of the Site.
- AQMA 2 – Ospinge Street, Faversham, 9.7 km southwest of the Site.
- AQMA 3 – East Street, Sittingbourne, 3 km south of the Site.
- AQMA 4 – St Pauls Street, Sittingbourne, 2.8 km south of the Site.

5.4.5 The Site is not located within a designated AQMA. As such, air quality at the Site is likely to be good.

Local Urban Background Monitoring

5.4.6 Monitors at urban background locations measure concentrations away from the local influence of emission sources. SBC does not operate any continuous automatic instruments in a background location. The nearest continuous automatic monitor in a background location is in the neighbouring borough of Maidstone, approximately 13 km from the Site; the urban background monitor at Chatham Luton was closed in 2014 and the urban background monitor at the Chaucer Technology School in Canterbury is approximately 23 km from the Site, considerably further away than the Maidstone site.

5.4.7 The most recent annual-mean concentrations measured at Maidstone are presented in Table 5.9. Values shown in bold have low data capture.

Monitor Name	Approx. Distance from the Site (km)	Pollutant	Concentration ($\mu g.m^{-3}$)						
			2011	2012	2013	2014	2015	2016	Ave
Maidstone (Rural Background)	13	NO_2	12.5	13.7	13.5	12.3	12.6	12.0	12.8
		PM_{10}	15.8	17.5	18.8	25.3	**19.0**	20	19.4

Table 5.9 Automatically Monitored Urban Background Annual-Mean Concentrations

5.4.8 SBC manually monitors NO_2 concentrations at three urban background locations using passive diffusion tubes and the most recently measured annual-mean concentrations are presented in Table 5.10. All concentrations have been adjusted for bias in accordance with good practice.

Monitor Name	Approx. Distance from the Site (km)	x	y	Concentration ($\mu g.m^{-3}$)					
				2011	2012	2013	2014	2015	Ave
SW34 - Hernehill Village Hall	15.5	606624	161110	14.9	13.1	11.9	10.0	10.2	12.0
SW77 - Kemsley Fields, Swale Way	0.4	591035	166521	32.3	31.3	34.5	30.9	29.7	31.7
SW88 - Sonara Way	2.5	589320	165047	-	27.2	24.3	22.3	19.5	23.3

Table 5.10 Passively Monitored Urban Background Annual-Mean NO_2 Concentrations

5.4.9 The existing background concentrations of other pollutants are provided in Appendix 5.3.

Defra Mapped Concentration Estimates

5.4.10 Defra's total annual-mean NO_2 concentration estimates have been collected for the 1 km grid squares of the monitoring sites and the Site. Similarly, Defra's total annual-mean PM_{10} concentration estimates have been collected for the 1 km grid square of the Maidstone (rural) monitoring sites and the Site. The concentrations are summarised in Table 5.11 and Table 5.12.

Monitor Name	Approx. Distance to Site (km)	Concentration ($\mu g.m^{-3}$)	
		Range of Monitored	Estimated Defra Mapped
Maidstone	13.0	12.0 - 13.7	13.6
SW34 -Hernehill Village Hall	15.5	10.0 – 14.9	13.1
SW77 - Kemsley Fields, Swale Way	0.4	29.7 – 34.5	13.6
SW88 - Sonara Way	2.5	19.5 – 27.2	16.2
The Site	-	-	12.5

Table 5.11 Defra Mapped Annual-Mean NO_2 Concentration Estimates

Monitor Name	Approx. Distance to Site (km)	Concentration ($\mu g.m^{-3}$)	
		Range of Monitored	Estimated Defra Mapped
Maidstone	13.0	15.8 – 25.3	15.4
The Site	-	-	15.4

Table 5.12 Defra Mapped Annual-Mean PM_{10} Concentration Estimates

Appropriate Background Concentrations for the K3/WKN Sites

5.4.11 For NO_2, the Defra mapped concentration estimates are within the range of the results from monitoring at the Maidstone continuous automatic monitor and Hernehill Village Hall but below the range at the other closest monitoring location sites, SW77 and SW88, where the Defra mapped concentration estimates are well below the bottom of the measured range. This suggests that the Defra mapped concentration estimate would not be conservative or representative of concentrations at the Site. On that basis, the average of the concentrations monitored at SW77 Kemsley Fields, 31.7 $\mu g.m^{-3}$, has been used to inform the existing background annual-mean NO_2.

5.4.12 For PM_{10}, the Defra mapped concentration estimate is are below the range of the results from monitoring at the Maidstone continuous automatic monitor suggesting that the Defra mapped concentration estimate would not be conservative or representative of concentrations at the Site. On that basis, the average of the concentrations monitored at Maidstone, 19.4 $\mu g.m^{-3}$, has been used to inform the existing background annual-mean PM_{10} concentration.

Sensitive Receptors

5.4.13 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. For human-health effects, such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG16 [Ref 5.13] provides examples of exposure locations and these are summarised in Table 5.13.

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual-mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building's façades), or any other location where public exposure is expected to be short-term.
Daily-mean	All locations where the annual-mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building's façade), or any other location where public exposure is expected to be short-term.

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Hourly-mean	All locations where the annual and 24-hour mean would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Table 5.13: Examples of Where Air Quality Objectives Apply

5.4.14 The ground level concentrations have been modelled across a grid of 20 km by 20 km, with a spacing of 200m, centred on the stack.

5.4.15 In addition, the effects of the K3 and WKN Proposed Developments have been assessed at the façades of a representative selection of discrete local existing receptors. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The locations of these discrete receptors are listed in Table 5.14 and illustrated in Figure 5.2.

Receptor ID	Receptor	Approx Distance to Site (m)	Grid Reference	
			x	y
R1	Recreation Way	670	591391	166087
R2	Premier Way	970	590967	166509
R3	Grovehurst Road	1,540	590404	166463
R4	Grovehurst Road	1,510	590746	165486
R5	Saffron Way	1,580	590924	165184
R6	Straymarsh Farm	4,200	592706	170419
R7	Wigeon Road	1,790	590368	167295
R8	Howt Green	2,250	589762	165887
R9	Lorimar Court	2,870	589256	165287
R10	Key Street	4,360	588127	164204
R11	Newlands Avenue	3,880	588855	163953
R12	East Street	2,870	591165	163568
R13	Frognam Gardens	4,900	595060	162529
R14	Hartlip Hill	7,600	584437	165225
R15	Rookery Close	6,500	588203	160829
R16	Wren's Hill	8,600	597167	159333
R17	Nunfield House	8,100	584481	163112
R18	Squirrels Farm	9,500	584146	160880
R19	Grovehurst Road	1700	590335	166741
R20	Swale Way	800	591251	166473

Table 5.14: Modelled Sensitive Receptors

5.4.16 The AQS NO_2 objectives for all the different averaging periods apply at the façades of the modelled sensitive receptors.

5.4.17 The receptor points selected for the assessment of sensitive ecological sites are described in Appendix 5.4.

5.5 Assessment baseline

5.5.1 For background traffic-related NO_2 concentrations, the view historically has been that in the UK it would reduce over time, due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on emissions. However, the results of recent monitoring across the UK suggest that background annual-mean NO_2 concentrations have not decreased in line with expectations. Inspection of the results of local monitoring presented here indicates that there is no particular trend over time for concentrations of NO_2 or PM_{10} in the vicinity of the K3/WKN Sites.

5.5.2 To ensure that the assessment presents conservative results, no reduction in the background has been applied for future years. Table 5.15 summarises the existing annual-mean Ambient Concentrations (AC) for NO_2 and PM_{10}. Where short-term background concentrations are required, the annual-mean concentrations have been doubled as is the convention.

Pollutant	Data Source	Ambient Concentration ($\mu g.m^{-3}$)	
		Long-term	Short-term
NO_2	SW77 - Kemsley Fields, Swale Way – diffusion tube	31.7	63.4
PM_{10}	Maidstone - continuous automatic monitor	19.4	-

Table 5.15 Summary of Background Annual-Mean Concentrations used in the Assessment

5.5.3 Where relevant, future baseline concentrations have been calculated at each modelled receptor location (grid points and selected sensitive receptors) as the total of the existing background concentration and the process contribution for the permitted K3. This is described as the Future Ambient Concentration (known hereafter as the Future AC) to distinguish it from the existing Ambient Concentration.

5.6 The K3 Proposed Development

Construction Effects

5.6.1 A construction dust assessment was undertaken as part of the original planning application for the now permitted K3 facility. Mitigation measures were recommended to ensure that the effect from construction would be not significant. (The original assessment is provided as Appendix 2.2. to Chapter 2.) Assuming that these mitigation measures are implemented during the construction phase for K3, the residual effect is expected to be not significant.

5.6.2 The air quality assessment for the permitted K3 did not quantitatively assess the effects of construction traffic on air quality as construction traffic flows were expected to be lower than operational traffic flows. The operational traffic flows are considered later in this chapter.

Completed Development Effects

5.6.3 For each of the five years of meteorological data (2012 to 2016), the maximum predicted concentration across the identified selected sensitive receptors has been derived and are reported below. The predicted Process Contribution (PC) is for the K3 Proposed Development.

Scenario 1: Short-Term IED Emission Limit Values

5.6.4 Table 5.16 summarises the maximum predicted PC to ground-level concentrations for all relevant pollutants with short-term emission limit values set out in the IED.

Scenario 2: Long-Term IED Emission Limit Values

5.6.5 Table 5.17 summarises the PCs for all pollutants assuming that the K3 Proposed Development is operating at long-term emission limit values.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	K3 PC ($\mu g.m^{-3}$)	K3 PC as % of EAL	Criteria (%)	Is K3 PC Potentially Significant?
HCl	1 hour (maximum)	750	15.0	2	10	No
HF	1 hour (maximum)	160	1.0	1	10	No
SO_2	15 minute (99.90th percentile)	266	45.3	17	10	Yes
	1 hour (99.73th percentile)	350	37.4	11	10	Yes
	24 hour (99.18th percentile)	125	16.0	13	10	Yes
NO_2	1 hour (99.79th percentile)	200	27.8	14	10	Yes
PM_{10}	24 hour (90.41st percentile)	50	1.0	2	10	No
CO	8 hour (maximum daily running)	10000	17.4	0	10	No

Table 5.16 Predicted Maximum Process Contributions at Short-Term Emission Limit Values – K3

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	K3 PC ($\mu g.m^{-3}$)	K3 PC as % of EAL	Criteria (%)	Is K3 PC Potentially Significant?
PM_{10}	24 hour (90.41st percentile)	50	0.3	1	10	No
	24 hour (annual mean)	40	0.1	0	1	No
$PM_{2.5}$	24 hour (annual mean)	25	0.1	0	1	No
HCl	1 hour (maximum)	750	2.5	0	10	No
HF	1 hour (maximum)	160	0.3	0	10	No
SO_2	15 minute (99.90th percentile)	266	11.3	4	10	No
	1 hour (99.73th percentile)	350	9.4	3	10	No
	24 hour (99.18th percentile)	125	4.0	3	10	No
	1 hour (annual mean)	50	0.5	1	1	No
NO_2	1 hour (99.79th percentile)	200	13.9	7	10	No
	1 hour (annual mean)	40	1.4	4	1	Yes
CO	8 hour (maximum daily running)	10,000	8.7	0	10	No

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Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	K3 PC ($\mu g.m^{-3}$)	K3 PC as % of EAL	Criteria (%)	Is K3 PC Potentially Significant?
Cd	1 hour (annual mean)	0.005	5.06E-04	10	10	No
Tl	1 hour (maximum)	30	1.25E-02	0	10	No
	1 hour (annual mean)	1	5.06E-04	0	1	No
Hg	1 hour (maximum)	7.5	1.25E-02	0	10	No
	1 hour (annual mean)	0.25	5.06E-04	0	1	No
Sb	1 hour (maximum)	150	1.25E-01	0	10	No
	1 hour (annual mean)	5	5.06E-03	0	1	No
As	1 hour (annual mean)	0.003	5.06E-03	169	1	Yes
Cr	1 hour (maximum)	150	1.25E-01	0	10	No
	1 hour (annual mean)	5	5.06E-03	0	1	No
Co	1 hour (maximum)	6	1.25E-01	2	10	No
	1 hour (annual mean)	0.2	5.06E-03	3	1	Yes
Cu	1 hour (maximum)	200	1.25E-01	0	10	No
	1 hour (annual mean)	10	5.06E-03	0	1	No
Pb	1 hour (annual mean)	0.25	5.06E-03	2	1	Yes
Mn	1 hour (maximum)	1500	1.25E-01	0	10	No
	1 hour (annual mean)	0.15	5.06E-03	3	1	Yes
Ni	1 hour (annual mean)	0.02	5.06E-03	25	1	Yes
V	1 hour (maximum)	5	1.25E-01	3	10	No
	1 hour (annual mean)	1	5.06E-03	1	1	No
Dioxins & Furans	1 hour (annual mean)	-	1.01E-09	-	-	-
PAHs	1 hour (annual mean)	0.00025	1.01E-05	4	1	Yes
PCB	1 hour (annual mean)	0.2	5.06E-05	0	1	No
NH_3	1 hour (annual mean)	5	5.06E-02	1	1	No

Table 5.17 Predicted Maximum Process Contributions at Long-Term Emission Limit Values – K3

5.6.6 The results presented in Table 5.16 show that the predicted PC is below 10% of the relevant EAL for all pollutants except SO_2 and NO_2.

5.6.7 When the 15-minute mean SO_2 PC of 45.3 $\mu g.m^{-3}$ is added to the AC of 22.1 $\mu g.m^{-3}$, the PEC is 67.4 $\mu g.m^{-3}$. As this is below the relevant EAL of 266 $\mu g.m^{-3}$ the effects are not considered to be significant.

5.6.8 When the 1-hour mean (99.73rd percentile) SO_2 PC of 37.4 $\mu g.m^{-3}$ is added to the AC of 15.7 $\mu g.m^{-3}$, the PEC is 53.1 $\mu g.m^{-3}$. As this is below the relevant EAL of 125 $\mu g.m^{-3}$ the effects are not considered to be significant.

5.6.9 When the 24-hour mean (99.18th percentile) SO_2 PC of 16.0 $\mu g.m^{-3}$ is added to the AC of 8.0 $\mu g.m^{-3}$, the PEC is 24.0 $\mu g.m^{-3}$. As this is below the relevant EAL of 125 $\mu g.m^{-3}$ the effects are not considered to be significant.

5.6.10 When the 1-hour mean (99.79th percentile) NO_2 PC of 27.89 $\mu g.m^{-3}$ is added to the AC of 63.5 $\mu g.m^{-3}$, the PEC is 91.3 $\mu g.m^{-3}$. As this is below the relevant EAL of 200 $\mu g.m^{-3}$ the effects are not considered to be significant.

5.6.11 The results presented in Table 5.17 show that the predicted PC is below 10% of the relevant short-term EAL and below 1% of the long-term EAL for all pollutants with the exception of nitrogen dioxide (NO_2), As (arsenic), Co (cobalt), Pb (lead), Mn (manganese) Ni (nickel), and PAHs.

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5.6.12 Table 5.18 summarises the K3 Proposed Development PECs for all pollutants that were considered to be potentially significant in Table 5.17.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	AC ($\mu g.m^{-3}$)	Max K3 PEC ($\mu g.m^{-3}$)	Max K3 PEC as % of EAL	Is K3 PEC Potentially Significant?
NO_2	1 hour (annual mean)	40	31.7	33.2	83	No
As	1 hour (annual mean)	0.003	7.78E-04	5.84E-03	195	Yes
Co	1 hour (annual mean)	0.2	6.17E-05	5.12E-03	3	No
Pb	1 hour (annual mean)	0.25	6.13E-03	1.12E-02	4	No
Mn	1 hour (annual mean)	0.15	3.27E-03	8.32E-03	6	No
Ni	1 hour (annual mean)	0.02	6.75E-04	5.73E-03	29	No
PAHs	1 hour (annual mean)	0.00025	9.59E-05	1.06E-04	42	No

Table 5.18 Predicted Environmental Concentrations at Long-Term Emission Limit Values – K3

5.6.13 The results presented in Table 5.18 show that the predicted PEC is below 100% of the relevant EAL for all pollutants with the exception of As (arsenic).

5.6.14 The predictions are based on the assumption that arsenic comprises the total of the group 3 metals emissions. In reality, the IED emission limit applies to all nine of the group 3 metals. If the emissions limit is assumed to apply equally to each of the nine group 3 metals, then the PCs for As would be divided by 9 (or 11%) and the predicted PEC for As would be less than 100% of the EAL as shown in Table 5.19. The effects are therefore not considered significant.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Max K3 PC ($\mu g.m^{-3}$)	Max K3 PC as % of EAL	Max K3 PEC ($\mu g.m^{-3}$)	Max K3 PEC as % of EAL	Is K3 PEC Potentially Significant?
As	1 hour (annual mean)	0.003	5.62E-04	19	1.34E-03	45	No

Table 5.19 Predicted Environmental Concentrations at Long-Term Emission Limit Values – K3

5.6.15 For hexavalent chromium (CrVI), the measured concentrations in the EA 'Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators' version 4 (undated), varies from 0.0005% to 0.03% of the IED emission concentration limit. Table 5.20 shows the predicted PC at these proportions.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	K3 PC ($\mu g.m^{-3}$)	K3 PC as % of EAL	Percentage of the IED Emission Limit
CrVI	1 hour (annual mean)	0.0002	2.53E-08	0	0.0005% (min)
			1.52E-06	1	0.03% (max)

Table 5.20 Predicted Environmental Concentrations at Long-Term Emission Limit Values – K3

5.6.16 The combined PCs for K3 and WKN Proposed Developments are considered in Section 5.12.

Traffic-related Emissions

5.6.17 Modelling has been undertaken for the key traffic-related pollutants (NO_2, PM_{10} and $PM_{2.5}$) at sensitive receptor locations adjacent to roads affected.

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5.6.18 Tables 5.21, 5.22 and 5.23 present the annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted at the facades of the receptors outlined in Table 5.14 for the K3 Proposed Development in the first fully operational year, 2021. The *With Development* scenarios is the *Without Development* scenario plus stack and traffic emissions from the K3 Proposed Development. The methodology and significance criteria for the traffic modelling are provided in Appendix 5.5.

5.6.19 It should be noted that the NO_2 future baseline concentration for the assessment of traffic emissions is based on the Defra mapped NO_2 background concentration of 12.5 $\mu g.m^{-3}$ (see Table 5.11) plus the K3 Proposed Development stack emissions rather than the baseline of 31.7 $\mu g.m^{-3}$ used for the stack emissions. The Defra mapped concentration is a background concentration (i.e. away from roads) whereas the 31.7 $\mu g.m^{-3}$ was measured at a roadside location and will include a large road contribution. Therefore, to avoid double counting of the road component, the Defra mapped background concentration has been used for all traffic modelling.

Receptor ID	Concentration ($\mu g.m^{-3}$)			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack emissions	With Development		
R1	16.6	0.56	17.2	1	Negligible
R2	18.5	0.58	19.3	2	Negligible
R3	16.2	0.48	16.7	1	Negligible
R4	13.8	0.32	14.1	1	Negligible
R5	13.7	0.32	14.0	1	Negligible
R6	15.2	0.15	15.4	0	Negligible
R7	15.6	0.13	15.8	0	Negligible
R8	26.9	0.29	27.3	1	Negligible
R9	26.9	0.18	27.3	1	Negligible
R10	21.8	0.11	22.0	1	Negligible
R11	14.0	0.12	14.1	0	Negligible
R12	13.4	0.14	13.6	0	Negligible
R13	13.2	0.08	13.3	0	Negligible
R14	13.7	0.10	13.7	0	Negligible
R15	23.2	0.06	23.2	0	Negligible
R16	26.4	0.05	26.5	0	Negligible
R17	22.2	0.06	22.3	0	Negligible
R18	13.3	0.04	13.3	0	Negligible
R19	24.8	0.35	25.5	2	Negligible
R20	21.1	0.58	22.0	2	Negligible
Maximum	**26.9**	**0.58**	**27.3**	-	-
Minimum	**13.2**	**0.04**	**13.3**	-	-

Table 5.21 Predicted Annual-Mean NO_2 Impacts at Receptors – K3 Proposed Development

Receptor ID	Concentration ($\mu g.m^{-3}$)			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack emissions	With Development		
R1	16.3	0.08	16.3	0	Negligible
R2	16.8	0.10	17.0	0	Negligible
R3	16.1	0.08	16.2	0	Negligible
R4	15.6	0.05	15.7	0	Negligible
R5	15.6	0.04	15.6	0	Negligible

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Receptor ID	Concentration (µg.m^{-3})			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack emissions	With Development		
R6	15.9	0.02	15.9	0	Negligible
R7	16.0	0.02	16.0	0	Negligible
R8	18.4	0.04	18.5	0	Negligible
R9	18.4	0.03	18.5	0	Negligible
R10	17.3	0.02	17.3	0	Negligible
R11	15.6	0.02	15.7	0	Negligible
R12	15.5	0.02	15.5	0	Negligible
R13	15.5	0.01	15.5	0	Negligible
R14	15.5	0.01	15.6	0	Negligible
R15	16.5	0.01	16.5	0	Negligible
R16	16.8	0.01	16.8	0	Negligible
R17	16.5	0.01	16.5	0	Negligible
R18	15.5	0.01	15.5	0	Negligible
R19	18.2	0.06	18.4	0	Negligible
R20	17.5	0.09	17.7	0	Negligible
Maximum	**18.4**	**0.10**	**18.5**	-	-
Minimum	**15.5**	**0.01**	**15.5**	-	-

Table 5.22 Predicted Annual-Mean PM_{10} Impacts at Receptors – K3 Proposed Development

Receptor ID	Concentration (µg.m^{-3})			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack emissions	With Development		
R1	11.1	0.08	11.2	0	Negligible
R2	11.5	0.10	11.6	1	Negligible
R3	11.1	0.08	11.2	0	Negligible
R4	10.8	0.05	10.8	0	Negligible
R5	10.8	0.04	10.8	0	Negligible
R6	10.9	0.02	10.9	0	Negligible
R7	11.0	0.02	11.0	0	Negligible
R8	12.4	0.04	12.4	0	Negligible
R9	12.4	0.03	12.4	0	Negligible
R10	11.7	0.02	11.8	0	Negligible
R11	10.8	0.02	10.8	0	Negligible
R12	10.7	0.02	10.7	0	Negligible
R13	10.7	0.01	10.7	0	Negligible
R14	10.7	0.01	10.8	0	Negligible
R15	11.4	0.01	11.4	0	Negligible
R16	11.6	0.01	11.6	0	Negligible
R17	11.3	0.01	11.4	0	Negligible
R18	10.7	0.01	10.7	0	Negligible
R19	12.2	0.06	12.4	1	Negligible
R20	11.8	0.09	12.0	1	Negligible
Maximum	**12.4**	**0.10**	**12.4**	-	-
Minimum	**10.7**	**0.01**	**10.7**	-	-

Table 5.23 Predicted Annual-Mean $PM_{2.5}$ Impacts at Receptors – K3 Proposed Development

5.6.20 Predicted annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations of the K3 Proposed Development once operational at the façades of the existing receptors are below the relevant AQS objectives. When the magnitude of change is considered in the

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context of the absolute concentrations, the impact descriptors are 'negligible' at all receptors.

5.6.21 As all predicted annual-mean NO_2 concentrations are below 60 $\mu g.m^{-3}$, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

5.6.22 As all predicted annual mean PM_{10} concentrations are below 31.5 $\mu g.m^{-3}$, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

5.6.23 Overall, the impact on the surrounding area from NO_2, PM_{10} and $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Dust Emissions

5.6.24 The operation of the K3 Proposed Development could potentially be associated with dust. Some of the key activities likely to generate dust during the operation of the K3 Proposed Development are:

- Delivery of waste; and
- Sorting and handling of waste.

5.6.25 Post recycled waste will be brought to the K3 Site in HGVs or RCVs. At arrival at the site the vehicles will be weighed on weighbridges at the site entrance before vehicles proceed to the tipping hall. Once at the tipping hall vehicles will be directed to one of the unloading bays from which waste will then be deposited into the fuel (waste) bunker. The bunker principally takes the form of a recessed rectangular pit below the floor level of the plant. The waste material can vary widely in moisture content and thermal value, so it is continually managed in the bunker to ensure consistency prior to the combustion process.

5.6.26 The process would produce residues in the form of bottom ash and boiler ash, together with air pollution control residue which would be collected and removed from the site for further treatment off-site.

5.6.27 There are dedicated areas for the reception and storage of imported material, which together with the processing and materials separation are all contained within a controlled environment.

5.6.28 The accepted best practice approach for the primary control of dust releases is containment within the building, which is the technique employed to be employed for the K3 Proposed Development. Air from within the waste reception hall and waste processing hall would be drawn for use as combustion air and the dust levels inside would be managed so as to comply with health and safety obligations for personal exposure. Based on the above, the magnitude of the source of emissions is considered to be small.

5.6.29 The wind roses illustrated in Figure 5.1 show that the prevailing wind direction is south westerly. The nearest high sensitivity receptors are residential properties on

Swale Way (to the south west of the site). These properties are upwind of the site and, at 770 metres, remote from potential sources of emissions. On that basis, the risk of dust impacts from the process is considered to be very low. No significant effects are anticipated.

Odour Emissions

Source Odour Potential

5.6.30 The first step in the qualitative assessment of odour impact is to estimate the odour source potential which has been determined based on the guidance set out in Appendix 5.6.

5.6.31 Waste delivered to the K3 Site would be unloaded within the tipping hall. Therefore, the potential for odours to be released to the outside air during the delivery stage and storage stages would be minimal.

5.6.32 Defra published a "Review of Environmental and Health Effects of Waste Management" (Defra, 2004). This publication included a literature review, which noted that odour is potentially significant from the waste storage and processing phases of incineration, but that odours are normally controlled via the combustion air. Combustion air for the plant would be drawn from within the buildings creating a slight negative pressure ensuring that airflow and, therefore, odours are likely to be directed into rather than out of the building. The height of the stack and the destruction of odours during the incineration process are sufficient to ensure that it is unlikely that odours from the stack would be detectable at ground level. On that basis, the Source Odour Potential has been categorised as 'small'.

Pathway Effectiveness

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

5.6.34 The wind roses illustrated in Figure 5.1 show that the prevailing wind direction is south westerly.

Risk of Odour Exposure (Impact)

5.6.35 When the small Source Odour Potential (ignoring mitigation) is considered in the context of the pathway effectiveness (Appendix 5.6, Table 5.6.3), the risk of odour exposure (impact) is negligible at all receptors.

Likely Magnitude of Odour Effect

5.6.36 When the above risk of odour exposure impact is considered in the context of the sensitivity of the receptors using the matrix in Appendix 5.6, Table 5.6.4, the likely resulting odour effect is summarised in Table 5.24.

Receptor	Source Odour Potential	Pathway Effectiveness	Risk Odour Exposure	Receptor Sensitivity	Likely Odour Effect
Station Road (770m to the	Small	Ineffective	Negligible Risk	High	Negligible Effect

south west-upwind)					

Table 5.24 Likely Odour Effects at the Proposed Development Site

5.6.37 The likely resulting odour effect would be "negligible". Overall, the effect is considered to be "negligible" and would not be significant.

Bioaerosol Emissions

5.6.38 Bioaerosols are microscopic airborne particles or droplets of biological origin. These biological aerosols are complex in nature, and may include: viruses, bacteria, actinomycetes, fungal spores, enzymes, endotoxins, mycotoxins and glucans, dust mites, protozoa, fragments of plant material, and human and animal debris (skin cells, hair, etc) that have been shed.

5.6.39 The individual particles vary in size from fractions of a micron to up to 30 μm or more, but many have a tendency to form larger clumps or agglomerations, or to attach to inert dust particles. Once airborne, bioaerosols may be transported by the wind away from the source and towards sensitive receptors.

5.6.40 The main effects of significant exposure of people to aerosols are on respiratory health. The main pathway is by inhalation of particles which reach the respiratory system (being of small size, most bioaerosols are inhalable and some are respirable). Other potential health effects can include irritation of the eyes and nose, nausea, headache and fatigue.

5.6.41 The 2009 EA Review of Methods to Measure Bioaerosols at Composting Sites [Ref 5.17] notes that the absence of definitive health-based data on dose-response relationships between bioaerosols and respiratory allergy or infection prevents the identification of an exposure level that poses no risk.

5.6.42 The EA takes a precautionary approach to permitting sites that emit bioaerosols, as described by its Position Statement [Ref 5.18] on permit applications for composting operations. It requires new composting operations within 250 metres of workplaces or dwellings to carry out a Site Specific Bioaerosol Risk Assessment (SSBRA) in support of their application to demonstrate that the level of bioaerosols emission attributable to the composting facility (i.e. the PC) can, and will, be maintained no higher than acceptable levels at nearby sensitive receptors. Whilst the Position Statement relates to composting facilities, it provides a useful starting point from which to assess the risks associated with bioaerosol emissions from other waste facilities. The Position Statement notes that "Generally, the complexity of a risk assessment is related to the size and complexity of the proposed facility and the uncertainty of the risk posed, varying from a qualitative, largely generic approach at one extreme to a site specific quantitative risk assessment at the other."

5.6.43 The 2008 EA Science Report Development of Amenity Risk Assessments at Organic Waste Treatment Facilities [Ref 5.19] was produced to provide scientific evidence to support the development of impact assessments and included a detailed review of bioaerosol monitoring and modelling. The project drew attention to the many challenges to modelling bioaerosols and concluded that although progress had been made in dispersion modelling of bioaerosols, it could not recommend the use of models as tools in regulatory risk assessment at that time.

5.6.44 The difficulties of producing quantitative assessments are reflected in the Position Statement, which notes, "Standard methods of determining bioaerosol levels are available. However, based on our present scientific understanding of bioaerosols, the way they behave and their health impacts we now consider that there is currently no suitable methodology for carrying out adequate quantitative SSBRAs for new composting facilities. Accordingly, we believe that we need to take a precautionary approach and not normally permit those facilities where we would have expected a quantitative SSBRA until such time as a suitable methodology becomes available." It clarifies that "The types of new facilities affected by this are those that would have handled more than 500 tonnes of waste at any one time and would have carried out any "composting operations in the open that are likely to result in the uncontrolled release of high levels of bioaerosols", as defined above. In practice, this would not include situations where the entire composting operation is carried out inside a building, or where composting takes place outside, but using negative aeration and without turning. However, it would include compost maturation in conventional outdoor turned windrows, carried out following other treatment operations such as in-vessel composting, treatment in a dry AD (anaerobic digestion) plant and treatment in an MBT (mechanical biological treatment) plant."

5.6.45 It follows that a qualitative approach may be used to assess bioaerosol impacts for facilities likely to pose a lower risk than large composting operations performed outdoors. This is consistent with the 2008 Defra-commissioned report [Ref 5.20] into the exposure-response relationships for bioaerosol emissions from waste treatment processes, which stated, "There have been relatively few studies of bioaerosol exposure at waste transfer stations, materials recovery facilities (MRFs), landfills or other waste processes" and acknowledged the difficulties in modelling and measuring bioaerosol emissions, stating that it is "… extremely difficult to define, model and measure emissions in a quantitative fashion for most waste management processes … Even where a waste process does incorporate discrete point sources that would be amenable to measurement, these sources may be small in comparison to fugitive sources elsewhere on site and be of limited relevance to overall emissions of bioaerosols from the site."

5.6.46 Paragraphs 5.6.18 to 5.6.21 set out the measures to control dust. These measures will also reduce emissions of bioaerosols and, on that basis, the magnitude of the source of emissions is considered to be small.

5.6.47 The wind roses illustrated in Figure 5.1 show that the prevailing wind direction is south westerly. The nearest sensitive receptors are workers at Kemsley Paper Mill which is upwind of the K3 Site and, at 200 metres, remote from potential sources of bioaerosol emissions. On that basis, the risk of bioaerosol impacts from the process is considered to be low and no significant effects are anticipated.

Decommissioning Effects

5.6.48 The construction dust assessment undertaken as part of the original planning application for the now permitted K3 facility provided a list of recommended mitigation measures to ensure that the effect from construction would be not significant. Assuming that these mitigation measures are implemented during the decommissioning phase, the effect is expected to be not significant.

5.6.49 The air quality assessment for the permitted K3 did not quantitatively assess the effects of construction traffic on air quality as construction traffic flows were expected to be lower than operational traffic flows. During the decommissioning phase the traffic generated is likely to be the same or lower than during the construction phase and on that basis the effect is expected to be not significant.

Effect Identified	Receptor Sensitivity	Impact Magnitude	Nature	Duration	Degree of Effect
Construction Effects					
Increase in deposited and suspended dust	High, medium and low	Low	Adverse	Short-term	Negligible
Completed Development Effects					
Increase in air quality pollutants (stack and traffic-related emissions)	High	Low	Adverse	Long-term	Negligible
Decommissioning Effects					
Increase in deposited and suspended dust	High, medium and low	Low	Adverse	Short-term	Negligible

Table 5.25 – Summary of Effects Prior to Mitigation

5.7 The Practical Effect of the K3 Proposed Development

5.7.1 Planning permission for K3, an energy-from-waste facility with a generating capacity of 49.9MW and an annual tonnage throughput of 550,000 tonnes of waste, was granted by Kent County Council on the 6th March 2012. A number of material and non-material amendments have been made to that original consent since then.

5.7.2 Construction of K3 began in 2016, with the facility expected to be fully operational to its consented generating capacity (49.9MW) and tonnage throughput (550,000 tonnes) by late 2019. The practical effect of the K3 Proposed Development allow K3 as consented and currently being built to operate to an upgraded power generation level of 75MW (an additional 25.1MW) and to process 657,000 tonnes of waste per annum (an additional 107,000 tonnes) above and beyond that permitted under its existing planning permission. For further details refer to Chapter 2.

Construction Effects

5.7.3 The practical effect of the consent sought would not result in any additional external physical changes to K3 as permitted and the layout and appearance of the facility will remain as per its consented design. There would be no additional construction work.

Completed Development Effects

5.7.4 The increase in power output and tonnage throughput increase to K3 as consented will increase the concentration of emissions from the facility. For each of the five years of meteorological data (2012 to 2016), the maximum predicted concentration across the identified selected sensitive receptors has been derived and are reported below. The predicted Process Contribution (PC) is the K3 Proposed Development PC – the K3 Permitted Development PC. i.e. it is contribution associated with the increased waste throughput.

<u>Scenario 1: Short-Term IED Emission Limit Values</u>

5.7.5 Table 5.26 summarises the maximum predicted PC to ground-level concentrations for all relevant pollutants with short-term emission limit values set out in the IED.

<u>Scenario 2: Long-Term IED Emission Limit Values</u>

5.7.6 Table 5.27 summarises the PCs for all pollutants assuming that the K3 Proposed Development is operating at long-term emission limit values.

Pollutant	Averaging Period	EAL (µg.m-3)	Max Increase in K3 PC (µg.m-3)	Max Increase in K3 PC as % of EAL	Criteria (%)	Is Increase in K3 PC Potentially Significant?
HCl	1 hour (maximum)	750	1.5	0	10	No
HF	1 hour (maximum)	160	0.1	0	10	No
SO_2	15 minute (99.90th percentile)	266	4.7	2	10	No
	1 hour (99.73th percentile)	350	3.3	1	10	No
	24 hour (99.18th percentile)	125	1.6	1	10	No
NO_2	1 hour (99.79th percentile)	200	2.6	1	10	No
PM_{10}	24 hour (90.41st percentile)	50	0.1	0	10	No
CO	8 hour (maximum daily running)	10000	1.4	0	10	No

Table 5.26 Predicted Maximum Process Contributions at Short-Term Emission Limit Values – Increase in K3

Pollutant	Averaging Period	EAL (µg.m-3)	Max Increase in K3 PC (µg.m-3)	Max Increase in K3 PC as % of EAL	Criteria (%)	Is Increase in K3 PC Potentially Significant?
PM_{10}	24 hour (90.41st percentile)	50	0.03	0	10	No
	24 hour (annual mean)	40	0.01	0	1	No
$PM_{2.5}$	24 hour (annual mean)	25	0.01	0	1	No
HCl	1 hour (maximum)	750	0.25	0	10	No

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Pollutant	Averaging Period	EAL (µg.m^{-3})	Max Increase in K3 PC (µg.m^{-3})	Max Increase in K3 PC as % of EAL	Criteria (%)	Is Increase in K3 PC Potentially Significant?
HF	1 hour (maximum)	160	0.03	0	10	No
SO_2	15 minute (99.90th percentile)	266	1.18	0	10	No
	1 hour (99.73th percentile)	350	0.83	0	10	No
	24 hour (99.18th percentile)	125	0.41	0	10	No
	1 hour (annual mean)	50	0.03	0	1	No
NO_2	1 hour (99.79th percentile)	200	1.32	1	10	No
	1 hour (annual mean)	40	0.09	0	1	No
CO	8 hour (maximum daily running)	10,000	0.72	0	10	No
Cd	1 hour (annual mean)	0.005	3.66E-05	1	10	No
Tl	1 hour (maximum)	30	1.36E-03	0	10	No
	1 hour (annual mean)	1	3.66E-05	0	1	No
Hg	1 hour (maximum)	7.5	1.36E-03	0	10	No
	1 hour (annual mean)	0.25	3.66E-05	0	1	No
Sb	1 hour (maximum)	150	1.36E-02	0	10	No
	1 hour (annual mean)	5	3.66E-04	0	1	No
As	1 hour (annual mean)	0.003	3.66E-04	12	1	Yes
Cr	1 hour (maximum)	150	1.36E-02	0	10	No
	1 hour (annual mean)	5	3.66E-04	0	1	No
Co	1 hour (maximum)	6	1.36E-02	0	10	No
	1 hour (annual mean)	0.2	3.66E-04	0	1	No
Cu	1 hour (maximum)	200	1.36E-02	0	10	No
	1 hour (annual mean)	10	3.66E-04	0	1	No
Pb	1 hour (annual mean)	0.25	3.66E-04	0	1	No
Mn	1 hour (maximum)	1500	1.36E-02	0	10	No
	1 hour (annual mean)	0.15	3.66E-04	0	1	No
Ni	1 hour (annual mean)	0.02	3.66E-04	2	1	Yes
V	1 hour (maximum)	5	1.36E-02	0	10	No
	1 hour (annual mean)	1	3.66E-04	0	1	No
Dioxins & Furans	1 hour (annual mean)	-	6.66E-11	-	-	-
PAHs	1 hour (annual mean)	0.00025	6.66E-07	0	1	No
PCB	1 hour (annual mean)	0.2	3.34E-06	0	1	No
NH_3	1 hour (annual mean)	5	3.34E-03	0	1	No

Table 5.27 Predicted Maximum Process Contributions at Long-Term Emission Limit Values – Increase in K3

5.7.7 The results presented in Table 5.26 show that the predicted PC is below 10% of the relevant EAL for all pollutants and the impacts at short-term emission limits are therefore not considered significant.

5.7.8 The results presented in Table 5.27 show that the predicted PC is below 10% of the relevant short-term EAL and below 1% of the long-term EAL for all pollutants with the exception of As (arsenic) and Ni (nickel).

5.7.9 The predictions are based on the assumption that arsenic and nickel each comprise the total of the group 3 metals IED emission limit. In reality, the IED emission limit applies to all nine of the group 3 metals. If the emission limit is therefore assumed

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to apply equally for each of the nine group 3 metals, then the PC for As and Ni would be divided by 9 (and therefore makes up 11% of the IED emission limit value) and the predicted PC for As would be marginally above than 1% of the EAL. This is likely to be a conservative assumption: The EA 'Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators' version 4 (undated), outlines monitoring data from 18 Municipal Waste Incinerators and Waste Wood Co-Incinerators between 2007 and 2015. For arsenic measured concentrations were between 0.04 to 5.0% of the group 3 metals IED emission limit value. If As was assumed to be 5.0% of the group 3 limit, the predicted PC for As would be below 1% of the EAL. For nickel the measured concentrations ranged from 0.5 to 44.0 % of the group 3 metals IED emission limit value. The guidance notes "*that the two highest nickel concentrations are outliers being 44%, as above, and 27% of the ELV. The third highest concentration is 0.53 mg/Nm3 or 11% of the ELV*". If nickel was assumed to make up 44% of the emission limit value, the PC would be well below 1% of the EAL. On that basis, the impacts of As and Ni are not considered significant.

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5.7.10 For hexavalent chromium (CrVI), the measured concentrations in the EA 'Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators' version 4 (undated), varies from 0.0005% to 0.03% of the IED emission concentration limit. Table 5.28 shows the predicted PC at these proportions.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Max Increase in K3 PC ($\mu g.m^{-3}$)	Max Increase in K3 PC as % of EAL	Percentage of the IED Emission Limit
CrVI	1 hour (annual mean)	0.0002	1.83E-09	0	0.0005% (min)
			1.10E-07	0	0.03% (max)

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Table 5.28 Predicted Environmental Concentrations at Long-Term Emission Limit Values – increase in K3

5.7.11 The combined PCs for K3 and WKN Proposed Developments are considered in Section 5.12.

Traffic-related Emissions

5.7.12 The results of an assessment of the impacts associated with vehicles generated by the K3 Proposed Development is provided in Section 5.6.

5.7.13 The practical effect of the K3 Proposed Development would be an additional 68 HGV movements per day on the A259, Barge Way and part of the Swale Way above that associated with K3 as consented. The indicative criterion of 100 vehicles outside an AQMA is therefore not exceeded.

5.7.14 The traffic flows are expected to be significantly lower on other routes as the traffic redistributes. Therefore, the aforementioned EPUK & IAQM traffic-flow thresholds are not expected to be exceeded for any individual road and the impacts of exhaust emissions associated with the K3 Proposed Development, compared with the permitted K3, have not been assessed specifically and can be considered to be negligible.

5.7.15 The practical effect of the K3 Proposed Development will not increase staff numbers beyond those associated with K3 as consented.

Decommissioning Effects

5.7.16 The construction dust assessment undertaken as part of the original planning application for the now permitted K3 facility provided a list of recommended mitigation measures to ensure that the effect from construction would be not significant. A Decommissioning Environmental Management Plan will be produced and assuming that these mitigation measures are implemented during the decommissioning phase, the effect is expected to be not significant.

5.7.17 The air quality assessment for the permitted K3 did not quantitatively assess the effects of construction traffic on air quality as construction traffic flows were expected to be lower than operational traffic flows. During the decommissioning phase the traffic generated is likely to be the same or lower than during the construction phase and on that basis the effect is expected to be not significant.

Effect Identified	Receptor Sensitivity	Impact Magnitude	Nature	Duration	Degree of Effect
Construction Effects					
N/A	-	-	-	-	-
Completed Development Effects					
Increase in air quality pollutants (stack and traffic-related emissions)	High	Low	Adverse	Long-term	Negligible
Decommissioning Effects					
Increase in deposited and suspended dust	High, medium and low	Low	Adverse	Short-term	Negligible

Table 5.29 – Summary of Effects Prior to Mitigation

5.8 Mitigation for the K3 Proposed Development

Mitigation from Completed Development Effects

5.8.1 Predicted concentrations of pollutants from the completed development have been demonstrated by the assessment to meet all relevant air quality standards and objectives. The air quality effect is considered to be “not significant”. On that basis, no further mitigation measures are considered necessary.

Mitigation from Decommissioning Effects

5.8.2 A detailed Decommissioning Environmental Management Plan (DEMP) is to form a requirement of the DCO, which will require the DEMP to be submitted for written approval prior to any decommissioning works. This will detail the IAQM dust guidance mitigation measures to be employed to minimise dust effects.

5.9 Residual Effects

5.9.1 Residual effects are those that are predicted to remain after implementation of mitigation measures. The residual air quality effects are summarised in Table 5.30.

Residual Effect Identified	Receptor Sensitivity	Impact Magnitude	Nature	Duration	Degree of Effect
Increase in air quality pollutants	**High**	**Low**	**Adverse**	**Long-term**	**Negligible**

Table 5.30: Residual air quality effects

5.10 WKN Proposed Development Predicted Effects

Construction Effects

Traffic-related Emissions

5.10.1 Modelling has been undertaken for the key traffic-related pollutants (NO_2, PM_{10} and $PM_{2.5}$) at sensitive receptor locations adjacent to roads affected.

5.10.2 Tables 5.31, 5.32 and 5.33 present the annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted at the facades of the receptors outlined in Table 5.14 for the WKN Proposed Development during the construction year, 2021. The 'Without Development' scenario assumes that K3 as consented is operational. The methodology and significance criteria for the traffic modelling are provided in Appendix 5.5.

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
R1	17.1	17.2	0	Negligible
R2	19.2	19.4	0	Negligible
R3	16.7	16.8	0	Negligible
R4	14.1	14.1	0	Negligible
R5	14.0	14.0	0	Negligible
R6	15.3	15.3	0	Negligible
R7	15.8	15.8	0	Negligible
R8	27.2	27.5	1	Negligible
R9	27.2	27.5	1	Negligible
R10	21.9	22.1	0	Negligible
R11	14.1	14.2	0	Negligible
R12	13.5	13.5	0	Negligible
R13	13.3	13.3	0	Negligible
R14	13.7	13.7	0	Negligible
R15	23.2	23.2	0	Negligible
R16	26.5	26.5	0	Negligible
R17	22.3	22.3	0	Negligible
R18	13.3	13.3	0	Negligible
R19	25.4	25.7	1	Negligible

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
R20	21.9	22.2	1	Negligible
Maximum	**27.2**	**27.5**	-	-
Minimum	**13.3**	**13.3**	-	-

Table 5.31 Predicted Annual-Mean NO_2 Impacts at Receptors – WKN Proposed Development, Construction Traffic

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
R1	16.4	16.4	0	Negligible
R2	17.0	17.1	0	Negligible
R3	16.3	16.3	0	Negligible
R4	15.7	15.7	0	Negligible
R5	15.6	15.6	0	Negligible
R6	15.9	15.9	0	Negligible
R7	16.0	16.0	0	Negligible
R8	18.5	18.6	0	Negligible
R9	18.5	18.6	0	Negligible
R10	17.4	17.4	0	Negligible
R11	15.7	15.7	0	Negligible
R12	15.5	15.5	0	Negligible
R13	15.5	15.5	0	Negligible
R14	15.6	15.6	0	Negligible
R15	16.5	16.5	0	Negligible
R16	16.8	16.8	0	Negligible
R17	16.5	16.5	0	Negligible
R18	15.5	15.5	0	Negligible
R19	18.4	18.4	0	Negligible
R20	17.7	17.8	0	Negligible
Maximum	**18.5**	**18.6**	-	-
Minimum	**15.5**	**15.5**	-	-

Table 5.32 Predicted Annual-Mean PM_{10} Impacts at Receptors – WKN Proposed Development, Construction Traffic

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
R1	11.3	11.3	0	Negligible
R2	11.6	11.7	0	Negligible
R3	11.2	11.2	0	Negligible
R4	10.8	10.8	0	Negligible
R5	10.8	10.8	0	Negligible
R6	11.0	11.0	0	Negligible
R7	11.0	11.0	0	Negligible
R8	12.5	12.5	0	Negligible
R9	12.4	12.5	0	Negligible
R10	11.8	11.8	0	Negligible
R11	10.8	10.8	0	Negligible

Receptor ID	Concentration ($\mu g.m^{-3}$)		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
R12	10.8	10.8	0	Negligible
R13	10.7	10.7	0	Negligible
R14	10.8	10.8	0	Negligible
R15	11.4	11.4	0	Negligible
R16	11.6	11.6	0	Negligible
R17	11.4	11.4	0	Negligible
R18	10.7	10.7	0	Negligible
R19	12.4	12.4	0	Negligible
R20	12.0	12.1	0	Negligible
Maximum	**12.5**	**12.5**	-	-
Minimum	**10.7**	**10.7**	-	-

Table 5.33 Predicted Annual-Mean $PM_{2.5}$ Impacts at Receptors – WKN Proposed Development, Construction Traffic

5.10.3 Predicted annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations of the WKN Proposed Development during the construction phase at the façades of the existing receptors are below the relevant AQS objectives. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptors are 'negligible' at all receptors.

5.10.4 As all predicted annual-mean NO_2 concentrations are below 60 $\mu g.m^{-3}$, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

5.10.5 As all predicted annual mean PM_{10} concentrations are below 31.5 $\mu g.m^{-3}$, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

5.10.6 Overall, the impact on the surrounding area from NO_2, PM_{10} and $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Construction Dust

5.10.7 The level and distribution of demolition and construction dust emissions will vary according to factors such as the type and size of dust, duration and location of dust-generating activity, weather conditions and the effectiveness of suppression methods.

5.10.8 The main effect of any dust emissions, if not mitigated, could be annoyance due to soiling of surfaces, particularly windows, cars and laundry. However, it is normally possible, by implementation of proper control, to ensure that dust deposition does not give rise to significant adverse effects, although short-term events may occur (for example, due to technical failure or exceptional weather conditions). The following assessment, using the IAQM methodology, predicts the risk of dust impacts and the level of mitigation that is required to control the residual effects to a level that is "not significant".

Risk of Dust Impacts

Source

5.10.9 The WKN Site is currently being used by the Applicant as a laydown and parking area for the construction of the adjacent K3 and so no demolition will occur.

5.10.10 The WKN Site area is more than 10,000 m^2, the dust emission magnitude for the earthworks phase is classified as large.

5.10.11 The total volume of the buildings to be constructed would be between 25,000 and 100,000 m^3, the dust emission magnitude for the construction phase is classified as medium.

5.10.12 The maximum number of deliveries to the WKN Site in any one day is expected to be more than 50 HDVs. The dust emission magnitude for trackout would be classified as large.

5.10.13 The source magnitudes in each of the three phases are summarised in Table 5.34.

Earthworks	Construction	Trackout
Large	Medium	Large

Table 5.34: Dust Emission Magnitude for Earthworks, Construction and Trackout

Pathway and Receptor

5.10.14 All earthworks and construction activities are assumed to occur within the DCO boundary. As such, receptors at distances within 20 m, 50 m, 100 m, 200 m and 350 m of the site boundary have been identified. The sensitivity of the area has been classified and the results are provided in Table 5.35 below.

Potential Impact	Sensitivity of the Surrounding Area	Reason for Sensitivity Classification
Dust Soiling	Low	There are few highly sensitive receptors in the area. The closest residential properties are more than 350 m from the Site (Appendix 5.1, Table A4)
Human Health	Low	Background PM_{10} concentrations for the assessment is below 24 $\mu g.m^{-3}$ (Appendix 5.1, Table A5)

Table 5.35: Sensitivity of the Surrounding Area for Demolition, Earthworks and Construction

5.10.15 The Dust Emission Magnitude for trackout is classified as medium and trackout may occur on roads up to 500 m from the site. The sensitivity of the area has been classified and the results are provided in Table 5.36 below.

Potential Impact	Sensitivity of the Surrounding Area	Reason for Sensitivity Classification
Dust Soiling	Low	The nearest highly sensitive receptors are the residential properties to the west of Swale Way. These are more than 500 m from the Site (Appendix 5.1, Table A4)
Human Health	Low	Background PM_{10} concentrations for the assessment is below 24 μg.m^{-3} (Appendix 5.1, Table A5)

Table 5.36: Sensitivity of the Surrounding Area for Trackout

Overall Dust Risk

5.10.16 The Dust Emission Magnitude has been considered in the context of the Sensitivity of the Area (Appendix 5.1, Tables A6 to A9) to give the Dust Impact Risk. Table 5.37 summarises the Dust Impact Risk for earthworks, construction and trackout without the implementation of mitigation.

Source	Earthworks	Construction	Trackout
Dust Soiling	Low	Low	Low
Human Health	Low	Low	Low
Risk	Low	Low	Low

Table 5.37 Dust Impact Risk for Earthworks, Construction and Trackout – Without Mitigation

5.10.17 Taking the site as a whole, the overall risk is deemed to be low. The mitigation measures appropriate to a level of risk for the site as a whole and for each of the three phases of activity.

5.10.18 Provided this package of mitigation measures is implemented, the residual construction dust effects will not be significant. The IAQM dust guidance states that "For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'." The IAQM dust guidance recommends that significance is only assigned to the effect after the activities are considered with mitigation in place. The agreed mitigation measures would be included in a CEMP, to be secured via a requirement in the DCO.

Completed Development Effects

Stack Emissions

5.10.19 For each of the five years of meteorological data (2012 to 2016), the maximum predicted concentration across the identified selected sensitive receptors has been derived and are reported below.

Scenario 1: Short-Term IED Emission Limit Values

5.10.20 Table 5.38 summarises the maximum predicted WKN Proposed Development PC to ground-level concentrations for all relevant pollutants with short-term emission limit values set out in the IED.

Scenario 2: Long-Term IED Emission Limit Values

5.10.21 Table 5.39 summarises the WKN Proposed Development PCs for all pollutants assuming that the proposed development is operating at long-term emission limit values.

Pollutant	Averaging Period	EAL (µg.m-3)	Max WKN PC (µg.m-3)	Max WKN PC as % of EAL	Criteria (%)	Is WKN PC Potentially Significant?
HCl	1 hour (maximum)	750	12.4	2	10	No
HF	1 hour (maximum)	160	0.8	1	10	No
SO_2	15 minute (99.90th percentile)	266	36.1	14	10	Yes
	1 hour (99.73th percentile)	350	30.9	9	10	No
	24 hour (99.18th percentile)	125	16.3	13	10	Yes
NO_2	1 hour (99.79th percentile)	200	22.1	11	10	Yes
PM_{10}	24 hour (90.41st percentile)	50	1.0	2	10	No
CO	8 hour (maximum daily running)	10000	15.9	0	10	No

Table 5.38 Predicted Maximum Process Contributions at Short-Term Emission Limit Values - WKN

Pollutant	Averaging Period	EAL (µg.m-3)	Max WKN PC (µg.m-3)	Max WKN PC as % of EAL	Criteria (%)	Is WK Poten Signi
PM_{10}	24 hour (90.41st percentile)	50	0.32	1	10	No
	24 hour (annual mean)	40	0.10	0	1	No
$PM_{2.5}$	24 hour (annual mean)	25	0.10	0	1	No
HCl	1 hour (maximum)	750	2.07	0	10	No
HF	1 hour (maximum)	160	0.21	0	10	No
SO_2	15 minute (99.90th percentile)	266	9.02	3	10	No
	1 hour (99.73th percentile)	350	7.73	2	10	No
	24 hour (99.18th percentile)	125	4.06	3	10	No
	1 hour (annual mean)	50	0.50	1	1	No
NO_2	1 hour (99.79th percentile)	200	11.06	6	10	No
	1 hour (annual mean)	40	1.41	4	1	Yes
CO	8 hour (maximum daily running)	10,000	7.93	0	10	No
Cd	1 hour (annual mean)	0.005	5.04E-04	10	10	No
Tl	1 hour (maximum)	30	1.04E-02	0	10	No
	1 hour (annual mean)	1	5.04E-04	0	1	No
Hg	1 hour (maximum)	7.5	1.04E-02	0	10	No
	1 hour (annual mean)	0.25	5.04E-04	0	1	No
Sb	1 hour (maximum)	150	1.04E-01	0	10	No
	1 hour (annual mean)	5	5.04E-03	0	1	No
As	1 hour (annual mean)	0.003	5.04E-03	168	1	Yes
Cr	1 hour (maximum)	150	1.04E-01	0	10	No
	1 hour (annual mean)	5	5.04E-03	0	1	No
Co	1 hour (maximum)	6	1.04E-01	2	10	No
	1 hour (annual mean)	0.2	5.04E-03	3	1	Yes
Cu	1 hour (maximum)	200	1.04E-01	0	10	No
	1 hour (annual mean)	10	5.04E-03	0	1	No
Pb	1 hour (annual mean)	0.25	5.04E-03	2	1	Yes

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Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Max WKN PC ($\mu g.m^{-3}$)	Max WKN PC as % of EAL	Criteria (%)	Is WKN PC Poten Signi
Mn	1 hour (maximum)	1500	1.04E-01	0	10	No
	1 hour (annual mean)	0.15	5.04E-03	3	1	Yes
Ni	1 hour (annual mean)	0.02	5.04E-03	25	1	Yes
V	1 hour (maximum)	5	1.04E-01	2	10	No
	1 hour (annual mean)	1	5.04E-03	1	1	No
Dioxins & Furans	1 hour (annual mean)	-	1.00E-09	-	-	-
PAHs	1 hour (annual mean)	0.00025	1.00E-05	4	1	Yes
PCB	1 hour (annual mean)	0.2	5.04E-05	0	1	No
NH_3	1 hour (annual mean)	5	5.04E-02	1	1	No

Table 5.39 Predicted Maximum Process Contributions at Long-Term Emission Limit Values - WKN

5.10.22 The results presented in Table 5.38 show that the predicted PC is below 10% of the relevant EAL for all pollutants except SO_2 and NO_2.

5.10.23 When the 15-minute mean SO_2 is added to the future AC of 64.5 $\mu g.m^{-3}$, the PEC is 100.6 $\mu g.m^{-3}$. As this is below the relevant EAL of 266 $\mu g.m^{-3}$ the effects are not considered to be significant.

5.10.24 When the 24-hour mean SO_2 is added to the future AC of 24.8 $\mu g.m^{-3}$, the PEC is 41.1 $\mu g.m^{-3}$. As this is below the relevant EAL of 125 $\mu g.m^{-3}$ the effects are not considered to be significant.

5.10.25 When the 1-hour mean NO_2 is added to the future AC of 90.3 $\mu g.m^{-3}$, the PEC is 112.4 $\mu g.m^{-3}$. As this is below the relevant EAL of 200 $\mu g.m^{-3}$ the effects are not considered to be significant.

5.10.26 The results presented in Table 5.39 show that the predicted PC is below 10% of the relevant short-term EAL and below 1% of the long-term EAL for all pollutants with the exception of annual-mean NO_2, As, Co, Mn, Ni and PAHs.

5.10.27 Table 5.40 summarises the WKN Proposed Development PECs for all pollutants that were considered to be potentially significant in Table 5.39.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Future AC ($\mu g.m^{-3}$)	Max WKN PEC ($\mu g.m^{-3}$)	Max WKN PEC as % of EAL	Is WKN PEC Potenti Signific
NO_2	1 hour (annual mean)	40	33.1	34.5	86	No
As	1 hour (annual mean)	0.003	5.63E-03	1.07E-02	356	Yes
Co	1 hour (annual mean)	0.2	4.92E-03	9.96E-03	5	No
Mn	1 hour (annual mean)	0.15	8.12E-03	1.32E-02	9	No
Ni	1 hour (annual mean)	0.02	5.53E-03	1.06E-02	53	No
PAHs	1 hour (annual mean)	0.00025	1.06E-04	1.16E-04	46	No

Table 5.40 Predicted Environmental Concentrations at Long-Term Emission Limit Values - WKN

5.10.28 The results presented in Table 5.40 show that the predicted PEC is below 100% of the relevant EAL for all pollutants with the exception of As (arsenic).

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5.10.29 The predictions are based on the assumption that arsenic comprises the total of the group 3 metals emissions. In reality, the IED emission limit applies to all nine of the group 3 metals. If the emissions limit is assumed to apply equally to each of the nine group 3 metals, then the PCs (and the WKN Proposed Development) for As for the would be divided by 9 (or 11%) and the predicted PEC for As would be less than 100% of the EAL as shown in Table 5.41 and the effects are therefore not considered significant. As discussed in paragraph 5.7.9, measured concentrations of arsenic ranged from 0.04 to 5.0% of the group 3 emission limit value so this is a conservative assumption.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Max WKN PC ($\mu g.m^{-3}$)	Max WKN PC as % of EAL	Future AC ($\mu g.m^{-3}$)	Max WKN PEC ($\mu g.m^{-3}$)	Max WKN PEC as % of EAL	Is WKN PEC Potentially Significant?
As	1 hour (annual mean)	0.003	5.6E-04	19	1.32E-03	1.88E-03	63	No

Table 5.41 Predicted Environmental Concentrations at Long-Term Emission Limit Values - WKN

5.10.30 For hexavalent chromium (CrVI), the measured concentrations in the EA 'Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators' version 4 (undated), varies from 0.0005% to 0.03% of the IED emission concentration limit. Table 5.42 shows the predicted PC at these proportions.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Max WKN PC ($\mu g.m^{-3}$)	Max WKN PC as % of EAL	Percentage of the IED Emission Limit
CrVI	1 hour (annual mean)	0.0002	2.52E-08	0	0.0005% (min)
			1.51E-07	1	0.03% (max)

Table 5.42 Predicted Environmental Concentrations at Long-Term Emission Limit Values – WKN

5.10.31 The PC at each end of the range is below 1% of the EAL and the impacts are not considered significant.

5.10.32 The combined PCs for the K3 and WKN Proposed Developments are considered in Section 5.12.

Traffic-related Emissions

5.10.33 Modelling has been undertaken for the key traffic-related pollutants (NO_2, PM_{10} and $PM_{2.5}$) at sensitive receptor locations adjacent to roads affected.

5.10.34 Tables 5.43, 5.44 and 5.45 present the annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted at the facades of the receptors outlined in Table 5.14 for the WKN Proposed Development in the opening year, 2024. The 'Without development' scenario assumes that the permitted K3 is operational. The PCs from stack emissions of the WKN Proposed Development at each of these receptors have been added to the *With Development* scenario and an Impact Descriptor has been derived based on EPUK&IAQM guidance. The methodology and significance criteria for the traffic modelling are provided in Appendix 5.5.

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5.10.35 It should be noted that the NO_2 future baseline concentration is based on the Defra mapped NO_2 background concentration of 12.5 µg.m^{-3} (see Table 5.11) plus the PC from K3. For the stack emissions, a baseline of 31.7 µg.m^{-3} representing the maximum AC across the grid was used. The Defra mapped concentration is a background concentration whereas the 31.7 µg.m^{-3} was measured at a roadside location. Therefore, to avoid double counting of the road component, the Defra mapped background concentration has been used for all traffic modelling.

Receptor ID	Concentration (µg.m^{-3})			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	WKN Stack Emissions	With Development		
R1	16.0	0.52	16.5	1	Negligible
R2	17.4	0.83	18.3	2	Negligible
R3	15.6	0.61	16.3	2	Negligible
R4	13.8	0.32	14.1	1	Negligible
R5	13.6	0.29	13.9	1	Negligible
R6	14.6	0.17	14.8	0	Negligible
R7	14.9	0.19	15.1	0	Negligible
R8	23.4	0.29	23.7	1	Negligible
R9	23.3	0.19	23.6	1	Negligible
R10	19.4	0.11	19.5	0	Negligible
R11	13.7	0.12	13.9	0	Negligible
R12	13.3	0.12	13.4	0	Negligible
R13	13.1	0.09	13.2	0	Negligible
R14	13.4	0.11	13.5	0	Negligible
R15	20.6	0.06	20.7	0	Negligible
R16	23.2	0.05	23.2	0	Negligible
R17	19.9	0.06	20.0	0	Negligible
R18	13.1	0.04	13.2	0	Negligible
R19	21.9	0.57	22.5	2	Negligible
R20	19.3	0.76	20.2	2	Negligible
Maximum	**23.4**	**0.83**	**23.7**	-	-
Minimum	**13.1**	**0.04**	**13.2**	-	-

Table 5.43 Predicted Annual-Mean NO_2 Impacts at Receptors – WKN Proposed Development

Receptor ID	Concentration (µg.m^{-3})			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	WKN Stack Emissions	With Development		
R1	16.4	0.04	16.4	0	Negligible
R2	17.0	0.06	17.1	0	Negligible
R3	16.2	0.04	16.3	0	Negligible
R4	15.7	0.02	15.7	0	Negligible
R5	15.6	0.02	15.7	0	Negligible
R6	15.9	0.01	15.9	0	Negligible
R7	16.0	0.01	16.0	0	Negligible
R8	18.4	0.02	18.5	0	Negligible
R9	18.4	0.01	18.5	0	Negligible
R10	17.3	0.01	17.3	0	Negligible
R11	15.6	0.01	15.7	0	Negligible
R12	15.5	0.01	15.5	0	Negligible
R13	15.5	0.01	15.5	0	Negligible
R14	15.6	0.01	15.6	0	Negligible
R15	16.4	<0.005	16.4	0	Negligible

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Receptor ID	Concentration (µg.m^{-3})			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	WKN Stack Emissions	With Development		
R16	16.7	<0.005	16.7	0	Negligible
R17	16.4	<0.005	16.4	0	Negligible
R18	15.5	<0.005	15.5	0	Negligible
R19	18.3	0.04	18.4	0	Negligible
R20	17.7	0.05	17.8	0	Negligible
Maximum	**18.4**	**0.06**	**18.5**	**0**	-
Minimum	**15.5**	**<0.005**	**15.5**	**0**	-

Table 5.44 Predicted Annual-Mean PM_{10} Impacts at Receptors – WKN Proposed Development

Receptor ID	Concentration (µg.m^{-3})			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	WKN Stack Emissions	With Development		
R1	11.2	0.04	11.3	0	Negligible
R2	11.6	0.06	11.7	0	Negligible
R3	11.2	0.04	11.2	0	Negligible
R4	10.8	0.02	10.9	0	Negligible
R5	10.8	0.02	10.8	0	Negligible
R6	10.9	0.01	10.9	0	Negligible
R7	11.0	0.01	11.0	0	Negligible
R8	12.4	0.02	12.4	0	Negligible
R9	12.3	0.01	12.4	0	Negligible
R10	11.7	0.01	11.7	0	Negligible
R11	10.8	0.01	10.8	0	Negligible
R12	10.7	0.01	10.8	0	Negligible
R13	10.7	0.01	10.7	0	Negligible
R14	10.8	0.01	10.8	0	Negligible
R15	11.3	<0.005	11.3	0	Negligible
R16	11.5	<0.005	11.5	0	Negligible
R17	11.3	<0.005	11.3	0	Negligible
R18	10.7	<0.005	10.7	0	Negligible
R19	12.3	0.04	12.3	0	Negligible
R20	12.0	0.05	12.0	0	Negligible
Maximum	**12.4**	**0.06**	**12.4**	-	-
Minimum	**10.7**	**<0.005**	**10.7**	-	-

Table 5.45 Predicted Annual-Mean $PM_{2.5}$ Impacts at Receptors – WKN Proposed Development

5.10.36 Predicted annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations in the opening year of the WKN Proposed Development at the façades of the existing receptors are below the relevant AQS objectives. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptors are 'negligible' at all receptors.

5.10.37 As all predicted annual-mean NO_2 concentrations are below 60 µg.m^{-3}, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

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5.10.38 As all predicted annual mean PM_{10} concentrations are below 31.5 $\mu g.m^{-3}$, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

5.10.39 Overall, the impact on the surrounding area from NO_2, PM_{10} and $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Dust Emissions

5.10.40 The operation of the WKN Proposed Development could potentially be associated with dust emissions. Sources of dust would be the same as for K3. The magnitude of the source of emissions is considered to be small.

5.10.41 The wind roses illustrated in Figure 5.1 show that the prevailing wind direction is south westerly. The nearest high sensitivity receptors are residential properties on Swale Way (to the south west of the site). These properties are upwind of the site and, at 770 metres, remote from potential sources of emissions. On that basis, the risk of dust impacts from the process is considered to be very low. No significant effects are anticipated.

Odour Emissions

5.10.42 The operation of the WKN Proposed Development could potentially be associated with odour emissions. Sources of odour would be the same as K3. The magnitude of the source of emissions is considered to be small.

5.10.43 Taking into account the pathway effectiveness and the sensitivity of receptors, as for K3, the likely resulting odour effect would be "negligible". Overall, the effect is considered to be "negligible" and would not be significant.

Bioaerosol Emissions

5.10.44 The approach to the assessment of bio-aerosol impacts is described in paragraph 5.6.37 to 5.6.46.

5.10.45 With the implementation of measures to control dust, as for K3, the magnitude of the source of emissions is considered to be small.

5.10.46 The wind roses illustrated in Figure 5.1 show that the prevailing wind direction is south westerly. The nearest sensitive receptors are workers at Kemsley Paper Mill which is upwind of the WKN Site and, at 200 metres, remote from potential sources of bioaerosol emissions. On that basis, the risk of bioaerosol impacts from the process is considered to be low and no significant effects are anticipated.

Decommissioning Phase

5.10.47 The risk of impacts during decommissioning and demolition phase will be the same or similar to the risk of impacts during the construction phase. With the effective implementation of the mitigation measures recommended for the construction phase, the residual effects are unlikely to be significant. A detailed Decommissioning Environmental Management Plan (DEMP) is to form a requirement of the DCO, which will require the DEMP to be submitted for written approval prior to any decommissioning works. This will detail the IAQM dust guidance mitigation measures to be employed to minimise dust effects.

5.10.48 During the decommissioning phase the traffic generated is likely to be the same or lower than during the construction phase and on that basis the effect is expected to

Effect Identified	Receptor Sensitivity	Impact Magnitude	Nature	Duration	Degree of Effect
Construction Effects					
Increase in deposited and suspended dust	High, medium and low	Low	Adverse	Short-term	Negligible
Completed Development Effects					
Increase in air pollutants including stack, vehicular emissions, dust, odour and bioaerosols	High	Low	Adverse	Long-term	Negligible
Decommissioning Effects					
Increase in deposited and suspended dust	High, medium and low	Low	Adverse	Short-term	Negligible

Table 5.46 Summary of Effects Prior to Mitigation

5.11 Mitigation

Mitigation for Construction Effects

5.11.1 The IAQM dust guidance lists mitigation measures for low, medium and high dust risks.

5.11.2 As summarised in Table 5.27, the predicted Dust Impact Risk is classified as low. The measures listed below are based on the IAQM dust guidance 'highly recommended' measures for low risk sites. The agreed mitigation measures would be included in a CEMP, a draft of which is included as Appendix 2.1.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Avoid site runoff of water or mud.

Operating vehicle/machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary – no idling vehicles.

Operations

- Use enclosed chutes and conveyors and covered skips.

Waste management

- Avoid bonfires and burning of waste materials.

Communications

- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.
- Develop and implement a Dust Management Plan.

Monitoring

- Carry out regular site inspections to monitor compliance with a Dust Management Plan, record inspection results, and make an inspection log available to the local authority when asked.

Mitigation for Completed Development Effects

5.11.3 Predicted concentrations of pollutants from the completed development have been demonstrated by the assessment to meet all relevant air quality standards and objectives. The air quality effect is considered to be "not significant". On that basis, no mitigation measures are considered necessary.

Mitigation for Decommissioning Effects

5.11.4 The nature of the decommissioning phase would remain similar to the construction phase and subject to the same or similar mitigation measures as set out in CEMP.

A Decommissioning Environmental Management Plan (DEMP) is to be produced and subject to the approval of the planning authority prior to the future decommissioning of the WKN Proposed Development As such, it can be concluded that the potential effects on air quality would remain the same as assessed for construction and would not be significant.

5.12 Residual Effects

5.12.1 Residual effects are those that are predicted to remain after implementation of mitigation measures described above. The residual air quality effects are summarised in Table 5.47.

Residual Effect Identified	Receptor Sensitivity	Impact Magnitude	Nature	Duration	Degree of Effect
Increase in air quality pollutants (stack emissions, traffic-related emissions, dust, odour and bioaerosol emissions)	High	Low	Adverse	Long-term	Negligible

Table 5.47 Summary of Residual Effects

5.13 Cumulative Effects

Stack Emissions

5.13.1 Table 5.48 and Table 5.49 summarises the cumulative PCs for the K3 and WKN Proposed Developments for five scenarios:

- The K3 Proposed Development + other cumulative developments
- The practical effect of the K3 Proposed Development + other cumulative developments
- WKN Proposed Development + other cumulative developments
- WKN Proposed Development + K3 Proposed Development + other cumulative developments.
- WKN Proposed Development + the practical effect of the K3 Proposed Development + other cumulative developments.

5.13.2 Table 5.48 and Table 5.49 also summarise the cumulative PECs.

5.13.3 Figures 5.3 and 5.4 illustrate the long and short-term NO_2 contours for the combined PC associated with the WKN Proposed Development and the practical effect of the K3 Proposed Development. The point of maximum impact is not at a location where the public are regularly present.

5.13.4 The sections below outline the 'other cumulative developments' considered.

5.13.5 During the construction and decommissioning phase, there is the potential for cumulative effects where there are other sources of dust located within 700 metres of the project (the IAQM indicative maximum radius of effects for an individual construction site being 350m). Large construction sites would typically implement mitigation measures, such as those recommended in the IAQM dust guidance. With the effective implementation of appropriate mitigation measures at other construction sites within 700 metres of the project, the residual cumulative dust effects are unlikely to be significant.

5.13.6 Once the proposed development is completed, there is the potential for cumulative effects where there are other sources of combustion-related pollutants in close proximity to the site and where developments generate vehicle movements on roads used by the K3 and/or the WKN Proposed Development. The following section considers the cumulative effects of the proposed developments with other schemes that introduce a point source and are operational /constructed, consented or for which planning permissions are currently being sought. The cumulative traffic effects are considered later in this chapter.

Other Cumulative Sites Considered – Point Source Emissions

5.13.7 EN010090 (18/501923/ADJ) Application for an Order Granting Development Consent to decommission the existing K1 CHP on the site and build, commission and operate a new CHP plant, known as K4. K4 has been included within the model and the maximum PCs have been added to give a cumulative PEC in Table 5.48 and 5.49.

5.13.8 SW/11/1291 – 700 m north - Construction of an anaerobic digestion (AD) plant at the Kemsley Paper Mill. Two scenarios were modelled for the assessment, with and without heat recovery, and the maximum PCs across the grid were higher for the with heat recovery scenario. The maximum PCs from Table 7.21 of the Kemsley AD application [Ref 5.21] have been added to give a cumulative PEC in Table 5.48 and 5.49.

5.13.9 18/500393/FULL – 1 km southeast - Erection of a natural gas fuelled reserve power plant with maximum export capacity of up to 12 MW. The maximum PCs at modelled discrete receptors from Tables 6.1, 6.3 and 6.5 of the air quality assessment [Ref 5.22] have been added to the cumulative PEC in Table 5.48 and 5.49. For CO, no maximum PC across the grid is included so the maximum PC at the modelled discrete receptors has been used instead. Construction traffic from this development has been considered in the cumulative traffic modelling.

5.13.10 15/500348/COUNTY – 800 m northwest - Land Off Kemsley Fields Business Park Barge Way Sittingbourne Kent. Installation of advance thermal conversion and energy facility at Kemsley Fields Business Park to produce energy and heat, including construction of new buildings to house thermal conversion and energy generation plant and equipment; construction of associated offices; erection of external plant including storage tanks; and erection of discharge stack (KCC planning application KCC/SW/0010/2015 refers). The maximum PCs from Table 19 of the air quality assessment [Ref 5.23] has been added to the cumulative PEC in Table 5.48 and 5.49. Traffic generated by the development has been included in the traffic data modelled.

			Max PC ($\mu g.m^{-3}$)				Max PC + total of other developments ($\mu g.m^{-3}$)					Max PEC ($\mu g.m^{-3}$)	Max PEC + as % of EAL
Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	K3 Proposed Development	Practical effect of the K3 Proposed Development	WKN	WKN + K3 Proposed Development	WKN + the practical effect of the K3 Proposed Development	K3 Proposed Development + WKN + AC + other developments	
HCl	1 hour (maximum)	750	-	-	-	13.6	28.6	15.1	26.0	41.0	27.5	42.2	6
HF	1 hour (maximum)	160	-	-	-	0.9	1.9	1.0	1.8	2.8	1.9	5.2	3
SO_2	15 minute (99.90th percentile)	266	-	-	-	33.4	78.6	38.1	69.5	114.7	74.2	136.9	51
	1 hour (99.73th percentile)	350	-	-	-	29.9	67.3	33.2	60.8	98.2	64.1	113.9	33
	24 hour (99.18th percentile)	125	-	-	-	13.5	29.5	15.1	29.7	45.7	31.4	53.7	43
NO_2	1 hour (99.79th percentile)	200	12.79	18.10	19.57	21.40	99.7	74.5	94.0	121.8	96.6	185.3	93
PM_{10}	24 hour (90.41st percentile)	50	-	-	-	1.1	2.1	1.2	2.1	3.1	2.2	22.5	45
CO	8 hour (maximum daily running)	10000	20	131	116	13.9	299.1	283.1	297.5	314.9	299.0	856.9	9

Table 5.48 Cumulative Predicted Environmental Concentrations at Short-Term Emission Limit Values

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			Max PC (µg.m^{-3})				Max PC + total of other developments (µg.m^{-3})					Max PEC (µg.m^{-3})	Max PEC + as % of EAL
Pollutant	Averaging Period	EAL (µg.m^{-3})	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	K3 Proposed Development	Practical effect of the K3 Proposed Development	WKN	WKN + K3 Proposed Development	WKN + the practical effect of the K3 Proposed Development	K3 Proposed Development + WKN + AC + other developments	
PM_{10}	24 hour (90.41st percentile)	50	-	-	-	0.38	0.7	0.4	0.7	1.0	0.7	20.4	41
	24 hour (annual mean)	40	-	-	-	0.12	0.2	0.1	0.2	0.3	0.2	19.7	49
$PM_{2.5}$	24 hour (annual mean)	25	-	-	-	0.12	0.2	0.1	0.2	0.3	0.2	10.8	43
HCl	1 hour (maximum)	750	-	-	-	2.26	4.8	2.5	4.3	6.8	4.6	8.0	1
HF	1 hour (maximum)	160	-	-	-	0.23	0.5	0.3	0.4	0.7	0.5	3.1	2
SO_2	15 minute (99.90th percentile)	266	-	-	-	8.34	19.7	9.5	17.4	28.7	18.5	50.8	19
	1 hour (99.73th percentile)	350	-	-	-	7.48	16.8	8.3	15.2	24.6	16.0	40.2	11
	24 hour (99.18th percentile)	125	-	-	-	3.37	7.4	3.8	7.4	11.4	7.8	19.4	16
	1 hour (annual mean)	50	-	-	-	-	0.5	0.0	0.5	1.0	0.5	3.1	6

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			Max PC (µg.m^{-3})				Max PC + total of other developments (µg.m^{-3})					Max PEC (µg.m^{-3})	Max PEC + as % of EAL
Pollutant	Averaging Period	EAL (µg.m^{-3})	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	K3 Proposed Development	Practical effect of the K3 Proposed Development	WKN	WKN + K3 Proposed Development	WKN + the practical effect of the K3 Proposed Development	K3 Proposed Development + WKN + AC + other developments	
NO_2	1 hour (99.79th percentile)	200	12.79	18.10	19.57	10.70	75.1	62.5	72.2	86.1	73.5	149.6	75
	1 hour (annual mean)	40	0.7	1.3	0.9	1.62	6.0	4.6	6.0	7.4	6.1	39.1	98
CO	8 hour (maximum daily running)	10,000	20	-	-	6.97	35.7	27.7	34.9	43.6	35.6	577.7	6
Cd	1 hour (annual mean)	0.005	-	-	-	5.800E-04	1.09E-03	6.17E-04	1.08E-03	1.59E-03	1.12E-03	1.21E-03	34
Tl	1 hour (maximum)	30	-	-	-	1.100E-02	2.35E-02	1.24E-02	2.14E-02	3.39E-02	2.27E-02	2.35E-02	0
	1 hour (annual mean)	1	-	-	-	5.800E-04	1.09E-03	6.17E-04	1.08E-03	1.59E-03	1.12E-03	1.09E-03	0
Hg	1 hour (maximum)	7.5	-	-	-	1.100E-02	2.35E-02	1.24E-02	2.14E-02	3.39E-02	2.27E-02	2.43E-02	0
	1 hour (annual mean)	0.25	-	-	-	5.800E-04	1.09E-03	6.17E-04	1.08E-03	1.59E-03	1.12E-03	1.87E-03	1
Sb	1 hour (maximum)	150	-	-	-	1.130E-01	2.38E-01	1.27E-01	2.17E-01	3.42E-01	2.30E-01	2.38E-01	0

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			Max PC (µg.m^{-3})				Max PC + total of other developments (µg.m^{-3})					Max PEC (µg.m^{-3})	Max PEC + as % of EAL
Pollutant	Averaging Period	EAL (µg.m^{-3})	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	K3 Proposed Development	Practical effect of the K3 Proposed Development	WKN	WKN + K3 Proposed Development	WKN + the practical effect of the K3 Proposed Development	K3 Proposed Development + WKN + AC + other developments	
	1 hour (annual mean)	5	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.09E-02	0
As	1 hour (annual mean)	0.003	-	-	-	0.000638	5.70E-03	1.00E-03	5.68E-03	1.07E-02	6.04E-03	6.47E-03	384
Cr	1 hour (maximum)	150	-	-	-	1.130E-01	2.38E-01	1.27E-01	2.17E-01	3.42E-01	2.30E-01	2.38E-01	0
	1 hour (annual mean)	5	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.22E-02	0
Co	1 hour (maximum)	6	-	-	-	1.130E-01	2.38E-01	1.27E-01	2.17E-01	3.42E-01	2.30E-01	2.38E-01	6
	1 hour (annual mean)	0.2	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.09E-02	8
Cu	1 hour (maximum)	200	-	-	-	1.130E-01	2.38E-01	1.27E-01	2.17E-01	3.42E-01	2.30E-01	2.43E-01	0
	1 hour (annual mean)	10	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.54E-02	0
Pb	1 hour (annual mean)	0.25	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.70E-02	9
Mn	1 hour (maximum)	1500	-	-	-	1.130E-01	2.38E-01	1.27E-01	2.17E-01	3.42E-01	2.30E-01	2.42E-01	0

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			Max PC ($\mu g.m^{-3}$)				Max PC + total of other developments ($\mu g.m^{-3}$)					Max PEC ($\mu g.m^{-3}$)	Max PEC + as % of EAL
Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	K3 Proposed Development	Practical effect of the K3 Proposed Development	WKN	WKN + K3 Proposed Development	WKN + the practical effect of the K3 Proposed Development	K3 Proposed Development + WKN + AC + other developments	
	1 hour (annual mean)	0.15	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.41E-02	13
Ni	1 hour (annual mean)	0.02	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.15E-02	83
V	1 hour (maximum)	5	-	-	-	6.000E-03	1.31E-01	1.96E-02	1.10E-01	2.35E-01	1.23E-01	1.32E-01	5
	1 hour (annual mean)	1	-	-	-	5.800E-03	1.09E-02	6.17E-03	1.08E-02	1.59E-02	1.12E-02	1.15E-02	2
Dioxins & Furans	1 hour (annual mean)	-	-	-	-	1.200E-09	2.21E-09	1.27E-09	2.20E-09	3.22E-09	2.27E-09	1.25E-08	
PAHs	1 hour (annual mean)	0.00025	-	-	-	1.200E-06	1.13E-05	1.87E-06	1.12E-05	2.14E-05	1.19E-05	1.07E-04	47
PCB	1 hour (annual mean)	0.2	-	-	-	1.200E-07	5.07E-05	3.46E-06	5.05E-05	1.01E-04	5.38E-05	1.51E-04	0
NH_3	1 hour (annual mean)	5	-	-	-	1.160E-01	1.67E-01	1.19E-01	1.66E-01	2.17E-01	1.70E-01	1.16E+00	24

Table 5.49 Cumulative Predicted Environmental Concentrations at Long-Term Emission Limit Values

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5.13.11 The values presented in Table 5.48 and 5.49 are the predictions at the location of maximum impact. In reality, the maximum impacts for each stack are unlikely to occur at the same location. Therefore, the results in these tables can be considered highly conservative.

5.13.12 The results presented in Table 5.48 show that the cumulative PECs are below the EAL for all pollutants and the effects are therefore not considered significant.

5.13.13 The results presented in Table 5.49 show that the cumulative PECs are below the relevant EALs for all pollutants except As (arsenic).

5.13.14 For As (arsenic) the predictions are based on the assumption that arsenic comprises the total of the group 3 metals emissions. In reality, the IED emission limit applies to all nine of the group 3 metals. If the predicted PC is assumed to apply equally to each of the nine group 3 metals, i.e. the PC for As is divided by 9, the predicted cumulative PEC for As would be less than 100% of the EAL as shown in Table 5.50 and the effects are therefore not considered significant.

Pollutant	Averaging Period	EAL ($\mu g.m^{-3}$)	K3 Proposed Development + WKN + other developments ($\mu g.m^{-3}$)		K3 Proposed Development + WKN + other developments + AC ($\mu g.m^{-3}$)	
			Max PC ($\mu g.m^{-3}$)	Max PC as % of EAL	Max PEC ($\mu g.m^{-3}$)	Max PEC as % of EAL
As	1 hour (annual mean)	0.003	1.19E-03	39.8	1.97E-03	66

Table 5.50 Cumulative Predicted Environmental Concentrations at Long-Term Emission Limit Values

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Other Cumulative Sites Considered - Traffic-related Emissions

5.13.15 An assessment of cumulative traffic-related emissions has been undertaken for the following scenarios:

- With and Without the WKN Proposed Development construction traffic and K3 Proposed Development in the opening year of the K3 Proposed Development, 2021.
- With and Without the WKN and K3 Proposed Development traffic in the opening year of WKN, 2024.

5.13.16 Both of these scenarios are based on traffic data that considers a number of other cumulative developments.

5.13.17 The practical effect of the K3 Proposed Development would be an additional 68 HGV movements per day on the A259, Barge Way and part of the Swale Way above that associated with K3 as consented. The indicative EPUK/IAQM criterion of 100 vehicles outside an AQMA is therefore not exceeded and the impacts are not considered to be significant.

5.13.18 Chapter 4: Traffic and Transport discusses in detail the cumulative traffic data and the cumulative developments included in each scenario are summarised below.

5.13.19 The traffic data includes the following committed developments:

- SW/18/503317 Amendment K3 to allow for additional Refuse Collection Vehicles
- Removal of vehicles associated with the IBA facility adjacent to the Wheelabrator Kemsley Generating Station (KCC/SW/0265/2016).
- 16/501484/COUNTY – 1 km north - Construction of a gypsum recycling building on land at Ridham Dock.
- 14/500327/OUT – 250 m south - Development of Fulcrum Business Park and extension to Milton Creek Country Park.
- 15/510589/OUT – 2.2 km south- Development of a business park (Eurolink V) on land north of Northern Relief Road.
- 15/500348/COUNTY – 800 m northwest - Land Off Kemsley Fields Business Park Barge Way Sittingbourne Kent. Installation of advance thermal conversion and energy facility at Kemsley Fields Business Park to produce energy and heat, including construction of new buildings to house thermal conversion and energy generation plant and equipment; construction of associated offices; erection of external plant including storage tanks; and erection of discharge stack (KCC planning application KCC/SW/0010/2015 refers).
- 17/505073/FULL- 800 m south - Erection of a tile factory including service yard, storage yard and car parking area.
- 14/501588/OUT Outline application for the development of 550-600 houses and all necessary supporting infrastructure including roads, open space, play areas, neighbourhood shopping/community facilities (up to 650 sq m gross) and landscaping. All detailed matters are reserved for subsequent approval except (i) vehicular access to A2 Fox Hill; (ii) emergency access to Peel Drive; (iii) landscape buffer between housing and countryside gap and (iv) layout, planting, biodiversity enhancement and management of countryside gap, as amended by drawings 5257/OPA/SK001 Rev J (new red line plan), D119/52 (Swanstree Avenue Plan) and D119/53 (junction layout plan). At this stage only the scoping report has been submitted and so the lack of information means it is not possible to include this development.
- 16/507877/FULL Erection of a residential development comprising 383 dwellings including associated access, parking, public open spaces and landscaping. New vehicular/pedestrian access from Eurolink Way and further secondary vehicular/pedestrian access off Crown Quay Lane. Associated drainage and earthworks.
- 16/507594/COUNTY County Matter - phased extraction of brickearth, advance planting, access improvements, restoration and replanting back to agricultural use.

- 16/501228/FULL Construction of a new baling plant building within an existing waste paper storage yard.
- SW/95/0099 G-Park Industrial and business park.

5.13.20 The 2021 cumulative traffic data includes two additional developments:

- EN010090 (18/501923/ADJ)) Kemsley K4 CHP - Construction traffic
- 18/500393/FULL Natural gas fuelled reserve power plant - Construction traffic

5.13.21 The 2024 cumulative traffic data includes four additional developments included in the Swale Borough Council Bearing Fruit 2031 Local Plan 2017 Allocations:

- A17 Iwade Expansion – Construction traffic
- MU1 North West Sittingbourne - minimum of 1,500 dwellings, community facilities and structural landscaping and open space adjacent the A249. – part operational/part construction traffic
- MU2 mixed use development comprising 43,000 sq m of 'B' use class employment uses, approximately 106 dwellings, together with 31.1 ha of open space, flooding, biodiversity and landscape enhancements – Construction traffic
- MU3 Planning permission will be granted for a minimum of 564 dwellings, commercial floorspace (including potential neighbourhood facilities), landscaping and open space on land at south-west Sittingbourne (Borden) – Construction traffic

5.13.22 The following Swale Borough Council Bearing Fruit 2031 Local Plan 2017 Allocations were not included in the 2021 or 2024 cumulative traffic data either because of the geographical location or the likely timing of the development. More detail is provided in Chapter 4: Traffic and Transport:

- A1 Land allocated for 'B' class employment uses
- A10 Housing allocations for a mix of at least 240 dwellings
- A3 Planning permission will be granted for employment uses (use classes B1, B2 or B8)
- A4 Planning permission will be granted for employment uses on sites north and south of the A249 at Cowstead Corner, as shown on the Proposals Map. The northern site is allocated for a hotel (use class C1), whilst the southern site for use classes B1, B2 or B8.
- MU4 Planning permission will be granted for mixed uses comprising approximately 260 dwellings, 26,840 sqm of 'B' use class employment, open space and landscaping

- MU5 Planning permission will be granted for mixed-uses, comprising 1,500 sqm of commercial floorspace, together with some 330 homes and proposals for the conservation, enhancement, and long term management of the site's ecological and heritage assets

5.13.23 The effects of these additional cumulative developments have not been specifically assessed as the traffic generated would increase the future baseline concentration only; the difference between the 'with development' and 'without development' scenarios would remain the same. If the change is small (i.e. less than 1% of the AQS Objective) the impact descriptors would be 'negligible' at all receptors regardless of the absolute concentration.

Results of Cumulative Traffic Modelling - WKN Proposed Development construction traffic and K3 Proposed Development in the opening year of the K3 Proposed Development, 2021.

5.13.24 Earlier traffic modelling in this chapter (Tables 5.43 to 5.46), provides the predicted impacts with WKN operating with the K3 Permitted Development.

5.13.25 Tables 5.51, 5.52 and 5.53 present the annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted at the facades of the receptors outlined in Table 5.14 for the WKN Proposed Development Construction traffic and K3 Proposed Development in the opening year of the K3 Proposed Development, 2021. The difference between the *Without development* and *With development* scenarios in this case is the following:

- WKN Proposed Development construction traffic emissions
- K3 Proposed Development operational traffic emission
- K3 Proposed Development stack emissions
- Other cumulative developments traffic emissions

5.13.26 The Impact Descriptor has been derived based on EPUK&IAQM guidance. The methodology and significance criteria for the traffic modelling are provided in Appendix 5.5.

Receptor ID	Concentration (μg.m^{-3})			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	With Development		
R1	16.6	0.56	17.3	2	Negligible
R2	18.5	0.58	19.6	3	Negligible
R3	16.2	0.48	16.8	2	Negligible
R4	13.8	0.32	14.2	1	Negligible
R5	13.7	0.32	14.0	1	Negligible
R6	15.2	0.15	15.4	0	Negligible
R7	15.6	0.13	15.8	1	Negligible
R8	26.9	0.29	27.7	2	Negligible
R9	26.9	0.18	27.7	2	Negligible
R10	21.8	0.11	22.2	1	Negligible

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Receptor ID	Concentration (µg.m-3)			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	With Development		
R11	14.0	0.12	14.2	0	Negligible
R12	13.4	0.14	13.6	0	Negligible
R13	13.2	0.08	13.3	0	Negligible
R14	13.7	0.10	13.8	0	Negligible
R15	23.2	0.06	23.3	0	Negligible
R16	26.4	0.05	26.5	0	Negligible
R17	22.2	0.06	22.4	0	Negligible
R18	13.3	0.04	13.3	0	Negligible
R19	24.8	0.35	26.0	3	Negligible
R20	21.1	0.58	22.4	3	Negligible
Maximum	**26.9**	**0.58**	**27.7**	-	-
Minimum	**13.2**	**0.04**	**13.3**	-	-

Table 5.51 Predicted Annual-Mean NO_2 Impacts at Receptors – WKN Proposed Development Construction Traffic and K3 Proposed Development

Receptor ID	Concentration (µg.m-3)			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	With Development		
R1	16.3	0.08	16.4	0	Negligible
R2	16.8	0.10	17.1	1	Negligible
R3	16.1	0.08	16.3	0	Negligible
R4	15.6	0.05	15.7	0	Negligible
R5	15.6	0.04	15.6	0	Negligible
R6	15.9	0.02	15.9	0	Negligible
R7	16.0	0.02	16.0	0	Negligible
R8	18.4	0.04	18.6	1	Negligible
R9	18.4	0.03	18.6	1	Negligible
R10	17.3	0.02	17.4	0	Negligible
R11	15.6	0.02	15.7	0	Negligible
R12	15.5	0.02	15.5	0	Negligible
R13	15.5	0.01	15.5	0	Negligible
R14	15.5	0.01	15.6	0	Negligible
R15	16.5	0.01	16.5	0	Negligible
R16	16.8	0.01	16.8	0	Negligible
R17	16.5	0.01	16.5	0	Negligible
R18	15.5	0.01	15.5	0	Negligible
R19	18.2	0.06	18.5	1	Negligible
R20	17.5	0.09	17.8	1	Negligible
Maximum	**18.4**	**0.10**	**18.6**	-	-
Minimum	**15.5**	**0.01**	**15.5**	-	-

Table 5.52 Predicted Annual-Mean PM_{10} Impacts at Receptors – WKN Proposed Development Construction Traffic and K3 Proposed Development

Receptor ID	Concentration (µg.m-3)			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	With Development		
R1	11.1	0.08	11.2	0	Negligible
R2	11.5	0.10	11.7	0	Negligible

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Receptor ID	Concentration ($\mu g.m^{-3}$)			With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	With Development		
R3	11.1	0.08	11.2	0	Negligible
R4	10.8	0.05	10.8	0	Negligible
R5	10.8	0.04	10.8	0	Negligible
R6	10.9	0.02	10.9	0	Negligible
R7	11.0	0.02	11.0	0	Negligible
R8	12.4	0.04	12.5	0	Negligible
R9	12.4	0.03	12.5	0	Negligible
R10	11.7	0.02	11.8	0	Negligible
R11	10.8	0.02	10.8	0	Negligible
R12	10.7	0.02	10.7	0	Negligible
R13	10.7	0.01	10.7	0	Negligible
R14	10.7	0.01	10.8	0	Negligible
R15	11.4	0.01	11.4	0	Negligible
R16	11.6	0.01	11.6	0	Negligible
R17	11.3	0.01	11.4	0	Negligible
R18	10.7	0.01	10.7	0	Negligible
R19	12.2	0.06	12.4	0	Negligible
R20	11.8	0.09	12.1	1	Negligible
Maximum	**12.4**	**0.10**	**12.5**	-	-
Minimum	**10.7**	**0.01**	**10.7**	-	-

Table 5.53 Predicted Annual-Mean $PM_{2.5}$ Impacts at Receptors – WKN Proposed Development Construction Traffic and K3 Proposed Development

5.13.27 Predicted annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations in the opening year of the K3 Proposed Development at the façades of the existing receptors are below the relevant AQS objectives. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptors are 'negligible' at all receptors.

5.13.28 As all predicted annual-mean NO_2 concentrations are below 60 $\mu g.m^{-3}$, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

5.13.29 As all predicted annual mean PM_{10} concentrations are below 31.5 $\mu g.m^{-3}$, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

5.13.30 Overall, the impact on the surrounding area from NO_2, PM_{10} and $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

<u>Results of Cumulative Traffic Modelling - WKN and K3 Proposed Development traffic in the opening year of WKN, 2024.</u>

5.13.31 Tables 5.54, 5.55 and 5.56 present the annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted at the facades of the receptors outlined in Table 5.14 for the WKN and K3 Proposed Development in the opening year of WKN, 2024. The

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difference between the *Without development* and *With development* scenarios are the following:

- WKN Proposed Development operational traffic emissions
- WKN stack emissions
- K3 Proposed Development operational traffic emissions
- K3 Proposed Development stack emissions
- Other cumulative developments traffic emissions

5.13.32 An Impact Descriptor has been derived based on EPUK&IAQM guidance. The methodology and significance criteria for the traffic modelling are provided in Appendix 5.5.

Receptor ID	Concentration ($\mu g.m^{-3}$)				With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	WKN Stack Emissions	With Development		
R1	15.5	0.56	0.52	16.6	3	Negligible
R2	16.7	0.58	0.83	18.4	4	Negligible
R3	15.2	0.48	0.61	16.4	3	Negligible
R4	13.5	0.32	0.32	14.1	2	Negligible
R5	13.4	0.32	0.29	14.0	2	Negligible
R6	14.5	0.15	0.17	14.9	1	Negligible
R7	14.8	0.13	0.19	15.2	1	Negligible
R8	23.1	0.29	0.29	24.2	3	Negligible
R9	23.1	0.18	0.19	24.0	2	Negligible
R10	19.3	0.11	0.11	19.8	1	Negligible
R11	13.6	0.12	0.12	13.9	1	Negligible
R12	13.2	0.14	0.12	13.4	1	Negligible
R13	13.0	0.08	0.09	13.2	0	Negligible
R14	13.4	0.10	0.11	13.6	1	Negligible
R15	20.6	0.06	0.06	20.7	0	Negligible
R16	23.1	0.05	0.05	23.3	0	Negligible
R17	19.8	0.06	0.06	20.1	1	Negligible
R18	13.1	0.04	0.04	13.2	0	Negligible
R19	21.4	0.35	0.57	22.8	3	Negligible
R20	18.6	0.58	0.76	20.3	4	Negligible
Maximum	**23.1**	**0.58**	**0.83**	**24.2**	-	-
Minimum	**13.0**	**0.04**	**0.04**	**13.2**	-	-

Table 5.54 Predicted Annual-Mean NO_2 Impacts at Receptors – WKN and K3 Proposed Development

Receptor ID	Concentration ($\mu g.m^{-3}$)				With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	WKN Stack Emissions	With Development		
R1	16.2	0.08	0.04	16.4	0	Negligible
R2	16.8	0.10	0.06	17.1	1	Negligible
R3	16.1	0.08	0.04	16.3	0	Negligible
R4	15.6	0.05	0.02	15.7	0	Negligible

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Receptor ID	Concentration (µg.m^{-3})				With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	WKN Stack Emissions	With Development		
R5	15.6	0.04	0.02	15.6	0	Negligible
R6	15.8	0.02	0.01	15.9	0	Negligible
R7	16.0	0.02	0.01	16.0	0	Negligible
R8	18.3	0.04	0.02	18.6	1	Negligible
R9	18.3	0.03	0.01	18.5	1	Negligible
R10	17.2	0.02	0.01	17.4	0	Negligible
R11	15.6	0.02	0.01	15.7	0	Negligible
R12	15.5	0.02	0.01	15.5	0	Negligible
R13	15.5	0.01	0.01	15.5	0	Negligible
R14	15.5	0.01	0.01	15.6	0	Negligible
R15	16.4	0.01	<0.005	16.5	0	Negligible
R16	16.7	0.01	<0.005	16.7	0	Negligible
R17	16.4	0.01	<0.005	16.4	0	Negligible
R18	15.5	0.01	<0.005	15.5	0	Negligible
R19	18.1	0.06	0.04	18.4	1	Negligible
R20	17.4	0.09	0.05	17.7	1	Negligible
Maximum	**18.3**	**0.10**	**0.06**	**18.6**		-
Minimum	**15.5**	**0.01**	**<0.005**	**15.5**	-	-

Table 5.55 Predicted Annual-Mean PM_{10} Impacts at Receptors – WKN and K3 Proposed Development

Receptor ID	Concentration (µg.m^{-3})				With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	K3 Stack Emissions	WKN Stack Emissions	With Development		
R1	11.1	0.08	0.04	11.2	0	Negligible
R2	11.4	0.10	0.06	11.7	1	Negligible
R3	11.0	0.08	0.04	11.2	0	Negligible
R4	10.8	0.05	0.02	10.8	0	Negligible
R5	10.7	0.04	0.02	10.8	0	Negligible
R6	10.9	0.02	0.01	10.9	0	Negligible
R7	11.0	0.02	0.01	11.0	0	Negligible
R8	12.2	0.04	0.02	12.4	0	Negligible
R9	12.2	0.03	0.01	12.4	0	Negligible
R10	11.7	0.02	0.01	11.8	0	Negligible
R11	10.8	0.02	0.01	10.8	0	Negligible
R12	10.7	0.02	0.01	10.7	0	Negligible
R13	10.7	0.01	0.01	10.7	0	Negligible
R14	10.7	0.01	0.01	10.8	0	Negligible
R15	11.3	0.01	<0.005	11.3	0	Negligible
R16	11.5	0.01	<0.005	11.5	0	Negligible
R17	11.3	0.01	<0.005	11.3	0	Negligible
R18	10.7	0.01	<0.005	10.7	0	Negligible
R19	12.1	0.06	0.04	12.4	1	Negligible
R20	11.8	0.09	0.05	12.0	1	Negligible
Maximum	**12.2**	**0.10**	**0.06**	**12.4**	-	-
Minimum	**10.7**	**0.01**	**<0.005**	**10.7**	-	-

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Table 5.56 Predicted Annual-Mean $PM_{2.5}$ Impacts at Receptors – WKN and K3 Proposed Development

5.13.33 Predicted annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations in the opening year of the WKN Proposed Development at the façades of the existing receptors are below the relevant AQS objectives. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptors are 'negligible' at all receptors.

5.13.34 As all predicted annual-mean NO_2 concentrations are below 60 $\mu g.m^{-3}$, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

5.13.35 As all predicted annual mean PM_{10} concentrations are below 31.5 $\mu g.m^{-3}$, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

5.13.36 Overall, the impact on the surrounding area from NO_2, PM_{10} and $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Summary of Cumulative Effects

K3 Proposed Development + other cumulative developments

5.13.37 As shown in Table 5.48 – 5.50 and discussed in paragraphs 5.13.11 to 5.13.14, the cumulative effects across the grid for the K3 Proposed Development + other cumulative developments are considered to be not significant.

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Practical effect of the K3 Proposed Development + other cumulative developments

5.13.38 As shown in Table 5.48 – 5.50 and discussed in paragraphs 5.13.11 to 5.13.14, the cumulative effects across the grid for the increase in K3 + other cumulative developments are considered to be not significant.

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WKN Proposed Development + other cumulative developments

5.13.39 As shown in Table 5.48 – 5.50 and discussed in paragraphs 5.13.11 to 5.13.14, the cumulative effects across the grid for the WKN Proposed Development + other cumulative developments are considered to be not significant.

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WKN Proposed Development + K3 Proposed Development + other cumulative developments.

5.13.40 As shown in Table 5.48 – 5.50 and discussed in paragraphs 5.13.11 to 5.13.14, the cumulative effects across the grid for the WKN Proposed Development + K3 Proposed Development + other cumulative developments are considered to be not significant.

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WKN Proposed Development + practical effect of the K3 Proposed Development + other cumulative developments.

5.13.41 As shown in Table 5.48 – 5.50 and discussed in paragraphs 5.13.11 to 5.13.14, the cumulative effects across the grid for the WKN Proposed Development + increase in K3 + other cumulative developments are considered to be not significant.

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5.13.42 When considering the cumulative effects of traffic-related and stack emissions at sensitive receptors, the cumulative effects are considered to be not significant.

5.14 Summary

5.14.1 A detailed air quality assessment predicting the potential effects of emissions generated during the construction and operation of the WKN and K3 Proposed Development has been undertaken.

5.14.2 Impacts during the construction, such as dust generation and plant vehicle emissions, are predicted to be of short duration and only relevant during the construction phase. The results of the risk assessment of construction dust impacts undertaken using the IAQM dust guidance, indicate that before the implementation of mitigation and controls, the risk of dust impacts will be medium. Implementation of the 'highly recommended' mitigation measures described in the IAQM construction dust guidance is likely to reduce the residual dust effects to a level categorised as "not significant".

5.14.3 Stack emissions from the K3 and WKN Proposed Development have been assessed through detailed dispersion modelling using best practice approaches. The assessment has been undertaken based on a number of conservative assumptions. This is likely to result in an over-estimate of the contributions that will arise in practice from the facility. The results of dispersion modelling reported in this assessment indicate that predicted contributions and resultant environmental concentrations of all pollutants considered would be of 'negligible' significance.

5.14.4 The operational impact of the K3 and WKN Proposed Developments on existing receptors in the local area are predicted to be 'negligible' taking into account the changes in pollutant concentrations and absolute levels.

5.14.5 The main dust mitigation measure is containment. Taking into account the fact that the processes would be largely contained, and the relative distance to sensitive receptors, the risk of dust impacts during operation is predicted to be not significant based on professional judgement.

5.14.6 The risk of odour and bioaerosol impacts has been assessed qualitatively using a source-pathway-receptor conceptual model. The likely odour and bioaerosol effect is negligible.

5.14.7 Overall the air quality effects of the K3 and WKN Proposed Developments, both separately and cumulatively, are not considered to be significant.

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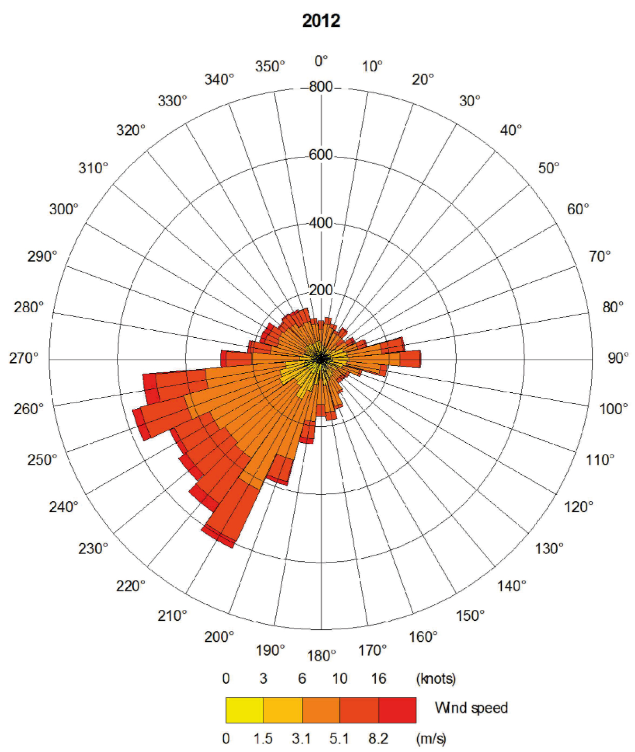

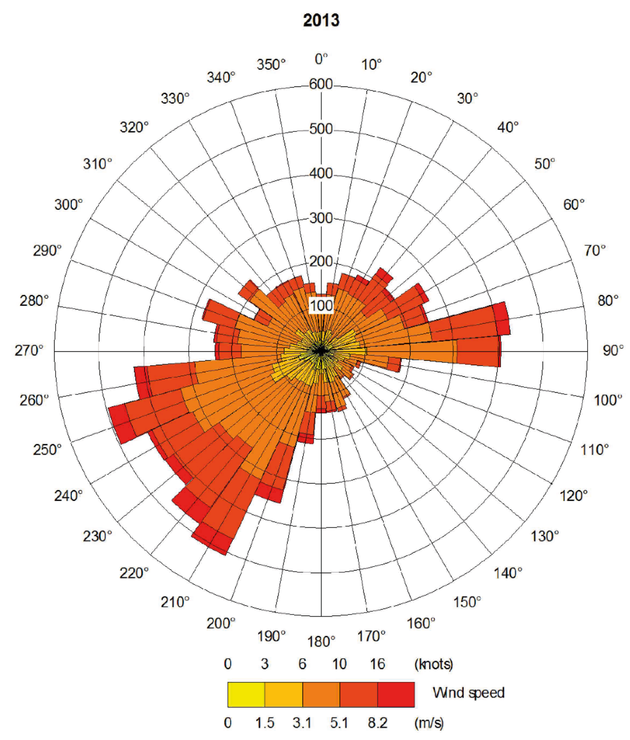

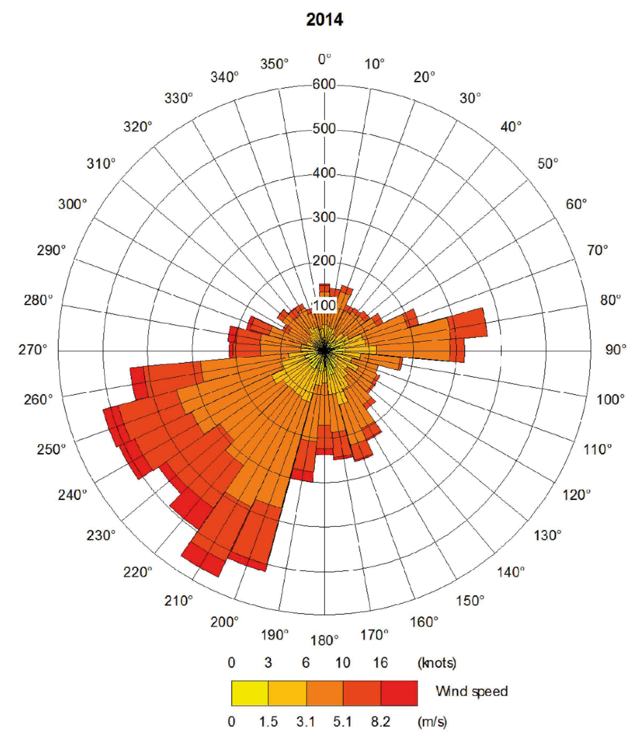

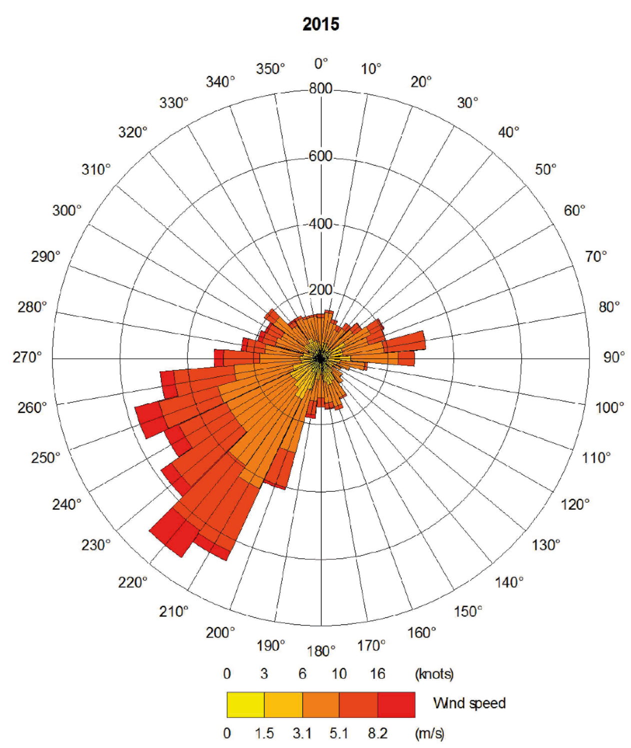

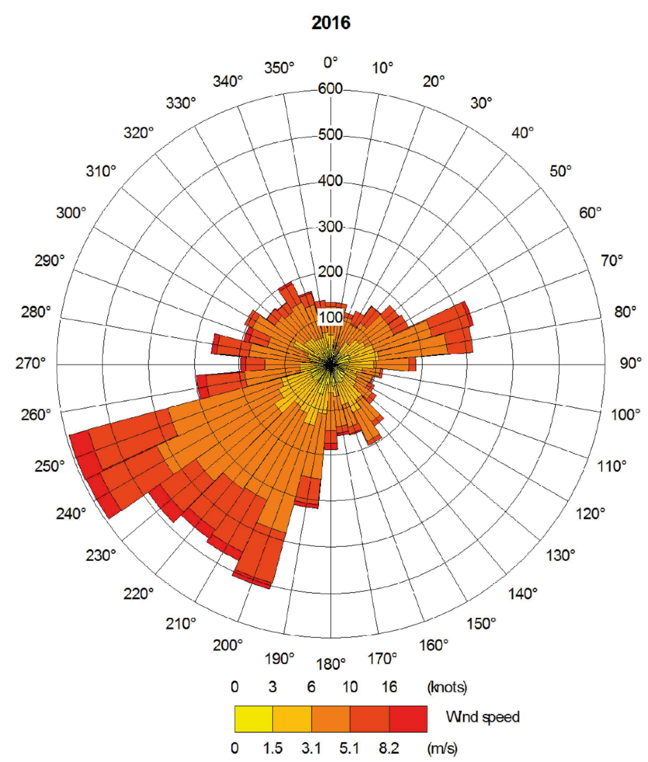

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Project: K3 and WKN DCO

Title Gravesend Windroses

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OXF9812	NTS	NOV 2018

Figure Number

5.1

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Client: Wheelabrator Technologies Inc

Project: K3 and WKN DCO

Title: Locations of stacks, receptors and AQMAs

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Final	FP/CR	KB
Job Ref	Scale @ A3	Date Created
OXF9812	NTS	NOV 2018

Figure Number
5.2

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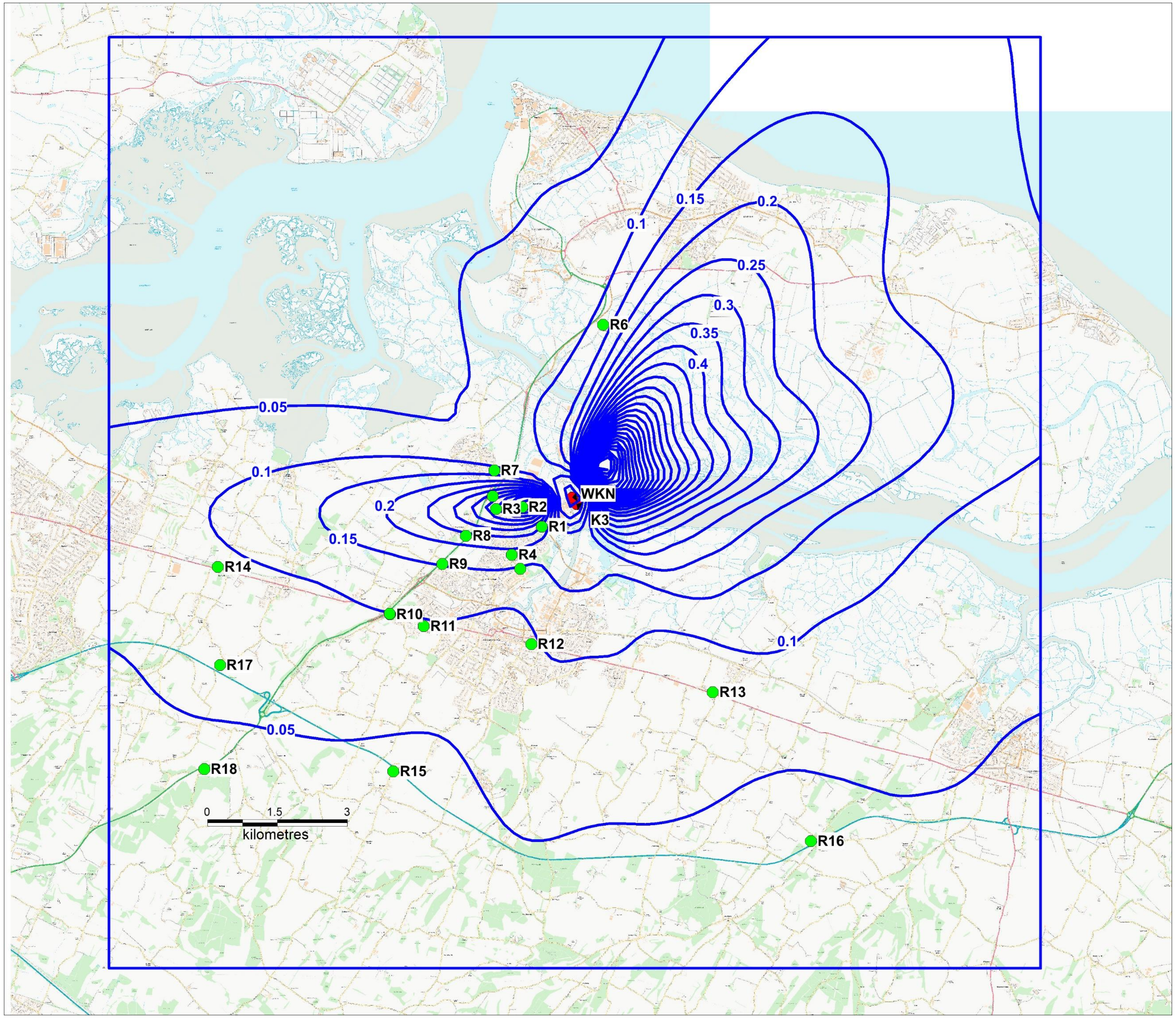

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Client: Wheelabrator Technologies Inc

Project: K3 and WKN DCO

Title: Contour of Annual-mean NO2 PCs (Increase in K3 and WKN)

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Job Ref	**Scale @ A3**	**Date Created**
OXF9812	NTS	MARCH 2020

Figure Number
5.3

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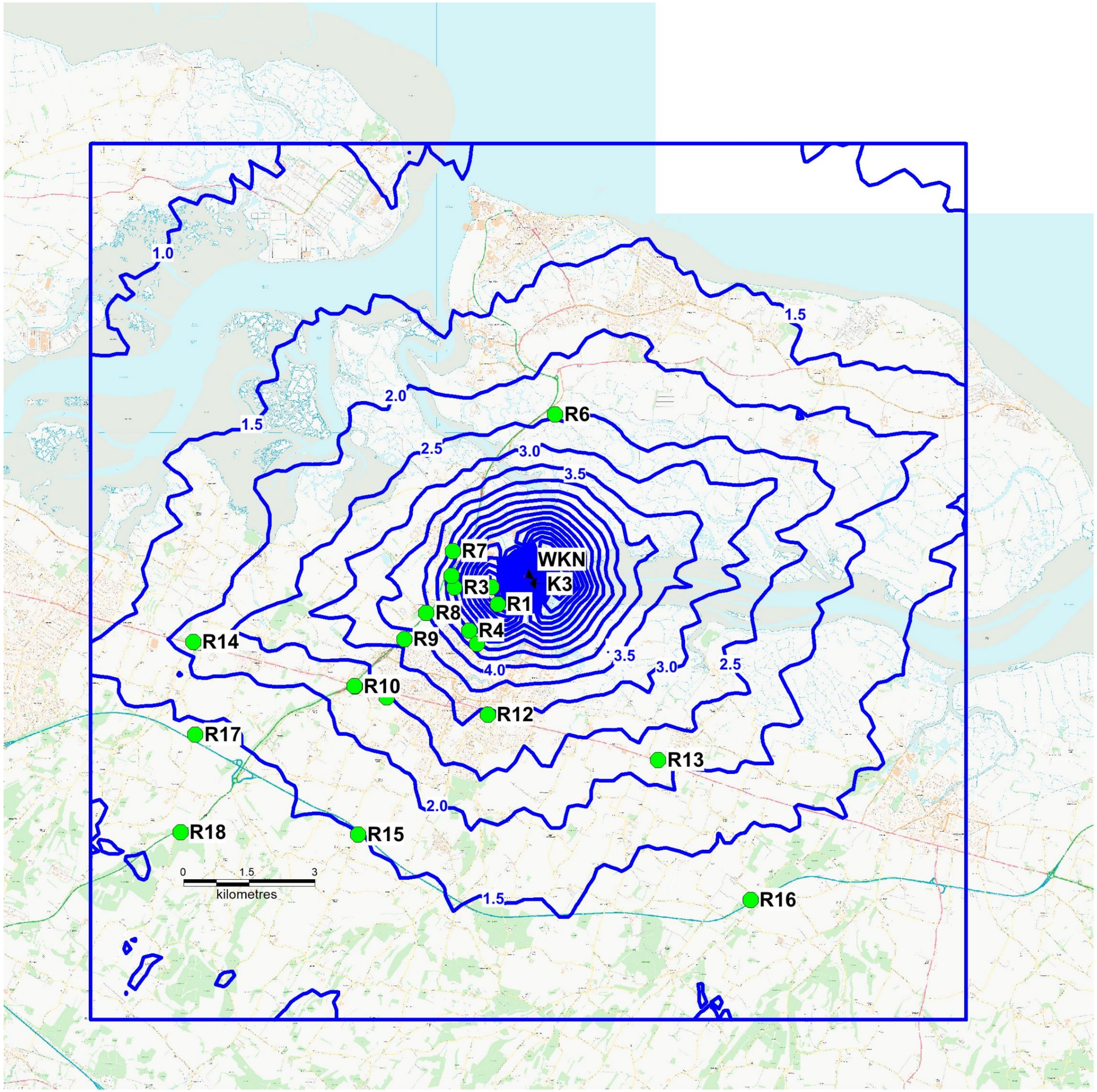

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Client: Wheelabrator Technologies Inc

Project: K3 and WKN DCO

Title: Contour of 99.79th Pecentile Hourly-mean NO2 PCs (Increase in K3 and WKN)

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Final	FP/CR	KB
Job Ref	Scale @ A3	Date Created
OXF9812	NTS	NOV 2018

Figure Number
5.4

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