Kimberly Clark

Kimberly Clark Northfleet Paper Mill

Air Quality Assessment

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RSK GENERAL NOTES

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Abbreviations

AER	Air Emissions Risk
AQO	Air Quality Objective
AQS	Air Quality Standard
AQMA	Air Quality Management Area
BAT	Best Available Technique
CLe	Critical Level
CLo	Critical Load
CO	Carbon Monoxide
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environment Assessment Level
EC	European Commission
EIP	Environmental Improvement Plan
ELV	Emission Limit Value
EPR	Environmental Permit Regulations
EPUK	Environmental Protection United Kingdom
EU	European Union
GBC	Gravesham Borough Council
IAQM	Institute of Air Quality Management
KC	Kimberly Clark
LAQM	Local Air Quality Management
LNR	Local Nature Reserve
LWS	Local Wildlife Site
MCPD	Medium Combustion Plant Directive
NNR	National Nature Reserve
NO_2	Nitrogen dioxide
NOx	Oxides of nitrogen
NPPF	National Planning Policy Framework
PC	Process Contribution
PEC	Predicted Environmental Concentration
SAC	Special Areas of Conservation
SSSI	Sites of Special Scientific Interest
SPA	Special Protection Area

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1 INTRODUCTION

RSK Environment Ltd (RSK) has been commissioned to undertake an air quality assessment to support the planning application for two new dual-fuelled (natural gas and hydrogen) boilers at Kimberly Clark's (KC) paper mill in Northfleet, Gravesend.

The facility produces tissue products and operates a single tissue machine, with a total capacity of 35,000 air-dried tonnes (ADT) per year. The facility's heat and steam requirements are met by two of three natural gas-fired boilers, configured in a duty/duty/standby setup, with a combined maximum output of 24 MWth (two boilers). It is proposed that the three natural gas-fired boilers and associated combined stack be replaced with two new dual-fuelled boilers (primarily hydrogen-fuelled) and two new stacks, configured in a duty/standby setup.

The following report presents the findings of an assessment of the impacts of emissions of nitrogen dioxide (NO_2) and carbon monoxide (CO) on nearby human receptors, as well as the impacts of oxides of nitrogen (NOx), and subsequent impacts of nutrient nitrogen and acid deposition on nearby sensitive ecological receptors. As referenced within the Environment Agency's hydrogen combustion guidance[1], only emissions of NOx (or NO_2) and CO need to be considered from hydrogen gas-fuelled plant. This assessment has considered both the long- and short-term air quality impacts of the proposed boilers by considering the existing and proposed situations.

The site, as presented in **Figure 1.1**, lies within the jurisdiction of Gravesham Borough Council (GBC), which contains three Air Quality Management Areas (AQMAs). The site is not located within any of the declared AQMAs.

The proposed replacement of the boiler systems is not expected to alter the onsite operations. As a result, it is anticipated that vehicle generation at the site will remain unchanged, and the related impacts of vehicle emissions have been screened from further consideration. Additionally, due to the construction activities proposed, which will be limited in nature, associated with materials that represent a low risk for dust generation (metallic structures, etc.), and at distances to ecological receptors greater than the screening distances provided by the Institute for Air Quality Management (IAQM), dust impacts require no further consideration.

[1] https://www.gov.uk/guidance/hydrogen-combustion-comply-with-emission-limit-values

Figure 1.1: Red line boundary of the Kimberly Clark Northfleet Paper Mill

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2 LEGISLATION & GUIDANCE

2.1 Key Legislation and Policy

2.1.1 Air Quality Regulations

The air quality standards (AQSs) and air quality objectives (AQOs) in the United Kingdom are derived from European Commission (EC) directives and are adopted into English law via the Air Quality (England) Regulations 2000 and Air Quality (England) Amendment Regulations 2002. EU Directives 2008/50/EC and 2004/107/EC set limits values and was translated into English law in 2010 via the Air Quality Standards Regulations 2010. The European Union (Withdrawal) Act retains existing EU environmental provisions in the UK.

2.1.2 Environment Act 2021

The Environment Act provides a mechanism to set long-term, legally binding environmental targets, including those for air pollution. The Act requires the government to have an Environmental Improvement Plan (EIP) covering at least 15 years and setting out steps it intends to take to improve the environment.

As part of the Environment Act, the Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 now sets targets for $PM_{2.5}$.

2.1.3 Clean Air Act 1993

The Clean Air Act 1993 prohibits the burning of pulverised fuel, solid fuel at a rate of 45.4 kg/h or liquid of gaseous fuel at a rate equivalent to 366.4 kilowatts, unless the chimney height has been approved by the local authority. Combustion units requiring permitting under the Environmental Permitting Regulations (>20 MW) are exempt from the Clean Air Act as a competent authority will be required to determine the suitability of any environmental impact.

2.1.4 Air Quality Strategy

The UK air quality policy is published under the umbrella of the Environment Act 1995, Part IV and specifically Section 80, the National Air Quality Strategy. The 2007 *Air* Quality *Strategy for England, Scotland, Wales and Northern Ireland*, published in July 2007, sets air quality standards and objectives for ten key air pollutants to be achieved between 2003 and 2020. It furthermore describes the role of local authorities in carrying out their duties under the Environment Act 1995 (i.e. the Local Air Quality Management (LAQM) regime).

The latest 2023 *air quality strategy: Air quality Strategy: framework for local authority delivery*, which supersedes the 2007 air quality strategy (in England only), retains the majority of the 2007 strategy but further sets out the actions that Defra expects local authorities to take in support of their long-term air quality goals, including the new $PM_{2.5}$ targets.

2.1.5 The Clean Air Strategy 2019

The Clean Air Strategy 2019 sets out ways that the UK government will seek to tackle major sources of pollution. This latest strategy aims to have a more joined-up approach, outlining actions the Government plans to take to reduce emissions from transport, homes, agriculture and industry.

2.1.6 Environmental Permitting Regulations (EPR)

Some industrial processes are regulated under the EPR, which either sets emission limit values (ELVs) with which the installation must comply and/or requires the best available techniques (BAT) to be employed.

The latest UK Environmental Permitting (England and Wales) Regulations 2018 bring the Medium Combustion Plant Directive (MCPD) (2015/2193/EC) into force in England and Wales. The Environment Agency, the regulatory authority in England, enforces the requirements of the Environmental Permitting Regulations.

As part of their regulatory position, the Environment Agency have produced environmental assessment levels (EALs) in order to regulate hazardous pollutants produced by industry that are not captured within the Air Quality Regulations. These are non-statutory guideline values and are contained within the Air Emissions Risk (AER) guidance[2]. Typically, a site will not need to go beyond Best Available Technique (BAT) to achieve these EALs.

2.2 Planning Policy

The land use planning process is a key means of improving air quality, particularly in the long term, through the strategic location and design of new developments. Any air quality concern that relates to land use and its development can, depending on the details of the proposed development, be a material consideration in the determination of planning applications.

2.2.1 National Planning Policy Framework

In December 2024, the last major revision of the National Planning Policy Framework (NPPF) was published, superseding the previous versions with immediate effect. The NPPF includes a presumption in favour of sustainable development, which includes environmental protection and minimising pollution.

Section 15 of the NPPF deals with Conserving and Enhancing the Natural Environment and states that *"planning policies and decisions should contribute to and enhance the natural and local environment"* and goes on to state that new developments should be appropriate for their location and the effects (including cumulative effects) of pollution on health, the natural environment or general amenity, should be taken into account.

[2]https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

With specific regard to air quality, paragraph 187 of the NPPF states that:

"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…."

Furthermore, paragraph 199 of the NPPF states that: *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

2.2.2 Gravesham Borough Council Policy

Gravesham Borough Council's Local Plan Core Strategy (2014) identifies four opportunity areas within which development can take place. The KC Northfleet site falls within Sub-area 1.7 of Spatial Policy CS03: Northfleet Embankment and Swanscombe Peninsula East Opportunity Area. The policy states:

"*It will be important to take account of air quality in bringing forward any development of the area and a key objective will be to secure continued improvements to air quality through the redevelopment and environmental improvement of sites.*"

Policy CS19: Development and Design Principles, also states:

"New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anti-crime standards. The design and construction of new development will incorporate sustainable construction standards and techniques, be adaptable to reflect changing lifestyles, and be resilient to the effects of climate change. This will be achieved through the criteria set out below:

…….. New development will be located, designed and constructed to:

- *safeguard the amenity, including privacy, daylight and sunlight, of its*

occupants and those of neighbouring properties and land;
avoid adverse environmental impacts from pollution, including noise, air, odour and light pollution, and land contamination; and …..;"

2.3 Guidance

2.3.1 Environmental Protection UK Guidance – Development Control: Planning for Air Quality

Environmental Protection UK (EPUK) and the IAQM jointly published a revised version of the guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' in 2017 (herein the 'EPUK-IAQM guidance') to facilitate consideration of air quality within local development control processes. It provides a framework for air quality considerations, promoting a consistent approach to the treatment of air quality issues within development control decisions.

The guidance includes methods for undertaking an air quality assessment and an approach for assessing the significance of effects. The guidance note is widely accepted as an appropriate reference method for this purpose.

2.3.2 Local Air Quality Management Review and Assessment Technical Guidance

The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance[3] for use by local authorities in their air quality review and assessment work. This guidance referred to in this document as LAQM.TG (22), has been used to identify locations where exposure can be considered 'relevant'.

2.3.3 AQTAG06: Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air

The 2014 AQTAG06 guidance provides technical guidance on how to approach detailed modelling of emissions to air when considering impacts on ecological receptors. It includes a method which can be used to assess the potential impacts of nitrogen and acid deposition on local ecosystems.

2.3.4 Air emissions risk assessment for your environmental permit (Environment Agency, 2024) ('the EA guidance')

This guidance[2], which was adopted in 2016 (and updated in 2024) by the Department for Environment, Food and Rural Affairs (Defra) and the EA, outlines a procedure which can be used to determine when detailed dispersion modelling is required and provides a list of air quality standards applicable to industrial installations.

2.3.5 Hydrogen combustion: comply with emission limit values

Current legislation (IED or MCPD) does not include emission limit values (ELVs) for hydrogen combustion; UK regulators have issued interim expectations for operators

[3] https://laqm.defra.gov.uk/wp-content/uploads/2021/03/LAQM-TG22-May-25-v2.1.pdf

of hydrogen-fired combustion plant. The guidance[4] contains interim ELVs and a method for calculating bespoke NOx and CO ELVs for mixed blends until formal BAT-AELs are set.

2.3.6 Air pollution and development: advice for local authorities

This guidance[5], created by Natural England, provides a structured framework for local planning authorities to assess whether proposed developments may adversely affect protected nature conservation sites through air pollution, particularly emissions of nitrogen oxides (NO_x) and ammonia (NH_3). It provides initial screening distances based on the type of development, as well as the steps to assess the air quality impacts of a proposal on a protected site under the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations) and the Wildlife and Countryside Act 1981.

2.3.7 IAQM's guide to the assessment of air quality impacts on designated nature conservation sites

The Institute of Air Quality Management (IAQM) has published guidance[6] on the assessment of air quality impacts of developments on designated nature conservation sites. This document focuses on air quality assessments in support of Habitat Regulations Assessments (HRA) but can also be applied to national or local designated nature conservation sites. This document provides methods for screening criteria and detailed air quality assessment on designated habitats.

[4] https://www.gov.uk/guidance/hydrogen-combustion-comply-with-emission-limit-values

[5] https://www.gov.uk/guidance/air-pollution-and-development-advice-for-local-authorities

[6] https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf

3 ASSESSMENT CRITERIA

Based on the current regulations, the air quality standards for the pollutants proposed for assessment are presented in **Table 3.1**. This includes the Environment Agency's and Defra's environmental assessment levels (EALs), as referenced in **Section 2.1.6.**

Table 3.1: Air Quality Standards Relevant to the Assessment

Pollutant	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m³)	Designation
Nitrogen dioxide (NO_2)	1-hour mean	18	200	AQO[1]
	calendar year mean	-	40	AQO[1]
Carbon monoxide (CO)	1-hour mean	-	30,000	EAL
	8-hour mean	-	10,000	AQO[1]

Note 1 The limit value is the same as the Air Quality Objective.

In addition, the United Nations Economic Commission for Europe (UNECE) has set environmental criteria known as critical levels (CLe) for the protection of vegetation from direct effects and critical loads (CLo) to protect against the indirect effects of the deposition of pollutants. The applicable critical levels, derived from EC directive 2008/50/EC and translated into UK law via the Air Quality Standards Regulations 2010, are provided in **Table 3.2.** Critical loads for the protection of vegetation are site-specific, and as such, they have been detailed further in **Table 4.3**.

Table 3.2: Critical Levels Relevant to the Assessment

Pollutant	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m³)	Designation
NOx	24-hour mean	-	75 or 200[1]	CLe[2]
	calendar year mean	-	30	AQO[3]/CLe

Note 1 The critical level is generally considered to be 75 µg/m³, but this only applies where ozone is below the AOT40 critical level, and sulphur dioxide is below the lower critical level of 10 µg/m³.

Note 2 Defined by the World Health Organisation and is not an Air Quality Objective.

Note 3 Only the critical level applies at locations within 20 km from agglomerations (250,000 people) or within 5 km away from other built-up areas, industrial installations (PART A) or motorways or major roads with traffic counts of more than 50,000 vehicles per day.

4 ASSESSMENT METHODOLOGY

4.1 Assessment Scope

The proposal at the KC Northfleet site requiring permission is the installation of two new dual-fuelled boilers, each with its own dedicated 20 m stack. As part of the proposal, the existing natural gas-fired steam boilers will be decommissioned, as will the existing combined stack. Currently, three of the existing boilers are operational on a duty/duty/standby configuration.

While the new boilers can be fired on both hydrogen and natural gas, it is assumed that the primary fuel will be hydrogen. Therefore, this assessment is focused on the assessment of emissions associated with the combustion of hydrogen fuel. However, sensitivity to the new boilers running on natural gas has been provided in **Appendix A**.

As with the current operation, not all two proposed boilers will be run simultaneously, with the maximum steam output from all two new boilers (24 tph) far exceeding the site's annual typical operating requirement of around 7 tph. Therefore, as with the current operations, the new boilers will run on a duty/standby configuration.

In addition to the new boilers, there is an additional natural gas-fired source that will remain onsite, this being linked to the tissue dryer machine, which have been included within the assessment to assess the site's full impact following the change in operations.

Based on the above, dispersion modelling of emissions will be conducted to predict the local impacts of the site's operations, both as they currently operate and as they will operate with the proposed hydrogen-fired boilers. This analysis will help determine the site's total future impacts and allow for a comparison with the existing baseline under the proposed operations.

Impacts will be compared against the annual and 1-hour mean NO_2 AQO, the 1-hour and 8-hour CO AQO/EAL for human receptors, and the annual mean and 24-hour NOx critical levels and nitrogen and acid deposition critical loads in relation to ecological receptors.

4.2 Dispersion Modelling Methodology

4.2.1 Modelling Software

The model used in this study is the Lakes AERMOD (V13) dispersion model, running the US EPA executable 24142. AERMOD is a steady-state Gaussian plume atmospheric dispersion model; it characterises the atmospheric boundary layer properties using the friction velocity and Monin-Obukhov length rather than the Pasquill-Gifford stability classes.

The AERMOD model can include the treatment of both surface and elevated sources, terrain, buildings and chemistry effects. The model calculates pollutant concentrations in the surrounding area for each hour of the day and night. Statistics on the frequency and concentration of pollutants at the receptor sites are based on hourly calculations.

Along with the ADMS dispersion model, AERMOD is commonly used within the UK for regulatory purposes and is judged fit for purpose for this assessment.

4.2.2 Modelling Scenarios

Based on the site's proposed operations and aims of the assessment, detailed in **Section 4.1**, the following modelling scenarios have been considered:

- **Existing -** Modelling of the site's existing operations, including two natural gas-fired steam boilers and a tissue dryer machine (PM3); and
- **Proposed -** Modelling of the site's proposed operations, including a single hydrogen steam boiler and a tissue dryer machine (PM3).

During short spells of commissioning and if the hydrogen supply is restricted, the new boilers are capable of running on natural gas; therefore, the results of modelling sensitivity to the new boilers running on natural gas have been provided in **Appendix A**.

All other emissions to air sources on-site are mothballed and planned for removal (existing fourth boiler, etc.) or do not emit NOx or CO and have not been included within the assessment.

4.2.3 Emission Sources

All physical stack parameters (stack heights and diameters, etc.) have been provided by the Kimberly Clark Northfleet site team. All efflux parameters for the existing operations have been taken from available stack monitoring data (from between 2022 – 2025) and emission limit values (ELVs) contained within the site's environmental permit (EPR/BJ7379IZ). All efflux parameters for the proposed boilers have been calculated based on design data provided by Ameresco and ELVs contained within the EA's hydrogen combustion guidance[8].

The emissions from the new hydrogen boilers have been modelled assuming they are running at 60% maximum continuous rating (MCR). This equates to 7.2 tph of steam, which is similar to the site's typical steam requirements (7 tph).

All emission rates and stack parameters entered into the model have been presented in **Table 4.1**.

[8] https://www.gov.uk/guidance/hydrogen-combustion-comply-with-emission-limit-values

Table 4.1: Stack Parameters Used Within the Dispersion Model

Parameter	Existing Boiler 1	Existing Boiler 2	Proposed Boiler[1]	TM3 Burner
Stack Location (X, Y)	562747, 174613		562585, 174367	562552, 174233
Stack Height (m)	61		20	21
Stack Diameter (m)	1.67		0.6	1.4
Exhaust Temperature (°C)	174[4]	152[4]	96/85	207
Exit Velocity (m/s)	4.64[4]		5.97/7.30	6.8[2]
Oxygen, dry exhaust (%)	n/a[5]	n/a[5]	3.82/3.81	n/a[5]
Moisture Content (%)	n/a[5]	n/a[5]	31.34/17.18	n/a[5]
Actual Flow (m^3/s)	5.71[4]	4.40[4]	1.69/2.06	10.47
Normalised flow (Nm^3/s)	2.49[3]	2.24[3]	0.819[3]/1.244[3]	1.86[3]
NOx Concentration (mg/Nm^3)	200[3]	200[3]	137[3]/100[3]	250[3]
CO Concentration (mg/Nm^3)	50[3]	50[3]	68.5[3,6]/50[3,6]	339[3]
NOx Emission Rate (g/s)	0.497[4]	0.449[4]	0.112/0.124	0.464
CO Emission Rate (g/s)	0.12[4]	0.11[4]	0.056/0.062	0.63

Note 1 Hydrogen/Natural gas-fired
Note 2 Square capped stack – velocity entered, with the capped stack module used in AERMOD.
Note 3 Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 3% oxygen.
Note 4 Stack monitoring was taken from separate boiler ducts feeding into a single exhaust stack. Therefore, combined parameters (average for temperature and summed emission rates and flow rates have been inputted into the model or used for velocity calculations).
Note 5 n/a - Flow rates used within the model and calculations are the maximum values from within the site's 2022, 2024 and 2025 stack monitoring reports and have not been calculated based on specific oxygen and moisture contents. Average data has been used for temperature.
Note 6 n/a -Based on manufacturer specifications and uplifted by 37% based on EA guidance.

4.2.4 Meteorological Data

Hourly sequential meteorological data from the London City Airport meteorological station for 2021 - 2023 have been used within the model. London City Airport is the nearest suitable meteorological station to the site; both the meteorological station and the proposed development are located near the Thames Estuary, and the meteorological station is 20.7 km northwest of the KC Northfleet site. Furthermore, the data capture is above 85%.

Each year has been modelled separately, with the worst-case prediction presented at each receptor. The wind rose diagram for the entire modelled period (2021 – 2023) is presented in **Figure 4.1**.

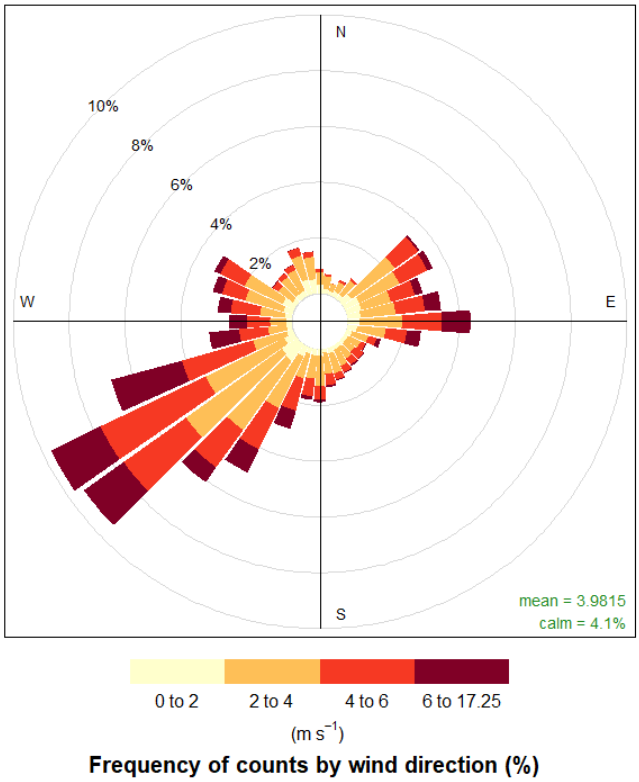

Figure 4.1: Wind Rose for the London City Airport Meteorological Station (2021 – 2023)

4.2.5 Terrain and Land Use

The topographical features surrounding the site will have an influence on the dispersion of pollution within the area. Terrain effects have been accounted for using 50 m resolution OS terrain data. Due to the complex terrain surrounding the site, sensitivity has been undertaken to running the model using alternative terrain heights (taken from Google Earth) for the receptor and stack locations.

4.2.6 Buildings

Buildings have the potential to disrupt atmospheric flow. In the case of emissions from a stack, they can entrain pollutants into the leeward side of the building (known

as a cavity region). This cavity region is highly turbulent, often bringing pollutants rapidly towards ground level, increasing their concentrations. These concentrations will then reduce with diminishing turbulent wake. AERMOD has the capability to model the impacts of stack pollutants being entrained into the cavity region through its BPIPPRM module. To capture the potential influence of buildings/structures on the dispersion profile of emissions (e.g. building 'downwash' effects), five nearby onsite buildings have been included. The parameters of the modelled buildings and structures are summarised in **Table 4.2** and illustrated in **Figure 4.2.**

Table 4.2: Buildings Included in the Model

Building ID	X (m)	Y (m)	Height (m)	Width (m)	Length (m)
BLD_1	562438	174323	29	51	140
BLD_3[1]	562798	174441	36	178	55
BLD_4[1]	562534	174297	19	155	84
BLD_5[1]	562517	174210	9	213	112
BLD_6[1]	562636	174455	8	60	45
BLD_9[2]	562609	174431	43	-	-

Note [1] Entered in the model as a polygon building
Note [2] Entered in the model as a circular building with a diameter of 14 m.

Figure 4.2: Buildings and Emission Points included in the Model

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4.2.7 Model Output Grid

A nested Cartesian receptor grid covering 20 km × 20 km, centred on the emission sources, was used to resolve concentration fields. The grid employed progressively finer resolution near the stack:

- 20 m spacing within 200 m;
- 50 m spacing within 500 m;
- 100 m spacing within 1,000 m;
- 200 m spacing within 2,000 m;
- 500 m spacing within 5,000 m; and
- 1000 m spacing within 10,000 m.

All receptors were assigned a height of 1.5 m above ground level to represent typical human breathing height.

4.2.8 Human Receptors

The modelled discrete human receptors were chosen based on where people may be located and judged in terms of the likely duration of their exposure to pollutants and proximity to the site, following the guidance given in **Section 2.3.2** (LAQM TG22). **Figure 4.3** details the discrete human receptors included within the model, with the full list contained in **Table B1** in **Appendix B**.

4.2.9 Ecological Receptors

The modelled ecological receptors have been determined using distance-based screening criteria from the nature and heritage conservation screening report for the site provided by the Environment Agency. All ecological sites within this distance have been considered for assessment.

The ecological sites included within this assessment and their associated critical loads (taken from APIS[9]) are presented in **Table 4.3**, with the full list contained in **Table B1** in **Appendix B** and shown in **Figure 4.4**

Table 4.3: Ecological Sites Considered in the Model

Receptor Description	Nutrient Nitrogen Dep Critical Load (kgN/ha/yr)	Acid Dep Critical Load (Keq/ha/yr) [1]	Modelled Receptors
North Downs Woodlands SAC	10	1.983	E7
Thames Estuary & Marshes SPA	5	1.019	E2, E8

[9] https://www.apis.ac.uk/

Receptor Description	Nutrient Nitrogen Dep Critical Load (kgN/ha/yr)	Acid Dep Critical Load (Keq/ha/yr) [1]	Modelled Receptors
Thames Estuary & Marshes Ramsar	5[2]	1.019[2]	E1 – E2, E8
Swanscombe Peninsula SSSI	5[2]	1.019[2]	E3 – E6
Local Wildlife Sites (including Ebbsfleet Marshes and Northfleet Botany Marshes)	5[2]	1.019[2]	E6, E9, E14 – E15
Protected Species migratory route (including Atlantic Salmon, Allis Shad, European Eel, River Lamprey, Sea Lamprey, Smelt, and Twaite Shad)	5[2]	1.019[2]	E10 – E13

Note [1] Represents the MinCLMaxN

Note [2] No data is available, so the corresponding value from the SAC/SPA/SSSI covering the same area has been used.

Figure 4.3: Location of Modelled Receptors

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026

Figure 4.4: Location of Modelled Ecological Receptors[1]

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026

Note [1] - Receptor E7 is not presented due to its distance from the site.

4.2.10 Baseline Air Quality

Local Authority Data

According to the latest 2025 Air Quality Annual Status Report (ASR) released by GBC, there was one automatic monitoring stations operating within the district. However, 65 diffusion tubes were monitoring NO_2 in 2024. Seven of these diffusion tubes were located in the vicinity of the proposed KC Northfleet site. The monitoring data from these seven diffusion tube sites are presented in **Table 4.4**. The data from these tubes show that there were no exceedances of annual average NO_2 concentrations between the years 2020 - 2024. This was also the case at all seven diffusion tubes where data were reported. The locations of the seven diffusion tubes in relation to the KC Northfleet site are presented in **Figure 4.5**.

The highest monitoring result from 2022 (in bold in **Table 4.4)** has been assumed to be representative of all receptors and has been used as the concentration within **Section 5**.

Table 4.4: Annual Mean NO_2 Selected Local Monitoring (2020-2024)

Site ID	Location	Site type	Approximate Distance from Site (km)	Annual Mean NO_2 Concentrations ($\mu g/m^3$)				
				2020	2021	2022	2023	2024
GR19[1]	Lawn Primary School, Air Monitoring Station, Highstreet, Northfleet, DA11 9HB	Roadside	0.4	20.6	20.9	18.9	15.5	13.9
GR52	32 The Hill (Lampost), Northfleet, DA11 9EX	Roadside	0.2	27.5	30.1	27.8	22.4	22.8
GR72[1]	Northfleet Cemetry (Post), Northfleet, DA11 8HW	Roadside	1.2	20.8	21.4	19.8	17.1	15.6
GR98	The Leather Bottle PH, Dover Road, Northfleet, DA11 9PH	Urban Background	0.3	28.5	30.3	25.8	23.8	22.3
GR112	50 Stonebridge Road (Façade), Northfleet	Urban Background	1.1	30.1	31.1	30.5	23.1	19.1
GR124	Stonebridge Road Telegraph Post Opposite No.67	Roadside	1.4	29.0	27.6	27.7	23	18.8

Site ID	Location	Site type	Approximate Distance from Site (km)	Annual Mean NO_2 Concentrations ($\mu g/m^3$)				
				2020	2021	2022	2023	2024
GR139	Rosherville Way, Lampost near Compass Court	Roadside	0.7	31.5	30.7	29.6	23.8	**24.7**
Air Quality Objective				**40**				

Note1 Triplicate sites

Defra Background Maps

In addition to the local monitoring data, estimated background air quality data is available from the Local Air Quality Management (LAQM) website operated by Defra. This website provides estimated annual average background concentrations of NO_2 and CO on a 1 km^2 grid basis. **Figure 4.5** represents the highest estimated annual average background concentrations for the grid square containing any modelled receptor for the year 2025.

Table 4.5: Estimated Background Annual Average NO_2 and CO Concentrations at the Proposed Development Site (from the 2021 base maps)

Assessment Year	Annual Average NO_2 ($\mu g/m^3$)	Annual Average CO ($\mu g/m^3$)
2026	21.7	375[2]
Air Quality Objective	**40**	-

Note 1: Presented concentrations for the 1 km^2 grid centred on 562500,174500.

Ecological Background

Background NOx concentrations and nitrogen and acid deposition fluxes have been taken from the APIS website, which provides three-year average background concentrations and fluxes on a 1 km^2 grid basis. The latest three-year average available is for 2021 (2020 - 2022). The background values in **Table 4.6** represent the worst-case predicted concentration across any of the habitat sites assessed.

Table 4.6: Estimated Background Annual Average NOx Concentrations and Nitrogen and Acid Deposition Fluxes in the Area Surrounding the KC Northfleet Site

	Annual Average NO_x ($\mu g/m^3$)	Nitrogen Deposition (kgN/hayr)	Acid Deposition (keq/ha/yr)
2021	31.3	12.3/25.7[1]	1.1/2.0[1]
Air Quality Objective	**30**	**-**	**-**

Note 1: Grassland/Forest Deposition

Figure 4.5: Location of nearby diffusion tubes

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4.2.11 Conversion of NO to NO_2 and Results Processing

NOx emitted to the atmosphere as a result of combustion will consist largely of nitric oxide (NO). Once released into the atmosphere, NO is oxidised to NO_2, which is of concern with respect to health and other impacts. The proportion of NO converted to NO_2 depends on a number of factors, including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as ozone (O_3). The dispersion modelling exercise predicts concentrations of NOx, which subsequently require conversion to NO_2 for comparison with objectives for human health.

Based on Environment Agency recommendations[9], NOx Process Contributions (PCs) have been converted to the respective NO_2 concentrations using 70% for long-term emissions and 35% for short-term emissions based on 'worst case' conversion criteria.

4.2.12 Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[10]. Dry deposition flux was calculated using the following equation:

Dry deposition flux (µg/m^2/s) = ground level concentration (µg/m^3) x deposition velocity (m/s)

Wet deposition occurs via the incorporation of the pollutant into water droplets, which are then removed in rain or snow and NO_2 wet deposition is not considered significant over short distances compared with dry deposition. Therefore for the purposes of this assessment (in accordance with AQTAG06), wet deposition has not been considered.

The applied deposition velocities for the relevant chemical species are shown in **Table 4.7.**

Table 4.7: Applied Deposition Velocities

Pollutant	Deposition Velocity (m s^{-1})
	Grassland/Forest
NOx	0.0015/0.003

For the purposes of this assessment, dry deposition rates of nitrogen and acidic equivalents at the identified ecological receptors have been calculated by applying the appropriate grassland or forest deposition velocities to the modelled annual mean concentrations of NO_2.

The critical loads for nitrogen (N) are recorded in units of kgN/ha/yr. The deposition PC is converted from µg/m^2/s to units of kgN/ha/year by multiplying the dry

[9] https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

[10] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014 version.

deposition flux by the standard conversion factor of 95.9.

The acid critical loads are provided in units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be. The deposition PC is converted from µg/m^2/s to units of keq/ha/year by a standard conversion factor for N of 6.84.

4.2.13 Results Processing

The site operates year-round, except during scheduled maintenance periods. The model, however, assumes that the site runs continuously for 8,760 hours each year. As a result, no post-processing of the results has been performed, except for the conversions of NOx to NO_2 and the calculations of deposition mentioned earlier.

4.2.14 Interpretation of Modelled Results

Human Receptors

The impact at each human receptor has been described using the criteria in EPUK/IAQM's Land-Use Planning & Development Control: Planning For Air Quality guidance. The method in this guidance derives the magnitude of impacts using the percentage of change in pollutant concentration relative to an Air Quality Assessment Level (AQAL) and long-term average pollutant concentration at the receptor, as presented in **Table 4.8**.

Table 4.8: Impact Descriptors for Individual Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
79 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

In addition, short term impacts have been judged using EPUK/IAQM's Land-Use Planning & Development Control: Planning For Air Quality guidance criteria, which states:

"Where such peak short-term concentrations from an elevated source are in the range 11-20% of the relevant AQAL, then their magnitude can be described as small, those in the range 21-50% medium and those above 51% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without

the need to reference background or baseline concentrations."

There is no official guidance on how to determine the significance of air quality impacts; therefore, recommendations from the IAQM's planning guidance have been used. This guidance highlights that the significance of air quality impacts should be based on professional judgement, which should be transparent and logically set out. However, it is common practice that the above magnitudes of impact are a starting point for determining significance, with impacts less than 'moderate' typically considered not significant. However, this is not always the case, and judgement considering the number of receptors impacted, the number of nearby cumulative schemes, local exceedances of any objectives, any uncertainties and the conservativeness of the assessment are also considered.

Ecological Receptors

To determine the significance of impacts on ecological sites, guidance from Natural England has been used. Natural England's *Air pollution and development: advice for local authorities' guidance* states that where the impacts or PCs from the proposed development are less than 1% of the standard, the impacts can be screened out of further consideration. This 1% applies to in-combination habitat assessments only; however, as only a qualitative in-combination habitat assessment has been undertaken, it has been used as a starting point to assess significance.

While this guidance has been used, it is acknowledged that there is other guidance from the Environment Agency, the IAQM, CEH, and National Highways that have varying criteria; however, the 1% threshold is used within both the IAQM[11] and Environmental Agency guidance[12] documents, with respect to European designated site (SACs, SPAs and Ramsar etc.). Where emissions affect non-statutory nature sites (local wildlife sites or statutory migration routes), EA guidance suggests that impacts can be considered insignificant where the PCs are less than 100% of the objective (for both long and short-term impacts).

Furthermore, when screening out short-term impacts on ecological sites, the Environment Agency's 10% threshold has been used to screen out impacts, where further consideration of the Predicted Environmental Concentration (PEC) is not needed.

4.3 Uncertainties and Assumptions

The following uncertainties and assumptions have been made in the air quality assessment:

- There will be uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example, it has been

[11] https://www.gov.uk/guidance/air-pollution-and-development-advice-for-local-authorities

[12] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

assumed that wind conditions measured at the London City Airport meteorological monitoring station for the years 2021 to 2023 are representative of wind conditions at the site; and

- The combustion processes emissions modelled in this assessment will in reality,vary over time. It is assumed that the data from the 3 years of stack monitoring used for the existing sources and design information used for the proposed boiler sources are representative of actual emissions.
- There is an element of uncertainty in all measured and modelled data. All values presented within the report are the best possible estimates.

5 ASSESSMENT OF IMPACTS

This section sets out the results of the dispersion modelling, which was undertaken in line with the methodology described in **Section 4**. The results have been compared against the ambient air quality objectives and critical loads and levels, as well as the IAQM's Impact Descriptors. The results presented in this section represent the worst-case impacts across the three years of meteorological data.

5.1 Impacts on Human Receptors

5.1.1 NO_2 Annual Mean

Table 5.1 shows the comparison of annual mean NO_2 concentrations between the Existing scenario (existing site operations plus background, as described in **Section 4.2.10**) and the Proposed scenario (background, as described in **Section 4.2.10,** plus proposed operations) at the assessed receptor locations.

A contour of the gridded annual mean NO_2 results for the total site-wide impacts under the proposed scenario (background, as described in **Section 4.2.10,** plus proposed operations) are presented in **Table 5.1**.

Table 5.1: Predicted Annual Mean NO_2 Impacts at Discrete Receptors

Receptor ID	Existing Concentration (µg/m³)[1]	Proposed Concentration (µg/m³)[1]	% of AQS (Proposed PEC)[13]	Change		
				µg/m³	% of Objective	Impact Descriptor
1	25.37	25.54	64%	0.16	0%	**Negligible**
2	25.44	25.52	64%	0.08	0%	**Negligible**
3	25.12	25.19	63%	0.06	0%	**Negligible**
4	25.00	25.04	63%	0.03	0%	**Negligible**
5	25.15	25.19	63%	0.05	0%	**Negligible**
6	25.11	25.19	63%	0.08	0%	**Negligible**
7	25.32	25.43	64%	0.12	0%	**Negligible**
8	25.01	25.05	63%	0.04	0%	**Negligible**
9	25.04	25.06	63%	0.02	0%	**Negligible**
10	25.13	25.15	63%	0.02	0%	**Negligible**
11	25.09	25.12	63%	0.03	0%	**Negligible**
12	24.97	25.01	63%	0.04	0%	**Negligible**
13	24.90	24.90	62%	0.01	0%	**Negligible**
14	24.91	24.87	62%	-0.04	0%	**Negligible**
15	24.93	24.89	62%	-0.05	0%	**Negligible**
16	25.04	25.00	62%	-0.04	0%	**Negligible**

[13] Predicted Environmental Concentration (PEC)

Receptor ID	Existing Concentration (µg/m³)[1]	Proposed Concentration (µg/m³)[1]	% of AQS (Proposed PEC)[13]	Change		
				µg/m³	% of Objective	Impact Descriptor
17	24.97	24.98	62%	0.01	0%	**Negligible**
18	24.92	24.91	62%	-0.01	0%	**Negligible**
19	24.78	24.74	62%	-0.04	0%	**Negligible**
20	24.83	24.76	62%	-0.07	0%	**Negligible**
21	24.86	24.77	62%	-0.09	0%	**Negligible**
22	25.21	25.25	63%	0.04	0%	**Negligible**
AQO			**40 µg/m³**			

Note 1 The highest nearby monitored NO_2 concentration in 2024 has been used for all receptors (see **Section 4.2.10**)

In the case of long-term NO_2, the model predicts that the greatest impact as a result of the proposed changes to the site would be at receptor R7 (0.16 µg/m³, or 0% of the AQO). This results in negligible impacts at all nearby modelled receptors, with all 'Proposed' concentrations below the annual NO_2 objective following changes to the site's operations.

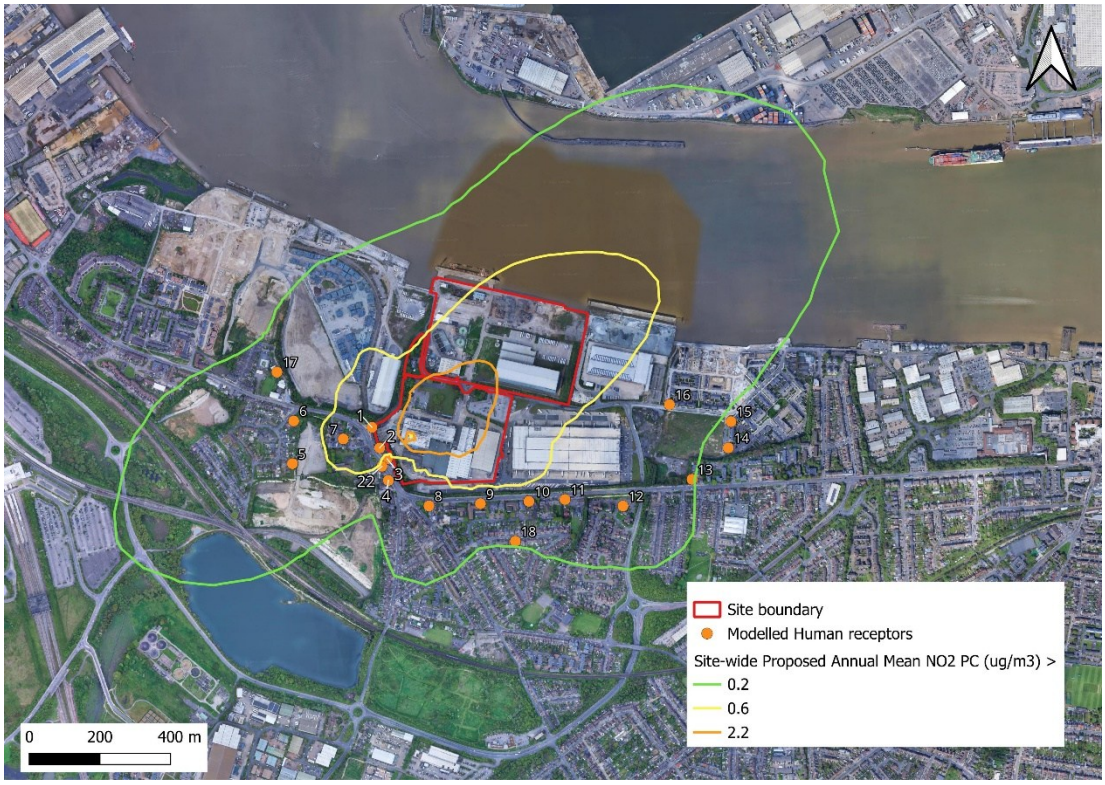

Figure 5.1: Site-wide Proposed Annual Mean NO_2 Contour (maximum of 3 years)

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026.

5.1.2 NO_2 1-hour Mean

Table 5.2 shows the comparison of the 99.79th percentile 1-hour mean NO_2 concentrations between the Existing scenario (existing site operations plus background, as described in **Section 4.2.10**) and the Proposed scenario (background, as described in **Section 4.2.10,** + proposed operations) at the assessed receptor locations.

Table 5.2: Predicted 99.79th Hourly Mean NO_2 Impacts at Discrete Receptors

Receptor ID	Existing Concentration (µg/m³)[1,2]	Proposed Concentration (µg/m³)[1,2]	% of AQS (Proposed PEC)[14]	Change		
				µg/m³	% of Objective	Impact Descriptor
1	52.22	52.25	26%	0.03	**0%**	**Negligible**
2	52.84	53.11	27%	0.27	**0%**	**Negligible**
3	52.73	54.32	27%	1.59	**1%**	**Negligible**
4	52.72	53.25	27%	0.53	**0%**	**Negligible**
5	52.47	52.68	26%	0.21	**0%**	**Negligible**
6	51.97	52.05	26%	0.08	**0%**	**Negligible**
7	52.64	52.65	26%	0.01	**0%**	**Negligible**
8	52.37	52.84	26%	0.47	**0%**	**Negligible**
9	52.23	52.30	26%	0.07	**0%**	**Negligible**
10	53.83	53.94	27%	0.10	**0%**	**Negligible**
11	53.29	53.76	27%	0.47	**0%**	**Negligible**
12	52.80	53.30	27%	0.50	**0%**	**Negligible**
13	51.47	52.73	26%	1.26	**1%**	**Negligible**
14	50.85	51.92	26%	1.07	**1%**	**Negligible**
15	50.90	51.68	26%	0.78	**0%**	**Negligible**
16	51.34	52.33	26%	0.99	**0%**	**Negligible**
17	51.03	51.20	26%	0.17	**0%**	**Negligible**
18	51.05	51.54	26%	0.49	**0%**	**Negligible**
19	50.53	50.14	25%	-0.39	**0%**	**Negligible**
20	50.81	50.27	25%	-0.54	**0%**	**Negligible**
21	50.81	50.31	25%	-0.50	**0%**	**Negligible**
22	52.68	53.71	27%	1.03	**1%**	**Negligible**
AQO		**200 µg/m³**				

Note 1 The highest nearby monitored NO_2 concentration in 2024 has been used for all receptors (see **Section 4.2.10**)

Note 2 2 x the annual mean background inline with EA guidance.

In the case of the 1-hour NO_2 objective, the model predicts that the greatest impact as a result of the proposed changes to the site would be at receptor R3 (1.59 µg/m³,

[14] Predicted Environmental Concentration (PEC)

or 1% of the objective). This results in negligible impacts at all nearby modelled receptors, in accordance with IAQM guidance. Furthermore, all proposed concentrations are predicted to be well below the 1-hour NO_2 objective following the changes in the site's operations.

5.1.3 CO 8-hour Mean

Table 5.3 shows the comparison of the 100th percentile 8-hour mean CO concentrations between the Existing scenario (existing site operations plus background, as described in **Table 4.6**) and the Proposed scenario (background, as described in **Table 4.6,** + proposed operations) at the assessed receptor locations.

Table 5.3: Predicted 100th 8-hour Mean CO Impacts at Discrete Receptors

Receptor ID	Existing Concentration (µg/m³)[1]	Proposed Concentration (µg/m³)[1,2]	% of AQS (Proposed PEC)[15]	Change	
				% of Objective	Impact Descriptor
1	760.79	760.81	7.6%	**0%**	**Negligible**
2	761.16	761.39	7.6%	**0%**	**Negligible**
3	757.59	758.37	7.6%	**0%**	**Negligible**
4	757.54	758.74	7.6%	**0%**	**Negligible**
5	756.85	757.62	7.6%	**0%**	**Negligible**
6	756.88	756.99	7.6%	**0%**	**Negligible**
7	758.32	758.60	7.6%	**0%**	**Negligible**
8	759.72	760.04	7.6%	**0%**	**Negligible**
9	757.83	758.57	7.6%	**0%**	**Negligible**
10	762.44	762.59	7.6%	**0%**	**Negligible**
11	761.08	761.84	7.6%	**0%**	**Negligible**
12	759.84	761.15	7.6%	**0%**	**Negligible**
13	755.16	755.56	7.6%	**0%**	**Negligible**
14	753.62	754.24	7.5%	**0%**	**Negligible**
15	753.37	753.68	7.5%	**0%**	**Negligible**
16	755.06	755.61	7.6%	**0%**	**Negligible**
17	754.61	754.88	7.5%	**0%**	**Negligible**
18	755.13	755.71	7.6%	**0%**	**Negligible**
19	751.36	751.31	7.5%	**0%**	**Negligible**
20	751.37	751.27	7.5%	**0%**	**Negligible**
21	751.58	751.52	7.5%	**0%**	**Negligible**
22	759.72	759.88	7.6%	**0%**	**Negligible**
AQO		**10,000 µg/m³**			

[15] Predicted Environmental Concentration (PEC)

Note 1 The 2001 DEFRA Background Concentration has been used for all receptors. See **Table 4.6.**
Note 2 2 x the annual mean background inline with EA guidance

In the case of the 8-hour CO objective, the model predicts that the greatest impact as a result of the proposed changes to the site would be 0% of the objective. This results in negligible impacts at all nearby modelled receptors, in accordance with IAQM guidance. Furthermore, all proposed concentrations are predicted to be well below the 8-hour CO objective following the changes in the site's operations.

5.1.4 CO 1-hour Mean

Table 5.4 shows the comparison of the 100th percentile 1-hour mean CO concentrations between the Existing scenario (existing site operations plus background, as described in **Table 4.6**) and the Proposed scenario (background, as described in **Table 4.6,** + proposed operations) at the assessed receptor locations.

Table 5.4: Predicted 100th 1-hour Mean CO Impacts at Discrete Receptors

Receptor ID	Existing Concentration (µg/m³)[1,2]	Proposed Concentration (µg/m³)[1,2]	% of AQS (Proposed PEC)[16]	Change	
				% of Objective	Impact Descriptor
1	763.50	763.57	2.5%	**0%**	**Negligible**
2	765.13	765.28	2.6%	**0%**	**Negligible**
3	766.07	766.56	2.6%	**0%**	**Negligible**
4	764.21	767.84	2.6%	**0%**	**Negligible**
5	763.94	764.17	2.5%	**0%**	**Negligible**
6	763.60	763.65	2.5%	**0%**	**Negligible**
7	763.89	763.91	2.5%	**0%**	**Negligible**
8	762.93	763.53	2.5%	**0%**	**Negligible**
9	763.62	763.62	2.5%	**0%**	**Negligible**
10	769.06	769.11	2.6%	**0%**	**Negligible**
11	768.35	768.43	2.6%	**0%**	**Negligible**
12	766.09	766.69	2.6%	**0%**	**Negligible**
13	763.19	764.06	2.5%	**0%**	**Negligible**
14	762.10	762.53	2.5%	**0%**	**Negligible**
15	761.85	762.96	2.5%	**0%**	**Negligible**
16	765.09	765.39	2.6%	**0%**	**Negligible**
17	763.29	763.38	2.5%	**0%**	**Negligible**
18	763.16	763.25	2.5%	**0%**	**Negligible**
19	753.38	753.13	2.5%	**0%**	**Negligible**
20	753.54	753.31	2.5%	**0%**	**Negligible**

[16] Predicted Environmental Concentration (PEC)

Receptor ID	Existing Concentration (µg/m³)[1,2]	Proposed Concentration (µg/m³)[1,2]	% of AQS (Proposed PEC)[16]	Change	
				% of Objective	Impact Descriptor
21	753.49	753.28	2.5%	**0%**	**Negligible**
22	763.98	765.32	2.6%	**0%**	**Negligible**
EAL		**30,000 µg/m³**			

Note 1 The 2001 DEFRA Background Concentration has been used for all receptors. See **Table 4.6.**

Note 2 2 x the annual mean background inline with EA guidance.

In the case of the 1-hour CO EAL, the model predicts that the greatest impact as a result of the proposed changes to the site would be 0% of the objective. This results in negligible impacts at all nearby modelled receptors, in accordance with guidance. Furthermore, all proposed concentrations are predicted to be well below the 1-hour CO EAL following the changes in the site's operations.

5.1.5 Significance of Effects

The assessment has demonstrated negligible impacts against all air quality standards, due to the associated change in boiler and stack configuration at the KC facility. Furthermore, all proposed total concentrations (background + proposed operational emissions) following the changes are well below all AQS. Therefore, the impacts on human health impacts due to the proposed changes are judged to be not significant.

Based on the results being well below IAQM significant thresholds (see **Table 4.8**), the uncertainty associated with the undertaken modelling sensitivity to the boilers being fired on natural gas and terrain heights is not judged to affect the conclusions of this assessment (see **Appendix A**).

5.2 Site-wide Impacts on Ecological Receptors

5.2.1 NOx Impacts

Table C1 and **Table C2** within **Appendix C** detail the results of the NOx assessment at nearby ecology sites, with an assessment against the annual mean (30 µg/m³) and 100th percentile 24-hour mean CLe (75 µg/m³) undertaken.

The site-wide impacts following the changes to the new boiler and stack configuration result in a predicted impact less than the 1%[17] or 10% screening/insignificance thresholds for both long and short impacts, respectively, at all modelled receptors.

The results presented demonstrate potential exceedances of the annual and 24-hour mean[18] NOx critical level as a result of the proposed operation's PEC

[17] The screening threshold of 100% has been used for non-statutory ecology sites such as local wildlife sites, as per EA guidance.

[18] Assuming a critical level of 75 µg/m3 only

(background + proposed operations impact). However, as the worst-case background concentration, assessment criteria and emission assumptions have been used, the results presented will have overestimated the impacts at some locations.

5.2.2 Critical Loads for Nutrient Nitrogen and Acidity

Table C3 and **Table C4** within **Appendix C** present the results for the total nutrient nitrogen and acid deposition assessment at each ecological receptor. The PCs are assessed against the minimum CLo for each site.

The site-wide impacts following the changes to the new boiler and stack configuration result in a predicted long-term impact less than the 1%[19] screening/insignificance threshold at all modelled receptors. A contour plot of the predicted site wide future nitrogen deposition impacts is illustrated in **Figure 5.2**.

The results presented demonstrate potential exceedances of the annual mean nitrogen deposition and acid critical loads as a result of the proposed operation's PEC (background + proposed operations impact). This is due to the existing background concentrations, of which the site is currently contributing. The above is the case for both the existing situation and following the changes to the site's operations.

5.2.3 Cumulative Impact Assessment

A search of Defra's Pollutant Transfer Register[20] demonstrates that there are no installations that release emissions to air in close proximity to the KC site not suitably accounted for within the background concentrations used within this assessment (the nearest installation being the Botany Road non-ferrous metals site (EPR/BM4945IW), 2.3 km south of the site). Furthermore, a search of GBC's planning portal shows no proposed nearby developments that will emit pollutants at a magnitude (large-scale industrial sites, etc.) or location likely to combine with the emissions from the KC that will have a significant impact on nearby habitat sites.

Based on the above, a quantitative cumulative assessment is not judged to be required, and the modelled in-isolation impacts are judged suitable to determine the proposed developments' impacts on nearby ecological sites.

5.2.4 Significance of Effects

The modelling has demonstrated that all site-wide impacts following the proposed changes to the onsite boiler configuration will not exceed Natural England's relevant screening/insignificance thresholds. As such, further consideration of the impacts is not needed, and the impacts on local ecological sites are judged to be

[19] The screening threshold of 100% has been used for non-statutory ecology sites such as local wildlife sites, as per EA guidance.

[20] https://prtr.defra.gov.uk/map-search

not significant.

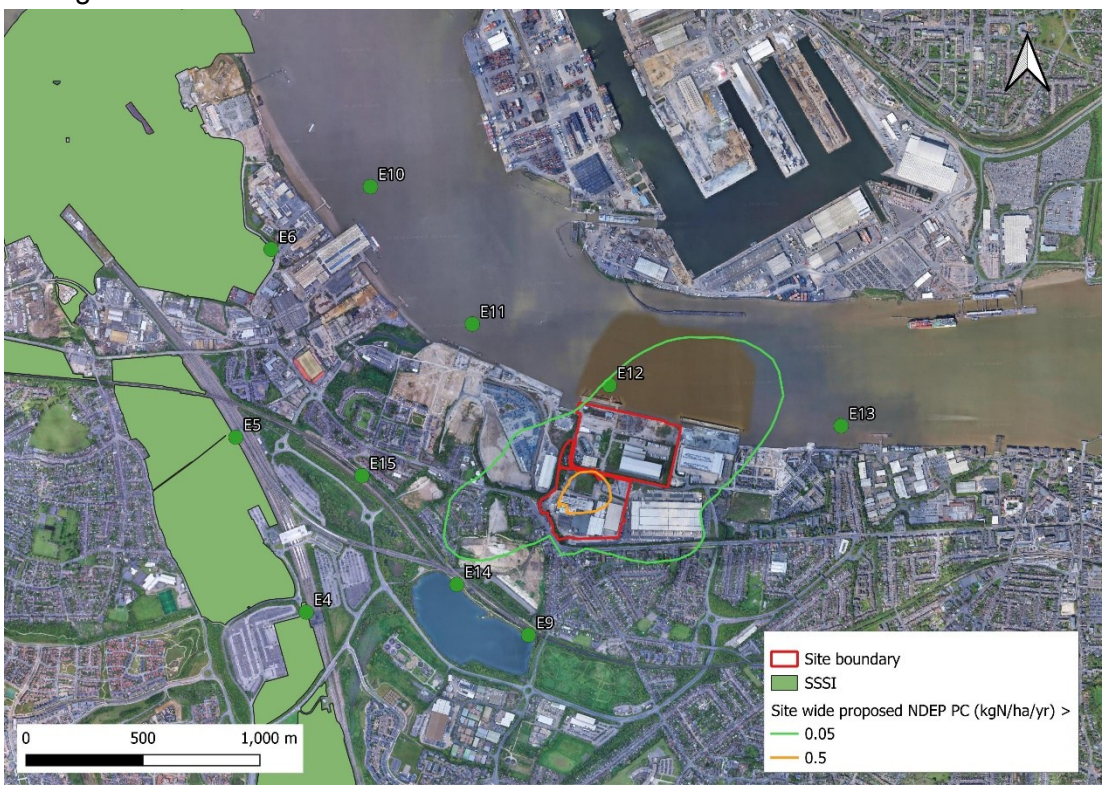

Figure 5.2: Site-wide Proposed Annual Mean Nitrogen Deposition Flux Contour (maximum of 3 years).

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026.

6 CONCLUSIONS

An air quality assessment to support a planning application for the replacement of three natural-gas fired boilers with two new hydrogen-fired boilers and associated stacks has been prepared with reference to existing air quality in the area and relevant air quality legislation, policy and guidance.

Ground level concentrations of oxides of nitrogen, nitrogen dioxide and carbon monoxide associated with the emissions from the new flues were predicted at nearby relevant human and ecological receptor locations using dispersion modelling. This included consideration of all site-wide combustion sources.

The assessment has demonstrated negligible and no significant impacts from the proposed changes to the site operations at nearby human receptors, with nitrogen dioxide and carbon monoxide concentrations staying well below the applicable air quality objectives.

At ecological receptors, the modelling has demonstrated that all site-wide impacts following the proposed changes to the onsite boiler configuration will not exceed Natural England's relevant screening/insignificance thresholds. As such, further consideration is not needed, and the impacts on local ecological sites are judged to be not significant.

Overall, the air quality effects of the proposed boiler replacement are judged to be not significant.

As such, the scheme is judged to be compliant with local council policies and consistent with the NPPF.

APPENDIX A – MODEL SENSITIVITY ANALYSIS

Table A1 presents the results of the model sensitivity testing described in Section 4. The results presented are the PCs for Receptor R1 (the worst-case modelled receptor against the annual mean AQO) for the 2023 meteorological year. As can be seen from the results, the model is not overly sensitive to changes in the fuel used within the proposed boilers; however, the model is sensitive to manually adjusting terrain heights to match those presented within Google Earth (as opposed to using 50 m OS terrain data). Based on the impacts predicted in the main body of the report, the sensitivity testing is not judged to impact the conclusions of the assessment.

Table A1: Results of the Sensitivity Testing

Model description	Annual mean NO_2 ($\mu g/m^3$)	99.79th %ile 1-hour Mean NO_2 ($\mu g/m^3$)
Core Model – Assuming proposed boilers are fired on Hydrogen	0.75	2.85
Model 1 – Assuming proposed new boilers are fired on natural gas	0.77	2.87
Model 2 – Core model with receptor heights manual adjusted	1.03	4.59

APPENDIX B – RECEPTORS

Table B1 presents the discrete human and ecological receptors included in the dispersion model.

Table B1: Discrete Human and Ecological Receptors Included in the Model

Receptor ID	Receptor Type	X (m)	Y (m)	Height (m)
1	Residential	562440	174256	1.5
2	Residential	562462	174198	1.5
3	Residential	562483	174167	1.5
4	Residential	562487	174106	1.5
5	Residential	562215	174153	1.5
6	Residential	562218	174274	1.5
7	Residential	562359	174223	1.5
8	Residential	562602	174033	1.5
9	Residential	562748	174040	1.5
10	Residential	562885	174046	1.5
11	Residential	562987	174052	1.5
12	Residential	563152	174033	1.5
13	Residential	563347	174109	1.5
14	Residential	563450	174198	1.5
15	Residential	563457	174272	1.5
16	Residential	563283	174321	1.5
17	Residential	562171	174413	1.5
18	Residential	562846	173933	1.5
19	Residential	563625	176392	1.5
20	Residential	563900	176181	1.5
21	Residential	564092	176016	1.5
22	Residential	562469	174146	1.5
E1	Ecological	567298	173750	1.5
E2	Ecological	568987	176177	1.5
E3	Ecological	561677	172882	1.5

Receptor ID	Receptor Type	X (m)	Y (m)	Height (m)
E4	Ecological	561451	173785	1.5
E5	Ecological	561150	174533	1.5
E6	Ecological	561300	175338	1.5
E7	Ecological	567598	165780	1.5
E8	Ecological	568067	174485	1.5
E9	Ecological	562401	173687	1.5
E10	Ecological	561725	175605	1.5
E11	Ecological	562161	175017	1.5
E12	Ecological	562747	174756	1.5
E13	Ecological	563738	174582	1.5
E14	Ecological	562095	173903	1.5
E15	Ecological	561689	174368	1.5

APPENDIX C – ECOLOGICAL RECEPTOR RESULTS

Table C1: Predicted Annual Mean NO_x Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (µg/m³)	Proposed PC (µg/m³)	% of CLe (Proposed PC)	Change % of Objective	PEC µg/m³	% PEC of CLe
E1 (Ramsar)	0.03	0.01	<0.1%	0%	31.31	104%
E2 (Ramsar/ SPA)	0.03	0.01	<0.1%	0%	31.31	104%
E3 (SSSI)	0.05	0.04	0.1%	0%	31.34	104%
E4 (SSSI)	0.22	0.18	0.6%	0%	31.48	105%
E5 (SSSI)	0.15	0.09	0.3%	0%	31.39	105%
E6 (SSSI/ LWS)	0.08	0.05	0.2%	0%	31.35	104%
E7 (SAC)	0.01	<0.01	<0.1%	0%	31.30	104%
E8 (Ramsar/ SPA)	0.02	0.01	<0.1%	0%	31.31	104%
E9 (LWS)	0.18	0.17	0.6%	0%	31.47	105%
E10 (SMR[21])	0.08	0.05	0.2%	0%	31.35	105%
E11 (SMR[19])	0.18	0.14	0.5%	0%	31.44	105%
E12 (SMR[19])	0.39	0.56	1.9%	1%	31.86	106%
E13 (SMR[19])	0.34	0.24	0.8%	0%	31.54	105%
E14 (LWS)	0.38	0.37	1.2%	0%	31.67	106%
E15 (LWS)	0.26	0.21	0.7%	0%	31.51	105%
CLe			**30**			

[21] Special Migratory Route

Table C2: Predicted 24-hour Mean NO_x Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (µg/m³)	Proposed PC (µg/m³)	% of CLe (Proposed PC)	Change % of Objective	PEC µg/m³	% PEC of CLe
E1 (Ramsar)	2.26	1.39	1.9%	-1%	63.99	85%
E2 (Ramsar/ SPA)	1.73	0.91	1.2%	-1%	63.51	85%
E3 (SSSI)	6.05	4.45	5.9%	-2%	67.05	89%
E4 (SSSI)	5.02	6.46	8.6%	2%	69.06	92%
E5 (SSSI)	3.80	4.27	5.7%	1%	66.87	89%
E6 (SSSI/ LWS)	5.33	5.00	6.7%	0%	67.60	90%
E7 (SAC)	1.49	0.64	0.8%	-1%	63.24	84%
E8 (Ramsar/ SPA)	2.08	1.19	1.6%	-1%	63.79	85%
E9 (LWS)	10.98	12.71	17.0%	2%	75.31	100%
E10 (SMR[22])	5.12	4.98	6.6%	0%	67.58	90%
E11 (SMR[19])	6.15	8.72	11.6%	3%	71.32	95%
E12 (SMR[19])	10.78	17.57	23.4%	9%	80.17	107%
E13 (SMR[19])	5.92	7.79	10.4%	2%	70.39	94%
E14 (LWS)	8.75	11.02	14.7%	3%	73.62	98%
E15 (LWS)	4.60	6.17	8.2%	2%	68.77	92%
CLe			**75**			

[22] Special Migratory Route

Table C3: Predicted Annual Mean Nutrient Nitrogen Deposition Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (kgN/ha/yr)	Proposed PC (kgN/ha/yr)	% of CLo (Proposed PC)	Change % of Objective	PEC (kgN/ha/yr)	% PEC of CLo	Critical Load (kgN/ha/yr)
E1 (Ramsar)	<0.01	<0.01	<0.1%	0%	12.30	246%	5
E2 (Ramsar/ SPA)	<0.01	<0.01	<0.1%	0%	12.30	246%	5
E3 (SSSI)	0.01	<0.01	0.1%	0%	12.30	246%	5
E4 (SSSI)	0.02	0.02	0.4%	0%	12.32	246%	5
E5 (SSSI)	0.02	0.01	0.2%	0%	12.31	246%	5
E6 (SSSI/ LWS)	0.01	<0.01	0.1%	0%	12.30	246%	5
E7 (SAC)	<0.01[1]	<0.01 [1]	<0.1%	0%	25.71 [1]	257%	10
E8 (Ramsar/ SPA)	<0.01	<0.01	<0.1%	0%	12.30	246%	5
E9 (LWS)	0.02	0.02	0.3%	0%	12.32	246%	5
E10 (SMR[23])	0.01	0.01	0.1%	0%	12.31	246%	5
E11 (SMR[23])	0.02	0.01	0.3%	0%	12.31	246%	5
E12 (SMR[23])	0.04	0.06	1.1%	0%	12.36	247%	5
E13 (SMR[23])	0.03	0.02	0.5%	0%	12.32	246%	5
E14 (LWS)	0.04	0.04	0.8%	0%	12.34	247%	5
E15 (LWS)	0.03	0.02	0.4%	0%	12.32	246%	5

Note 1 – Forest deposition values applied.

[23] Special Migratory Route

Table C4: Predicted Annual Mean Acid Deposition Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (Keq/ha/yr)	Proposed PC (Keq/ha/yr)	% of CLo (Proposed PC)	Change % of Objective	PEC Keq/ha/yr	% PEC of CLo	Critical Load (Keq/ha/yr)
E1 (Ramsar)	<0.001	<0.001	0.01%	0%	1.10	108%	1.019
E2 (Ramsar/ SPA)	<0.001	<0.001	0.01%	0%	1.10	108%	1.019
E3 (SSSI)	<0.001	<0.001	0.03%	0%	1.10	108%	1.019
E4 (SSSI)	0.002	0.001	0.13%	0%	1.10	108%	1.019
E5 (SSSI)	0.001	0.001	0.07%	0%	1.10	108%	1.019
E6 (SSSI/ LWS)	0.001	<0.001	0.03%	0%	1.10	108%	1.019
E7 (SAC)	<0.001 [1]	<0.001 [1]	<0.01%	0%	2.00 [1]	101%	1.983
E8 (Ramsar/ SPA)	<0.001	<0.001	0.01%	0%	1.10	108%	1.019
E9 (LWS)	0.001	0.001	0.12%	0%	1.10	108%	1.019
E10 (SMR[24])	0.001	<0.001	0.04%	0%	1.10	108%	1.019
E11 (SMR[24])	0.001	0.001	0.10%	0%	1.10	108%	1.019
E12 (SMR[24])	0.003	0.004	0.40%	0%	1.10	108%	1.019
E13 (SMR[24])	0.002	0.002	0.17%	0%	1.10	108%	1.019
E14 (LWS)	0.003	0.003	0.26%	0%	1.10	108%	1.019
E15 (LWS)	0.002	0.002	0.15%	0%	1.10	108%	1.019

Note 1 – Forest deposition values applied.

[24] Special Migratory Route