



Air Emissions Risk Assessment

Northfleet Sample Preparation Plant

Britannia Refined Metals Ltd

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Basis of Report

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Executive Summary

SLR Consulting Limited has been instructed by Britannia Refined Metals Ltd to undertake an Air Emissions Risk Assessment (AERA) in support of an Environmental Permit (EP) application. The EP application is for a sample preparation plant at the existing BRM facility in Northfleet, Gravesend.

The sample preparation plant would receive and process contaminated metallic sample material. The sample preparation process will consist of several steps comprising receipt, roasting, matting, comminution and collection. Emissions to air from the sample preparation plant would be limited to the roasting, matting and comminution processes. A bespoke extraction and abatement system would draw air from these operational areas for treatment prior to discharge to atmosphere.

The conclusions of the dispersion modelling assessment are:

- there are no exceedances of long-term EALs at human receptors;
- there are no exceedances of short-term impacts at human receptors;
- the maximum predicted annual mean PC for NO₂ across the Dartford AQMA No.2 is well below 1% of the EAL and can be considered insignificant;
- the maximum predicted annual mean ground level PC for PM₁₀ at any area of relevant public exposure across the Northfleet Industrial Area AQMA is well below 1% of the EAL and can be considered insignificant; and
- impacts at ecological receptors will result in 'no likely damage' at the Swanscombe Peninsula SSSI and 'no likely significant effects' at the Thames Estuary & Marshes SPA / Ramsar site.



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1.0 Introduction

SLR Consulting Limited (SLR) has been instructed by Britannia Refined Metals Ltd ('the client' BRM) to undertake an Air Emissions Risk Assessment (AERA) in support of an Environmental Permit (EP) application. The EP application is for a sample preparation plant at the existing BRM facility in Northfleet, Gravesend (the 'Site').

The assessment describes the scope, relevant legislation, assessment methodology and the baseline conditions at the Site and its surroundings. It then considers the significance of potential environmental impacts of the proposed operations on the baseline environment.

1.1 Proposed Operations

The Operations and Environmental Management Plan provided in Section 3 of the application gives a full description of the EP application and the sample preparation plant. The key details of relevance to this air quality assessment are as follows:

- The sample preparation plant would typically process samples of waste electrical and electronic equipment (WEEE) weighing between 10 and 15 kg, as well as copper-scrap (Cu-scrap) or Automobile Shredder Waste (ASW) and Automobile Shredder Residues (ASR) samples weighing up to 40 kg;
- The sample preparation plant will initially process five to six samples per day, increasing by a further three samples per day as operations scale up;
- Samples processed at the facility are anticipated to comprise 75% e-scrap and 25% Cu-scrap, ASW or ASR;
- The sample preparation process will consist of several steps comprising receipt, roasting, matting, comminution and collection. The roasting, matting and comminution steps will give rise to emissions that will be extracted and routed to an abatement system; and
- The abatement system would utilise bag filtration and activated carbon media to adsorb target pollutants prior to release of treated air to atmosphere via a single 20m emission stack.

1.2 Scope and Objective

The focus of this assessment is emissions resulting from the sample preparation plant via the abatement system emission stack. The plant has been categorised as a Small Waste Incineration Plant (SWIP). The scope incorporates:

- a review of relevant legislation and guidance;
- a review of baseline conditions at the site;
- quantification of pollutant emissions to air;
- prediction of the impact of emissions to air using atmospheric dispersion modelling techniques;
- consideration of model uncertainties and sensitivities; and
- assessment of the significance of these predicted impacts on air quality.

The objective of the assessment is to determine the potential effect of emissions from the proposed e-scrap sample preparation plant on the air quality environment by comparison to relevant guidelines for the protection of human health and the environment (i.e. protected sensitive habitats).



The pollutants considered within this assessment have been determined in consideration of the proposed operations and reference to relevant guidance (as presented in Section 2.2.1) as follows:

- Oxides of Nitrogen (NO_x)
- Total Particulate Matter (PM);
- Carbon Monoxide (CO)
- Sulphur Dioxide (SO₂)
- Total Organic Compounds (TOC);
- Hydrogen Fluoride (HF);
- Hydrogen Chloride (HCl);
- Group 1 heavy metals;
- Group 2 heavy metals; and
- Group 3 heavy metals.



2.0 Relevant Legislation, Policy & Guidance

2.1 Air Quality Legislation and Guidance

2.1.1 Air Quality Standards Regulations

The Air Quality Standards Regulations 2010¹ (AQSR) transpose both the EU Ambient Air Quality Directive (2008/50/EC), and the Fourth Daughter Directive (2004/107/EC) into national legislation. The regulations set Limit Values, Target Values, and Objectives for the protection of human health and the environment. Following the UK's withdrawal from the EU, the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020² made amendments to existing retained EU law relating to air quality, to ensure they continue to operate effectively after the transition period.

2.1.2 Air Quality Strategy

The latest AQS for England was published in 2023³. The AQS provides the delivery framework for air quality management across England for local authorities and summarises the air quality standards and objectives operable within England for the protection of public health and the environment.

The ambient air quality objectives of relevance to human receptors in this assessment are provided in Table 2-2.

2.1.3 Local Air Quality Management

Part IV of the Environment Act 1995 (as amended by the 2021 Environment Act) requires local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to Review and Assess air quality within their boundaries to determine the likelihood of compliance, regularly and systematically.

Where any of the prescribed AQS objectives are not likely to be achieved, the authority must designate an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to prepare an Air Quality Action Plan (AQAP), which details measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the objective. Local authorities therefore have formal powers to control air quality through a combination of LAQM and through application of wider planning policies.

Defra has published technical guidance for use by local authorities in their LAQM work⁴. This guidance, referred to in this report as LAQM.TG22, has been used where appropriate in the assessment presented here.

¹ The Air Quality Standards Regulations (England) 2010, Statutory Instrument No 1001, The Stationary Office Limited.

² The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, Statutory Instrument No. 1313, The Stationary Office Limited.

³ Air Quality Strategy: Framework for Local Authority Delivery, Defra. April 2023.

⁴ Defra, in partnership with Scottish Government, Department of Agriculture, Environment and Rural Affairs and Welsh Government, Local Air Quality Management Technical Guidance (TG22), LAQM.TG22, August 2022.



2.2 Regulation of Industrial Emissions

2.2.1 Industrial Emissions Directive

The Industrial Emissions Directive⁵ (IED) recast seven existing directives including the Waste Incineration Directive (WID)⁶. Chapter IV of the IED applies to incineration and co-incineration plants (which accept waste and other fuels such as biomass) which thermally treat waste as defined in the Waste Framework Directive.

The Emission Limit Values (ELVs) for emissions to air, as defined within the IED, are summarised in Table 2-1 below.

Table 2-1: ELVs from IED Chapter IV

Pollutant	Emission Limits (mg/Nm ³) ^(A)		
	Daily average values	Half hourly averages	
		100 th Percentile	97 th Percentile
Continuous Monitoring			
Oxides of nitrogen (NO _x)	200	400	200
Total Particulate Matter	10	30	10
Carbon Monoxide (CO) ^(B)	50	150	100
Sulphur dioxide (SO ₂)	50	200	50
Total Organic Carbon (TOC)	10	20	10
Hydrogen chloride (HCl)	10	60	10
Hydrogen fluoride (HF)	1	4	2
Spot sample measurements			
Group 1 metals: Cadmium and thallium	0.05		
Group 2 metals: Mercury	0.05		
Group 3 metals ^(C)	0.5		
Dioxins and furans ^(D)	0.0000001		
Table notes:			
(A) Concentrations presented at the following reference conditions: temperature 273K, pressure 101.3kPa, 11% O ₂ , dry gas.			
(B) 150 mg/Nm ³ of combustion gas for at least 95% of all measurements determined as 10-minute averages or 100 mg/Nm ³			
(C) Antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, and vanadium.			
(D) The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence (TEQ).			

⁵ Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

⁶ Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste.



2.2.2 Environmental Permitting

The proposed installation would be regulated by the Local Authority under the Environmental Permitting (England and Wales) Regulations 2016 (as amended), as a SWIP.

The IED provides the basis for Environmental Permit conditions as regards releases to air and mitigation measures.

Of particular relevance to the assessment of air quality impacts is the EA's '*air emission risk assessment for your environmental permit*' guidance⁷ (referred to as the AERA guidance throughout this report). The purpose of this guidance is to assist operators to assess risks to the environment and human health when applying for a permit under the EP Regulations. This guidance sets out Environmental Assessment Levels (EALs) which are taken from the AQS and AQSR but also includes EALs for additional pollutants. Those relevant to this assessment are presented within Table 2-2 below.

2.3 Environmental Standards

2.3.1 Standards for the Protection of Human Health

The standards applied in this assessment are presented in Table 2-2.

Table 2-2: Applied Air Quality Assessment Levels

Pollutant	Annual Standard (µg/m³)	Short-term Standard (µg/m³)	Short-term Reference Period	Ref.
Nitrogen Dioxide (NO ₂)	40	200	1-hour mean, not to be exceeded more than 18 times per year	AQSR
Particulates (PM ₁₀)	40	50	24-hour mean, not to be exceeded more than 35 times per calendar year	AQSR
Particulates (PM _{2.5})	20	-	-	AQSR
CO	-	30,000	1-hour mean	AERA
		10,000	8-hour running mean	AQSR
SO ₂	-	125	24-hour mean, not to be exceeded more than 3 times per calendar year	AQSR
		350	1-hour mean, not to be exceeded more than 24 times per calendar year	AQSR
		266	15-minute mean, not to be exceeded more than 35 times per calendar year	AQS
TOC (as benzene)	5	30	24-hour mean	AERA / AQSR
HCl	-	750	1-hour mean	AERA
HF	16 (monthly)	160	1-hour mean	AERA
Cadmium	0.005	0.03	24-hour mean	AQSR
Mercury	-	0.06	24-hour mean	AERA

⁷ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>



Pollutant	Annual Standard (µg/m ³)	Short-term Standard (µg/m ³)	Short-term Reference Period	Ref.
		0.6	1-hour mean	AERA
Antimony	5	150	1-hour mean	AERA
Arsenic	0.006	-	-	
Lead	0.25	-	-	AQSR
Chromium (III)	-	2.0	24-hour mean (long-term)	AERA
Chromium (VI)	0.00025	-	-	AERA
Copper	-	0.05	24-hour mean	AERA
Manganese	0.15	1500	1-hour mean	AERA
Nickel	0.02	-	-	AQSR
Vanadium	-	1.0	24-hour mean	AERA
Table note: (A) There is no established EAL for Thallium, Cobalt or dioxins.				

The AQS objectives apply at locations which are situated outside of buildings or other natural or man-made structures above or below ground and where members of the public are regularly present; and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period (referred to as 'relevant exposure'). Table 2-3 provides an indication of those locations.

Table 2-3: Human Health Relevant Exposure

AQAL Averaging Period	Relevant Locations	AQALs should apply at	AQALs should not apply at
Annual Mean	Where individuals are exposed for a cumulative period of 6-months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	Where individuals might reasonably be expected to spend one hour or longer	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

2.3.2 Standards for the Protection of Ecosystems

2.3.2.1 Critical Levels (C_{Le})

C_{Le}'s are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do



not occur, according to present knowledge. The relevant C_{Le} for the protection of vegetation and ecosystems is specified within the AQSR and AERA guidance.

Table 2-4: Relevant C_{Le} for the Protection of Vegetation and Ecosystems

Pollutant	Concentration ($\mu\text{g}/\text{m}^3$)	Habitat and Averaging Period
Nitrogen oxides (NO_x)	30	Annual mean
	75	Daily mean
Sulphur Dioxide (SO_2)	10	Annual mean (where lichens or bryophytes are present)
	20	Annual mean (all ecosystems)
HF	5.0	Daily mean
	0.5	Weekly mean

2.3.2.1 Critical Loads (C_{Lo})

C_{Lo} 's are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Critical loads are set for the deposition of various substances to sensitive ecosystems.

Empirical C_{Lo} 's for eutrophication (derived from a range of experimental studies) are assigned based on different habitats, including grassland ecosystems, mire, bog and fen habitats, freshwaters, heathland ecosystems, coastal and marine habitats, and forest habitats and can be obtained from the UK Air Pollution Information System (APIS) website (www.apis.ac.uk/).

The C_{Lo} 's relevant to this assessment are presented in Section 4.4.



3.0 Assessment Methodology

3.1 Approach

A detailed assessment has been undertaken using dispersion modelling, and incorporates:

- identification of sensitive receptors and compilation of the existing air quality baseline;
- quantification of emissions from the installation;
- atmospheric dispersion modelling to determine process contribution to ground level concentrations and calculate deposition rates; and
- assessment of impacts by comparison to standards for protection of human health and ecological receptors.

3.2 Detailed Modelling Parameters

For this assessment the AERMOD model has been utilised; this model is widely used and accepted by the EA for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United States (US) Environmental Protection Agency (EPA). It is therefore considered a suitable model for this assessment.

Model validation studies⁸ for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short term high percentiles concentrations well within a factor of two and the latest evaluation study for AERMOD shows the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data is available to validate model performance), to be between 0.96 and 1.2.

3.2.1 Modelled Domain / Receptors

The modelling has been undertaken using a receptor grid across a map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration outside the Site boundary to be assessed.

A nested receptor grid of 10km by 10km centred at x561367, y175314 was applied as follows:

- 200m x 200m at 20m grid resolution;
- 500m x 500m at 50m grid resolution;
- 1km x 1km at 100m grid resolution;
- 2km x 2km at 200m grid resolution;
- 5km x 5km at 500m grid resolution; and
- 10km x 10km at 1km grid resolution.

In addition, the modelling of discrete sensitive receptor locations, as described in Section 4.1, was undertaken to assess predicted concentrations at relevant exposure locations and facilitate the discussion of results.

⁸ AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003 (United States Environmental Protection Agency).



3.2.2 Topography

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

As such, topography has been incorporated within the dispersion modelling. AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights.

3.2.3 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Further details on the buildings considered within the dispersion modelling are presented in Section 4.7.

3.2.4 Meteorological Data Preparation

A 5-year meteorological dataset from the Gravesend-Broadness recording station data has been utilised for the dispersion modelling. The Gravesend-Broadness recording station is located approximately 1.3km to the north of the Site.

The meteorological data was converted to the required surface and profile formats for use in AERMOD, in accordance with the latest guidance⁹, using AerMet View meteorological pre-processor. Details specific to the meteorological recording station location were used to define surface roughness, albedo and bowen ratio in the conversion using the AerSurface tool within AerMet.

3.2.5 Dispersion Coefficients

The 'urban' option for dispersion coefficients was selected in accordance with AERMOD guidance.

3.3 Assessment of Impacts on Human Receptors

The assessment of impacts against the standards as defined in Section 2.3.1 was undertaken using model outputs as described in Table 3-1 below.

⁹ AERMOD Implementation guide. AERMOD implementation workgroup, USEPA. Last revised October 2023.



Table 3-1: Model Outputs

Averaging Period	Model Output – Process Contribution (PC)	Predicted Environmental Concentration (PEC)
15-minute	99.9%ile of 1-hour means multiplied by 1.34	PC + 2 x annual mean background
1-hour	99.79%ile of 1-hour means	PC + 2 x annual mean background
	99.73%ile of 1-hour means	
	Maximum 1-hour mean	
8-hour	Maximum 8-hour mean	PC + 2 x annual mean background
24-hour	90.18%ile of 24 hour means	PC + annual mean background if EAL defined as short-term or PC + 2 x annual mean background if EAL defined as long-term in AERA guidance
	90.4%ile of 24 hour means	
	Maximum 24-hour mean	
Monthly	Maximum monthly mean	PC + annual mean background
Calendar year	Annual Mean	PC + annual mean background

In accordance with AERA guidance, the impact is considered to be insignificant or negligible if:

- the long-term process contribution <1% of the long term EAL; and
- the short-term process contribution is <10% of the short term EAL.

For process contributions that cannot be considered insignificant further assessment has been undertaken and the Predicted Environmental Concentration (PEC: PC + existing background pollutant concentration) determined for comparison as a percentage of the relevant EAL.

3.4 Assessment of Impacts on Vegetation and Ecosystems

3.4.1 Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06¹⁰. Dry deposition flux was calculated using the following equation:

Dry deposition flux ($\mu\text{g}/\text{m}^2/\text{s}$) = ground level concentration ($\mu\text{g}/\text{m}^3$) 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 is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

The applied deposition velocities for the relevant chemical species are as presented in Table 3-2.

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



Table 3-2: Applied Deposition Velocities

Chemical Species	Recommended deposition velocity (m/s)	
NO ₂	Grassland	0.0015
	Woodland	0.003
SO ₂	Grassland	0.012
	Woodland	0.024
HCl	Grassland	0.025
	Woodland	0.06

3.4.2 Critical Loads - Acidification

The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by multiplying by the dry deposition flux (µg/m²/s) by the standard pollutant specific conversion factors presented within Table 3-3.

Table 3-3: Applied Deposition Velocities

Chemical Species	Conversion factor to keq/ha/year
NO ₂	6.84
SO ₂	9.84
HCl	8.63

3.4.3 Calculation of PC as a percentage of Acid Critical Load Function

The calculation of the process contribution of N and S to the acid C_{Lo} function has been carried out according to the guidance on the APIS, which is as follows:

‘The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less than CLminN only the acidifying affects of sulphur from the process need to be considered:

Where PEC N Deposition < CLminN

*PC as % CL function = (PC S deposition/CLmaxS)*100*

Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.

Where PEC N Deposition > CLminN

*PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100’*

3.4.4 Assessment of Impact and Significance

In addition to the AERA guidance, the EA’s Operational Instruction 66_12¹¹ details how air quality impacts on ecological sites should be assessed. This guidance provides risk-based

¹¹ EA Operational Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Issued 08/05/2012.



screening criteria to determine whether impacts will have 'no likely significant effects' for European sites, 'no likely damage' for Sites of Special Scientific Interest (SSSIs), or 'no significant pollution' for other sites, as follows:

- PC does not exceed 1% long-term C_{Le} and/or C_{Lo} or that the PEC does not exceed 70% long-term C_{Le} and/or C_{Lo} for European sites and SSSIs; and
- PC does not exceed 10% short-term C_{Le} for NO_x for European sites and SSSIs;
- PC <100% long-term C_{Le} and/or C_{Lo} for other conservation sites; and
- PC <100% short-term C_{Le} for NO_x (if applicable) for other conservation sites.



4.0 Baseline Environment

4.1 Site Setting and Sensitive Receptors

The BRM Northfleet Site is located off Botany Road at the northwestern extent of Northfleet, Gravesend, at approximate National Grid Reference (NGR): x561400, y175300. The Site is located within the administrative area of Gravesham District Council (GDC) and is located within the Northfleet Industrial Area AQMA.

The Site is surrounded by mixed industrial and commercial premises to the north, south and southwest, the River Thames to the northeast and undeveloped land (Swanscombe Peninsula) to the west and northwest. The A226 lies approximately 350m to the south of the Site, running east to west. The nearest residential properties to the Site are located at a distance of 300m or more; off Lower Road (to the south) and Galley Hill Road (to the southwest).

There are a number of ecological sites in proximity to the Proposed Development; most notably the Swanscombe Peninsula and Swanscombe Skull SSSI. In addition to this, the Thames Estuary & Marshes Ramsar site and Special Protection Area (SPA) is located at an extended distance of approximately 6km to the east.

Figure 4-1 below presents the Site location, with the Site boundary outlined in red and other land under the applicant's control outlined in blue.

Figure 4-1: Site Location



4.1.1 Human Receptors

Receptors in proximity to the Proposed Development have been identified and presented in Figure 4-1 and Figure 4-2 below. The selection of human receptors has considered the closest receptor locations in each direction to provide a precautionary assessment representative of the general scale of impacts. According to LAQM.TG(22), AQALs should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant AQAL.

Table 4-1: Human Receptors

Receptor	Receptor Type	Applicable Averaging Period	Receptor Location	
			x	y
DR1	Residential	Long-term and short-term	561280	174903
DR2	Residential	Long-term and short-term	561235	174897
DR3	Residential	Long-term and short-term	561208	174898
DR4	Residential	Long-term and short-term	561180	174893
DR5	Residential	Long-term and short-term	561150	174891
DR6	Residential	Long-term and short-term	561244	174858
DR7	Residential	Long-term and short-term	561246	174812
DR8	Residential	Long-term and short-term	561222	174856
DR9	Residential	Long-term and short-term	561230	174810
DR10	Residential	Long-term and short-term	561184	174842
DR11	Residential	Long-term and short-term	561159	174850
DR12	Residential	Long-term and short-term	561129	174860
DR13	Residential	Long-term and short-term	561274	174793
DR14	Residential	Long-term and short-term	561292	174769
DR15	Residential	Long-term and short-term	561222	174758
DR16	Residential	Long-term and short-term	561287	174727
DR17	Residential	Long-term and short-term	561276	174692
DR18	Residential	Long-term and short-term	561235	174686
DR19	Residential	Long-term and short-term	561138	174785
DR20	Residential	Long-term and short-term	561350	174940
DR21	Residential	Long-term and short-term	561350	174927
DR22	Residential	Long-term and short-term	561474	174671
DR23	Residential	Long-term and short-term	561503	174675
DR24	Residential	Long-term and short-term	561588	174633
DR25	Residential	Long-term and short-term	561603	174683
DR26	Residential	Long-term and short-term	561649	174727
DR27	Residential	Long-term and short-term	561712	174732
DR28	Residential	Long-term and short-term	561765	174706
DR29	Residential	Long-term and short-term	561839	174582

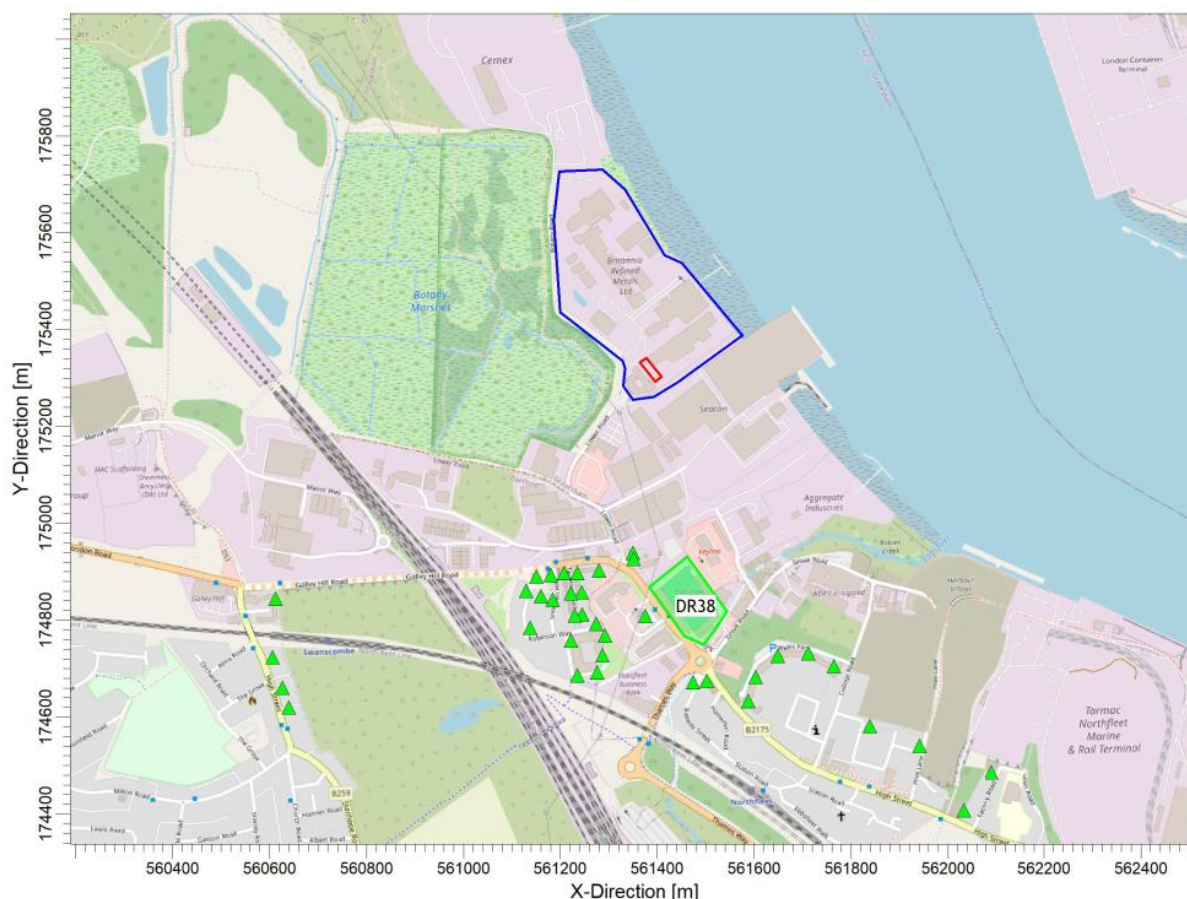


Receptor	Receptor Type	Applicable Averaging Period	Receptor Location	
			x	y
DR30	Residential	Long-term and short-term	561941	174541
DR31	Residential	Long-term and short-term	562033	174407
DR32	Residential	Long-term and short-term	562091	174486
DR33	Residential	Long-term and short-term	560613	174844
DR34	Residential	Long-term and short-term	560606	174724
DR35	Residential	Long-term and short-term	560627	174660
DR36	Residential	Long-term and short-term	560640	174620
DR37	Commercial (filling station)	Short-term only	561375	174809
DR38	Recreational (sports ground)	Short-term only	Multiple across receptor area. See Figure 4-2 below.	
Northfleet Industrial Area AQMA	AQMA	Long-term only (declared for annual-mean PM ₁₀ only)	See Figure 4-4	
Dartford AQMA No.2	AQMA	Long-term only (declared for annual-mean NO ₂ only)	See Figure 4-4	

Figure 4-2 below presents the Site boundary outlined in red, the nearest sensitive human receptors as green triangles, and the area comprising DR38 is outlined in green.



Figure 4-2: Human Receptors



4.1.2 Ecological Receptors

The AERA Guidance requires that ecological habitats should be screened against relevant standards if they are located within the following set distances from the facility:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the installation; and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNR), Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and Ancient Woodland (AW) within 2km of the installation.

A review using the Magic web-based mapping service¹² was undertaken to identify any designated sites of ecological or nature conservation importance required for consideration within the assessment. The ecological receptors and designations considered in the assessment are presented in Table 4-2 below.

Table 4-2: Ecological Receptors

Receptor ID	Designation Name	Approximate Distance and Direction from the Site	Most Sensitive Habitat
ER1 (SSSI)	Swanscombe Peninsula SSSI	50m west	Grassland / Reed, swamp or fen

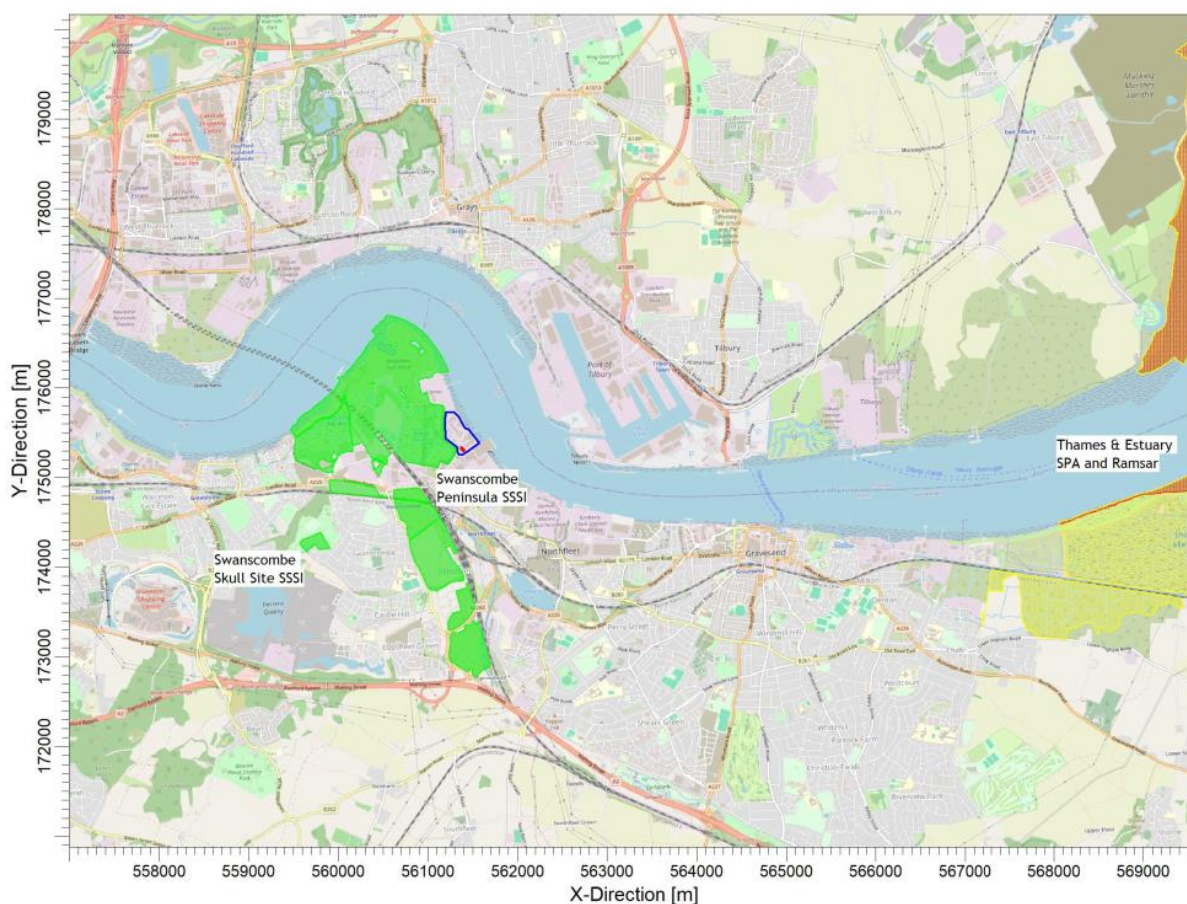
¹² Natural England, www.magic.gov.uk, accessed January 2024.



Receptor ID	Designation Name	Approximate Distance and Direction from the Site	Most Sensitive Habitat
N/A	Swanscombe Skull Site SSSI / NNR	1.8km southwest	Geological interest only ^(A)
ER2 (SPA / Ramsar)	Thames Estuary & Marshes SPA / Ramsar	6km east	Northern wet heath
Table note: (A) The Swanscombe Skull Site ecological designation is classified as 'geological interest only' and therefore has not been considered further within this assessment.			

The ecological designations are presented in Figure 4-3 below, with the SSSIs shaded and outlined in green, the SPA in red and the Ramsar site in yellow.

Figure 4-3: Ecological Receptors



4.2 Ambient Air Quality

The Site is situated on the edge of the administrative area of GBC which borders the administrative area of Dartford Borough Council (DBC) within approximately 300m to the west of the Site.

As such, the Annual Status Reports (ASR) produced by both GBC and Dartford Borough Council (DBC) have been reviewed. At the time of writing, the latest ASR published by GBC is the 2023 ASR¹³ (i.e. containing data up to and including 2022), and the latest ASR

¹³ 2023 Annual Status Report, Gravesham Borough Council, June 2023.



published by DBC is the 2023 ASR¹⁴. As the data presented for 2020 and 2021 were potentially impacted by the COVID-19 pandemic this data has not been presented and has been discounted from further consideration.

4.2.1 Local Air Quality Management

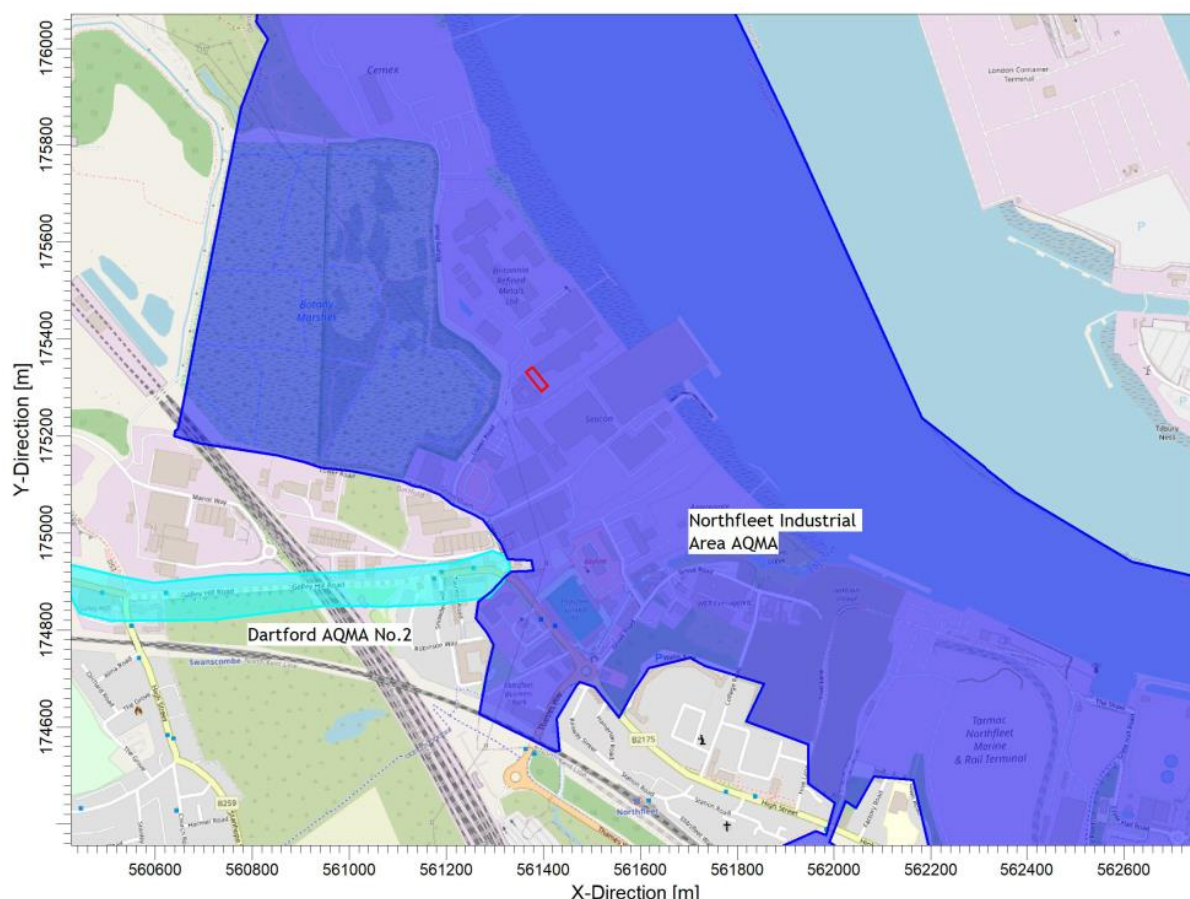
A review of the 2023 APRs indicates that air quality, in regard to NO₂ and PM₁₀ concentrations, is generally improving across the administrative areas.

One AQMA within GBC's administrative area has been identified within the Site locale; the Northfleet Industrial Area AQMA, declared for exceedences of the PM₁₀ annual-mean AQAL. One AQMA within DBC's administrative area has been identified within the Site locale; the Dartford AQMA No.2, declared for exceedences of the NO₂ annual-mean AQAL.

Whilst there are other AQMAs within the area, such as the Gravesham A226 One-way system AQMA and Gravesham A2 AQMA, these AQMAs are located at a distance of 2.5km or more from the site and have therefore not been considered further within this assessment.

The location of the AQMAs in proximity to the Site are presented in Figure 4-4 below.

Figure 4-4: Nearby AQMAs



4.2.2 Local Authority Monitoring Data

Passive diffusion tube monitoring is currently undertaken by GBC and DBC at numerous locations throughout their administrative areas as part of their commitment to LAQM. The

¹⁴ 2023 Air Quality Annual Progress Report (APR) for South Lanarkshire Council, June 2023.



diffusion tubes are located in areas which are deemed to require further assessment of NO₂ concentrations.

GBC and DBC have a select number of urban monitoring locations, generally located at the kerbside/roadside. Urban monitoring locations in proximity to the Site are presented in Table 4-3 below. GR19, GR112 and GR124 are located within the administrative area of GBC. DA92 and DA93 are located within the administrative area of DBC.

Table 4-3: NO₂ Diffusion Tube Monitoring Results

Location ID	Site Classification	Distance to relevant exposure (m)	Distance from Kerb (m)	Distance and Direction from the Site	Annual Mean Concentration (µg/m ³)		
					2018	2019	2022
GR19	Industrial Background	3.7	20	1.2km, SE	23.3	23.2	18.9
GR112	Roadside	0	4	0.6km, S	34.8	35.7	30.5
GR124	Roadside	1.5	4.7	0.4km, S	32.1	33.2	28.3
DA92	Roadside	9.5	2.4	0.4km, SSW	42.5	35.2	32.4
DA93	Roadside	3.3	2.4	1.0km, SW	41.0	38.2	35.3

Automatic monitoring of NO₂ and PM₁₀ is currently undertaken by GBC and DBC at numerous locations throughout their administrative areas as part of their commitment to LAQM.

There is a single automatic monitoring station located within proximity of the Site, as presented in Table 4-4 below.

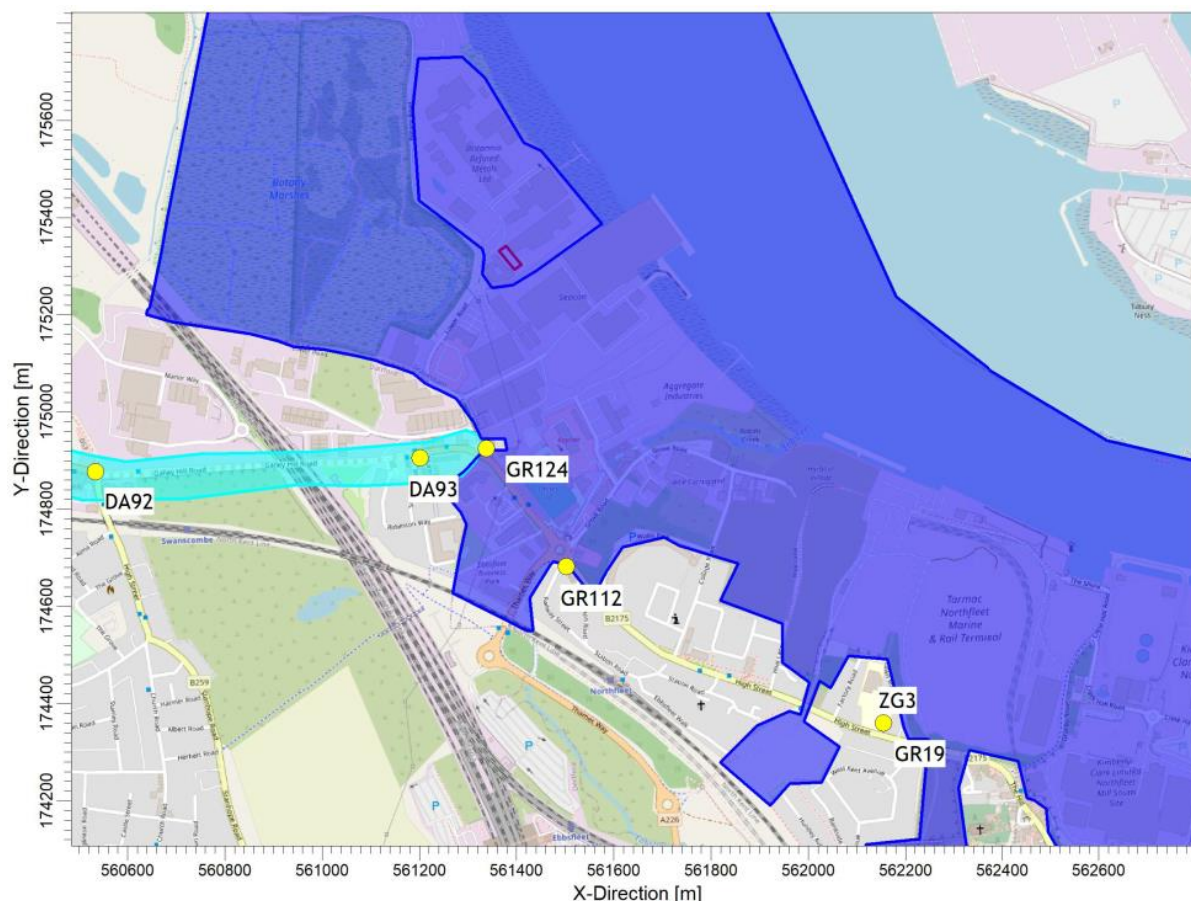
Table 4-4: Automatic Monitoring Results

Local Authority	Site Classification	Distance to relevant exposure (m)	Distance from Kerb (m)	Distance and Direction from the Site	Pollutant	Annual Mean Concentration (µg/m ³)		
						2018	2019	2022
ZG3	Industrial Background	3.7	20	1.2km, SE	NO ₂	23.5	24.5	18.2
					PM ₁₀	21.9	22.3	22.5

As presented in Table 4-4 above, recorded annual mean NO₂ and PM₁₀ concentrations in the Site locale were measured below the respective annual mean AQUAL.



Figure 4-5: Monitoring Locations



4.2.3 National Monitoring Networks

Whilst GBC and DBC undertake automatic monitoring within their administrative areas, this is limited to NO₂ and PM₁₀ (as presented in Section 4.2.2).

SO₂ and Hydrogen halides are monitored nationally through the 'Acid Gas and Aerosol Network' (AGAN).

The closest monitoring station at which SO₂ has been monitored is the 'urban background' classified site at Thurrock, located approximately 2.5km north of the Site.

The closest monitoring station at which HCl has been monitored is the 'rural background' classified site at Detling, located approximately 24km southeast of the Site.

Where available, monitored concentrations are presented in Table 4-5 and Table 4-6 below.

Table 4-5: SO₂ Monitoring Results

Monitoring Station	Monitoring Period	Average Annual Concentration (µg/m ³)	Number of 15-minute Means >266µg/m ³	Number of 1-hour Means >350µg/m ³	Number of 24-hour Means >125µg/m ³	Data Capture (%)
Thurrock	2023	1.64	0	0	0	77.3



Table 4-6: HCl Monitoring Results

Monitoring Station	Monitoring Period	Annual Average Concentration ($\mu\text{g}/\text{m}^3$)	Data Capture (%)
Detling	2015 ^(A)	0.22	76.7
Table note: (A) The most recent available monitoring data from the Detling monitoring station is presented, as monitoring of HCl at this station ceased in 2016.			

HF is not currently monitored as part of national monitoring networks. However in 2005 The Expert Panel on Air Quality Standards (EPAQS) published a draft report entitled 'Guidelines for halogen and hydrogen halides in ambient air for protecting human health against acute irritancy effects'. The report noted that only a small number of measurements of ambient concentrations of HF have been made in the UK. All of these have been made in the vicinity of three industrial plants. Many samples were below the limit of detection, however, measurable values were in the range 0.05 to 3.5 $\mu\text{g}/\text{m}^3$ as approximate monthly averages. In consideration that these measurements were undertaken in the vicinity of industrial plants identified as potential sources of hydrogen halides, the lower range of concentrations observed (0.05 $\mu\text{g}/\text{m}^3$) has been applied to represent background concentrations of hydrogen fluoride in the Site locale.

4.2.1 Monitoring of Metals

Monitoring of metals is currently carried out by 24 sites around the UK as part of the Heavy Metals Monitoring Network (HMMN). The closest current monitoring location to the Application Site is the 'urban background' classified site at Chadwell St Mary, located approximately 4.5km northeast of the Site. A summary of the latest available monitoring data is presented in Table 4-7.

Table 4-7: Metals Monitoring Data - Chadwell Station

Metal	Most Recently Available Data Period	Annual Average (ng/m^3)
Cadmium	2022	0.23
Mercury	2013 ^(A)	0.013
Arsenic	2022	0.84
Lead	2022	7.82
Chromium (total)	2022	1.8
Copper	2022	7.8
Manganese	2022	6.1
Nickel	2022	1.6
Vanadium	2022	2.0
Table note: (A) The most recent available monitoring data from the Chadwell monitoring station is presented, as monitoring of mercury at this station ceased in 2014.		



Monitoring is not routinely undertaken for antimony, thallium or hexavalent chromium (chromium VI) in the UK and therefore no background data are available. The Expert Panel on Air Quality Standards (EPAQS) report¹⁵ states '*data from Canada, quoted by Rowbotham et al. (2000), suggest that Cr(VI) constitutes between 3 and 8% of total airborne chromium in that country*'; therefore a value of 8% (0.14ng/m³) has been adopted in this assessment.

4.2.2 DEFRA Modelled Background Concentrations and Projections

Predictions of background pollutant concentrations on a 1km-by-1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality¹⁶. Mapped background concentrations of PM₁₀ and PM_{2.5}, based upon the 2018 base year Defra update and projected to 2024, were downloaded for the grid squares containing the Site and relevant receptors, as presented within Table 4-8.

Table 4-8: DEFRA Background Concentrations

Grid reference (BNG)	Mapped Background Concentration (µg/m ³)		
	NO ₂	PM ₁₀	PM _{2.5}
x561500, y175500	20.6	14.5	9.7
x560500, y175500	15.8	14.7	9.7
x561500, y176500	21.3	14.1	9.5
x561500, y174500	17.5	15.1	10.2
Maximum	21.3	14.7	10.2

Mapped background concentrations of CO and benzene based upon the 2001 base year were downloaded for the grid squares containing the Site and relevant receptors, as presented within Table 4-9.

Table 4-9: DEFRA Background Concentrations – 2001 Base Year

Grid reference (BNG)	Mapped Background Concentration (µg/m ³)	
	CO	Benzene
x561500, y175500	348	0.68
x560500, y175500	343	0.65
x561500, y176500	- (A)	- (A)
x561500, y174500	357	0.70
Maximum	357	0.70
Table note:		

¹⁵ Expert Panel on Air Quality Standards Guidelines for metals and metalloids in ambient air for the protection of human health (2009).

¹⁶ Background mapping data for local authorities – <http://uk-air.defra.gov.uk/data/laqm-background-home>, accessed January 2024.



Grid reference (BNG)	Mapped Background Concentration (µg/m³)	
	CO	Benzene
No value is assigned for this grid reference.		

4.3 Baseline Conditions at Human Receptors

The background concentrations applied in this assessment are presented in Table 4-10 below. Baseline concentrations for short-term averaging periods have been calculated from the annual mean in accordance with the approach outlined within AERA guidance (i.e. 2x long-term average).

Table 4-10: Applied Background Concentrations

Pollutant	Units	Background Concentration	Data Source
NO ₂	µg/m³	35.3	Maximum roadside NO ₂ concentration reported by DBC or GBC within the Site locale in 2022 (location DA93).
PM ₁₀	µg/m³	22.5	2022 annual mean concentration reported at the GBC automatic monitoring station ZG3
PM _{2.5}	µg/m³	10.2	DEFRA background maps (2018 base year projected to 2024) – maximum within study area
CO	µg/m³	357	DEFRA background maps (2001 base year) – maximum within study area
SO ₂	µg/m³	1.64	2023 annual mean concentration reported at the Thurrock AURN monitoring station
Benzene (for TOC)	µg/m³	0.7	DEFRA background maps (2001 base year) – maximum within study area
HCl	µg/m³	0.22	2015 annual mean concentration reported at the Detling AGAN monitoring station
HF	µg/m³	3.5	Higher range of EPAQS monitored data
Cadmium	ng/m³	0.23	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station
Mercury	ng/m³	0.013	2013 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station
Arsenic	ng/m³	0.84	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station
Lead	ng/m³	7.8	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station
Chromium (total)	ng/m³	1.8	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station
Chromium (VI)	ng/m³	0.14	Calculated in consideration that 20% of total chromium would comprise chromium VI
Copper	ng/m³	7.8	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station



Pollutant	Units	Background Concentration	Data Source
Manganese	ng/m ³	6.1	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station
Nickel	ng/m ³	1.6	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station
Vanadium	ng/m ³	2.0	2022 annual mean concentration reported at the Chadwell St Mary HMMN monitoring station

4.4 Baseline Conditions at Ecological Receptors

The Air Pollution Information System (APIS) website¹⁷ is a support tool used in the assessment of potential effects of air pollutants upon habitats and species - developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology. The APIS support tool has subsequently been used to provide information on NO_x concentrations, current deposition rates and C_{Lo} for nutrient nitrogen (Table 4-11) and C_{Lo} functions for acidity (Table 4-12).

Table 4-11: Nitrogen Critical Loads and Current Loads

ID	APIS Critical Load Class (most sensitive)	NO _x Annual Mean (µg/m ³)	C _{Lo} Range (kg N/ha/yr)	C _{Lo} Applied in Assessment (kg N/ha/yr)	Current Load (kg N/ha/yr)
ER1 (SSSI)	Grassland	28.2	10-20	10	13.8
	Reed, swamp or fen		10-15		
ER2 (SPA / Ramsar)	Dwarf shrub heath	25.3	5-15	5	13.4

Table 4-12: Acid Critical Load Functions and Current Loads

ID	APIS Critical Load Class (most sensitive)	Critical Load Function (k _{eq} /ha/yr)			Current Load (k _{eq} /ha/yr)	
		CLmaxS	CLminN	CLmaxN	N	S
ER1 (SSSI)	Grassland	Not available ^(A)			0.91	0.19
	Reed, swamp or fen					
ER2 (SPA / Ramsar)	Dwarf shrub heath	4.17	0.892	5.032	0.96	0.16

Table note:
(A) A critical load for acidification has not been assigned for this feature, in reference to the APIS website.

4.5 Meteorological Conditions

The most important climatic parameters governing the release and dispersal of emissions are:

¹⁷ <http://www.apis.ac.uk/>, accessed April 2024.

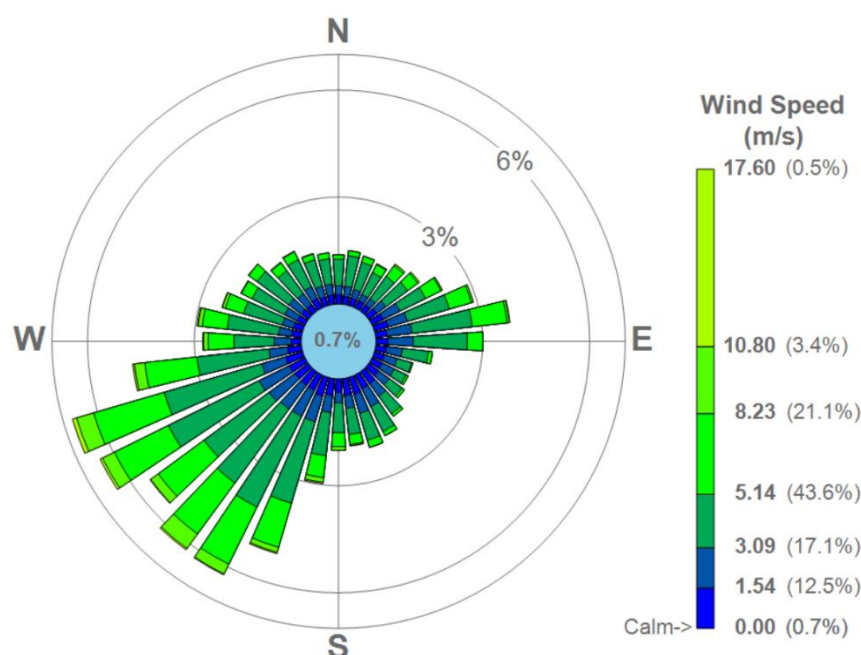


- wind direction, which determines the broad direction of dispersal; and
- wind speed, which will affect ground level concentrations by increasing the initial dilution of pollutants in the emission.

The Gravesend-Broadness meteorological recording station is located just 1.3km to the northwest of the Site, and therefore is considered representative of the Site locale. The Gravesend-Broadness recording station ceased recording in 2018, however data is available for the years preceding this. In consideration that the next nearest monitoring station is located at an extended distance of 18km or more from the Site, the most recently available data from the Gravesend-Broadness recording station has been utilised.

As such, five consecutive years of the most recently available observation data (2013 – 2017 inclusive) from this station was acquired. A windrose showing the frequency of wind speed and direction is provided in Figure 4-6 below. The windrose shows winds from the southwest are most prevalent.

Figure 4-6: Gravesend-Broadness Wind Rose (2013-2017 average)

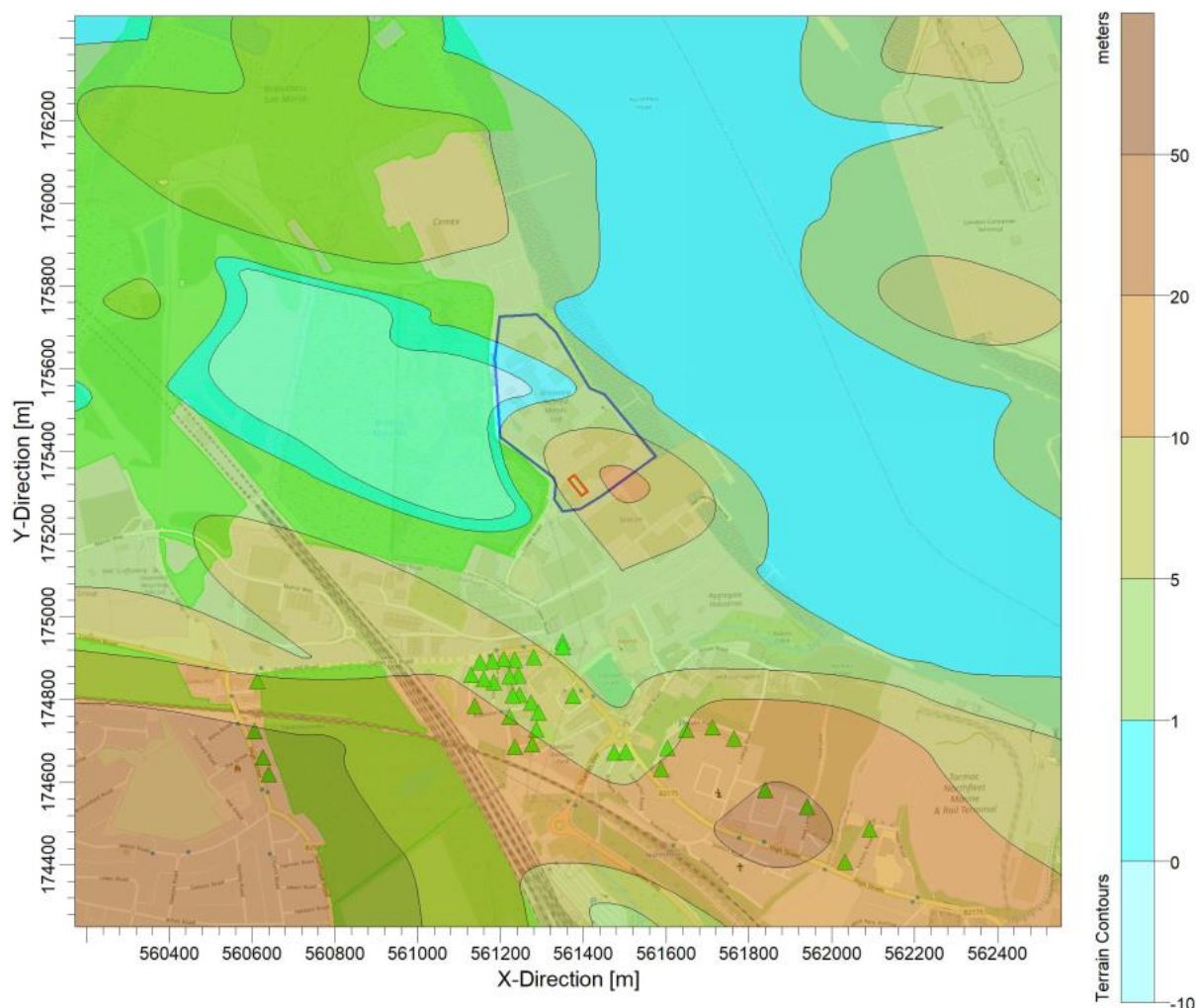


4.6 Topography

The Site lies on a flat area at approximately 20m AOD on the bank of the Thames. The Site locale elevation ranges between 0 and 30m within 1km of the Site. Swanscombe Peninsula, extending to the north and west of the Site, lies at or around sea level. The land gently rises to approximately 30m in the direction of Northfleet (south) and Swanscombe (southwest). The local topography is illustrated in Figure 4-7.



Figure 4-7: Local Topography

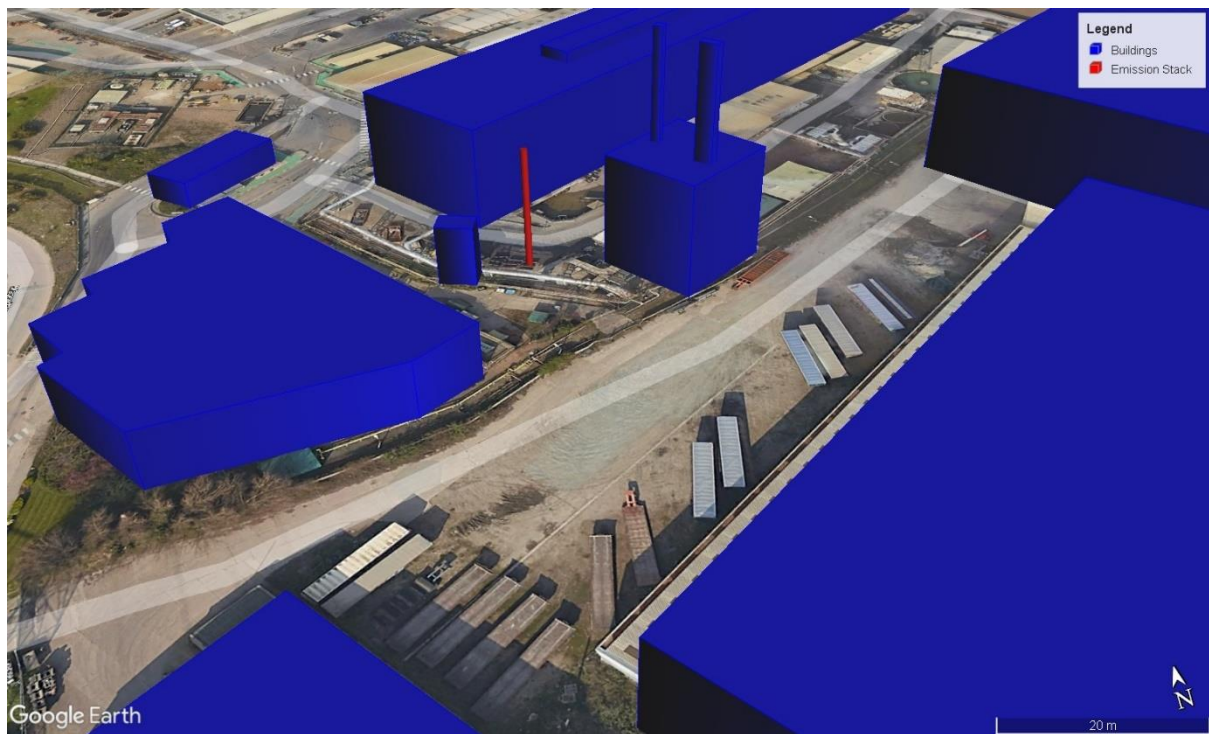


4.7 Building Downwash

The integrated BPIP module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. The buildings/structures input into the model are presented in Figure 4-8.



Figure 4-8: Modelled Buildings and Structures



5.0 Emissions to Atmosphere

5.1 Process Description

The Operations and Environment Management Plan provided in Section 3 of the application gives a full description of the EP application and the e-scrap sample preparation plant.

5.1.1 Overview

The sample preparation plant would receive and process e-scrap and Cu-scrap samples. The majority of samples received would be E-scrap (comprising 75% of total samples received), with each sample weighing between 10 and 15 kg. A lesser number of Cu-scrap and ASW/ASR samples would be received (25% of total samples received), with each weighing up to 40 kg.

The sample preparation process will consist of several steps comprising receipt, roasting, matting, comminution and collection. The roasting, matting and comminution processes would be undertaken in parallel by two separate lines. Emissions to air from the sample preparation plant would be limited to the roasting, matting and comminution processes. A bespoke extraction and abatement system would draw air from these operational areas for treatment prior to discharge to atmosphere.

5.1.2 Roasting

The roasting area removes the volatile portion of the samples, subjecting samples to temperatures between 450 and 800 °C within the two roasting furnaces. Each furnace is fitted with an afterburner to incinerate the waste gases at a temperature of more than 1,100 °C (and a residence time of more than 2 seconds). Both furnaces and afterburners are fuelled by natural gas. Samples are processed within the roasting furnaces over a period of up to 2 hours. Samples would then be left to cool within the furnaces for up to one hour. The resultant ash is then transported to the matting area.

5.1.3 Matting

The matting area utilises two (electrically powered) induction furnaces to melt the resultant ash with pyrite and flux (sodium carbonate based) at a temperature of approximately 1200 °C to produce a sulphurised ingot. The resulting sulphurised ingot are then transported to the comminution area.

5.1.4 Comminution

The comminution area size reduces the ingots to < 2mm with a jaw crusher. The 1kg samples are then further size reduced with a pulverising ring mill to < 150 micron where it is split into 10 equal sub-samples of 100g. These sub-samples are then bagged and labelled for storage.

The comminution process utilises a jaw crusher, pulverising ring mill and two rotary sample dividers to reduce the size of the sulphurised ingots to particles of 150 microns or less. The resulting material is then bagged into 100g samples for subsequent storage and export.

5.1.5 Extraction and Abatement System

The extraction system will utilise Local Extraction Ventilation (LEV) hoods located within the roasting, matting and comminution areas to capture fumes and dust resulting from processing equipment. The air extracted from these areas would be routed via ductwork to the abatement unit, comprising a bag filter (to remove 99% or more of particulates at a particle size of 5 micron or greater), cross-flow non-contact heat exchanger (lowering the temperature of the airstream less than 70 °C) and an activated carbon filter. The treated



process air would subsequently be released to atmosphere via a single 20m dispersion stack.

The overall system has been designed for a total air extraction rate of up to 24,000 m³/hr.

5.1.6 Operational Hours

It is anticipated that the sample preparation plant would initially process five to six samples per day, rising by a further three samples per day as operations scale up. The roasting, matting and comminution processes outlined above would be intermittent in nature and would likely overlap.

5.2 Modelling Scenario

For the purposes of the dispersion modelling assessment, and to represent a precautionary approach, it has been assumed that all roasting, matting and comminution assets will be in constant operation for 24-hours per day and 365 days per year (i.e. 8,760 hours per year). In reality the operational hours of the facility would be less than this to allow for time preparing and handling samples, and undertaking maintenance.

5.3 Emission Characteristics

There would only be a single emission point associated with the proposed operations (as described in Section 5.1 above); the outlet of the extraction and abatement system. The emission characteristics are taken from supplier's specification for the system.

The emission characteristics considered within the modelling are detailed in Table 5-1 below.

Table 5-1: Emission Characteristics

Parameter / Source	Extraction and Abatement System – Outlet Stack
Stack location (NGR x,y)	x561404, y175308
Stack internal diameter (m)	1.1
Stack exhaust height (m)	20
Normalised air flow rate (Nm ³ /s)	0.327 ^(B)
Emission temperature (°C)	32
Anticipated oxygen content (% O ₂ dry gas)	20.2
Anticipated moisture content (% H ₂ O)	1.2
Actual air flow rate (Am ³ /s)	6.67 (24,000 m ³ /hr)
Efflux velocity (m/s)	7.02
Table notes: (A) Normalised to reference conditions: temperature 273K, pressure 101.3kPa, 11% O ₂ , dry gas.	



5.4 Emission Rates

The emission rates have been calculated in application of the ELVs outlined within the IED. The IED outlines daily average ELVs for all pollutants, and additional half-hourly ELVs for a select few pollutants. Assessment of potential short-term impacts has been undertaken in application of the half-hourly ELVs where relevant.

5.4.1 Daily Average Emission Rates

The modelling input parameters for the calculation of long-term impacts are detailed in Table 5-2 below.

Table 5-2: Daily Average Emission Rates

Parameter	IED ELV (mg/Nm ³) (A)	Extraction and Abatement System – Outlet Stack	
		Normalised Air Flow Rate (Nm ³ /s) (A)	Emission Rate
NO _x	200	0.327	0.0654 g/s
PM	10	0.327	0.00327 g/s
CO	50	0.327	0.0164 g/s
SO ₂	50	0.327	0.0164 g/s
TOC	10	0.327	0.00327 g/s
HCl	10	0.327	0.00327 g/s
HF	1.0	0.327	0.00033 g/s
Group 1 metals: Cadmium and thallium	0.05	0.327	0.0164 mg/s
Group 2 metals: Mercury	0.05	0.327	0.0164 mg/s
Group 3 metals (B)	0.5	0.327	0.164 mg/s
Dioxins and furans	0.0000001	0.327	0.033 ng/s
Table notes: (A) At reference conditions: temperature 273K, pressure 101.3kPa, 11% O ₂ . (B) Antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, and vanadium.			

The IED emission limits for metals are based on total emission rates for 3 different groups. As there is no established EAL for thallium, the group 1 metals ELV has been applied for the assessment of cadmium. Group 2 metals comprise mercury only, therefore the group 2 metals ELV has been applied for the assessment of mercury. The EA's approach to assessment of Group 3 metals¹⁸ is based on emissions monitoring data from the UK and includes two steps. Step 1 is a screening stage and requires each metal to be modelled at

¹⁸ Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators. Version 4. Environment Agency, June 2016.



100% of the group limit and Step 2 (which has been applied in this detailed assessment) involves partitioning of the metals within this group, determined in reference to the data presented in Table 5-3.

Table 5-3: EA Group 3 Metals Monitoring Data

Parameter	Measured Concentrations (mg/Nm ³)			Max as a % of Group 3 total	Emission Rate (µg/s)
	Maximum	Mean	Minimum		
Antimony	0.0115	0.0014	0.0001	2.30%	3.8
Arsenic	0.0250	0.0010	0.0002	5.00%	8.2
Chromium (II and III)	0.0920	0.0084	0.0002	18.40%	30.1
Chromium (VI)	1.3 x 10 ⁻⁴	3.5 x 10 ⁻⁵	2.3 x 10 ⁻⁶	0.003%	0.05
Cobalt	0.0056	0.0011	0.0002	1.10%	1.8
Copper	0.0290	0.0075	0.0019	5.80%	9.5
Lead	0.0503	0.0109	0.0003	10.10%	16.5
Manganese	0.0600	0.0168	0.0015	12.00%	19.6
Nickel	0.2200	0.0150	0.0025	44.00%	71.9
Vanadium	0.0060	0.0004	0.0001	1.20%	2.0

5.4.2 Half-hourly Emission Rates

The modelling input parameters for the calculation of short-term impacts are detailed in Table 5-4 below.

Table 5-4: Half-hourly Emission Rates

Parameter	IED ELV (mg/Nm ³) (A)	Extraction and Abatement System – Outlet Stack	
		Normalised Air Flow Rate (Nm ³ /s) (A)	Emission Rate (g/s)
NO _x	400	0.327	0.131
PM	30	0.327	0.00981
CO	100	0.327	0.0327
SO ₂	200	0.327	0.0654
TOC	20	0.327	0.00654
HCl	60	0.327	0.0196
HF	4.0	0.327	0.00131



Parameter	IED ELV (mg/Nm³) (A)	Extraction and Abatement System – Outlet Stack	
		Normalised Air Flow Rate (Nm³/s) (A)	Emission Rate (g/s)
Table notes: (A) At reference conditions: temperature 273K, pressure 101.3kPa, 11% O₂.			

5.4.3 Particulate Matter

PM is classified in terms of its aerodynamic diameter; with PM₁₀ relating to particles with an aerodynamic diameter of less than 10µm. Other smaller relevant fractions of particulate matter such as PM_{2.5} (aerodynamic diameter less than 2.5µm) are a sub-fraction of the PM₁₀ fraction i.e. PM₁₀ includes PM_{2.5}.

For the purposes of this assessment 100% of particulate matter has been assumed to be PM₁₀ and 100% to be PM_{2.5}. This approach ensures that a worst-case scenario has been considered for the smallest particles.

5.4.4 Total Organic Carbon

There are no relevant air quality assessment levels or backgrounds for TOC. Whilst it is unlikely that any benzene would be released from the process due to the high temperature of combustion a cautious approach has been adopted by assuming all the organic carbon would be in the form of benzene in line with AERA guidance.



6.0 Predicted Air Quality Impacts

6.1 Human Receptors

6.1.1 Predicted Long-term Impacts

The maximum predicted long-term ground level PC and PEC are summarised in Table 6-1 below.

Table 6-1: Maximum Predicted Ground Level Long-term Impacts

Pollutant	Averaging Period	Standard (µg/m³)	PC (µg/m³)	PC as % of Standard	PEC (µg/m³)	PEC as % of Standard
NO ₂	Annual	40	0.658	1.6%	35.96	89.9%
PM ₁₀	Annual	40	0.0470	0.1%	22.55	56.4%
PM _{2.5}	Annual	20	0.0470	0.2%	10.247	51.2%
TOC (as benzene)	Annual	5.0	0.0470	0.9%	0.747	14.9%
HF	Monthly	16	0.0078	<0.1%	3.51	21.9%
Cadmium	Annual	0.005	0.0024	4.7%	0.0024	4.7%
Antimony	Annual	5.0	0.00005	<0.1%	0.00005	<0.1%
Arsenic	Annual	0.006	0.00012	2.0%	0.00012	2.0%
Lead	Annual	0.25	0.00024	<0.1%	0.00025	0.1%
Chromium (VI)	Annual	0.00025	0.0000007	0.3%	0.0000008	0.3%
Manganese	Annual	0.15	0.00028	0.2%	0.00029	0.2%
Nickel	Annual	0.02	0.0010	5.2%	0.0010	5.2%

The maximum predicted annual mean ground level PC for PM₁₀ across the study area (and therefore at any area within the Northfleet Industrial Area AQMA) is well below 1% of the EAL (0.1%).

With the exception of NO₂, the maximum predicted ground level PEC is well below the EAL for all pollutants. As the maximum predicted long-term NO₂ PEC is approaching the EAL, this has been investigated in further detail below. Full results for long-term NO₂ impacts are presented in Appendix A, and an isopleth plot is presented in Appendix B.

The maximum predicted long-term NO₂ PC and PEC at any sensitive human receptor identified (see Section 4.1) is presented in Table 6-2 below.

Table 6-2: Maximum Predicted Long-term Impacts at Sensitive Receptors

Pollutant	Averaging Period	Receptor with Highest PC	Standard (µg/m³)	PC (µg/m³)	PC as % of Standard	PEC (µg/m³)	PEC as % of Standard
NO ₂	Annual	DR20	40	0.05	0.1%	35.3	88.4%
	Annual	Dartford AQMA No.2	40	0.04	0.1%	35.3	88.4%



The maximum predicted annual mean NO₂ PC at any sensitive receptor is well below 1% of the EAL. The maximum predicted annual mean NO₂ PC across the Dartford AQMA No.2 is well below 1% of the EAL (0.4%).

6.1.2 Predicted Short-term Impacts

The maximum predicted short-term ground level PC and PEC are summarised in Table 6-3 below.

Table 6-3: Maximum Predicted Ground Level Short-term Impacts

Pollutant	Averaging Period	Standard (µg/m³)	PC (µg/m³)	PC as % of Standard	PEC (µg/m³)	PEC as % of Standard
NO ₂	1-hour 99.79%ile	200	6.96	3.5%	77.6	38.8%
PM ₁₀	24-hour 90.41%ile	50	0.37	0.7%	22.9	45.7%
CO	1-hour	30000	6.80	<0.1%	720.8	2.4%
	8-hour	10000	3.25	<0.1%	717.2	7.2%
SO ₂	24-hour 99.18%ile	125	3.91	3.1%	7.2	5.8%
	1-hour 99.73%ile	350	9.72	2.8%	13.0	3.7%
	15-minute 99.9%ile	266	14.12	5.3%	17.40	6.5%
TOC	24-hour	30	0.44	1.5%	1.84	6.1%
HCl	1-hour	750	4.08	0.5%	4.52	0.6%
HF	1-hour	160	0.27	0.2%	7.27	4.5%
Cadmium	24-hour	0.03	0.0005	1.8%	0.001	3.3%
Mercury	1-hour	0.6	0.003	0.6%	0.003	0.6%
	24-hour	0.06	0.003	5.7%	0.003	5.7%
Antimony	1-hour	150	0.0008	<0.1%	0.0008	<0.1%
Chromium (III)	1-hour	2	0.006	0.3%	0.010	0.5%
Copper	24-hour	0.05	0.0006	1.3%	0.016	32.5%
Manganese	1-hour	1500	0.004	<0.1%	0.016	<0.1%
Vanadium	24-hour	1	0.00013	<0.1%	0.0041	0.4%

The maximum predicted short-term ground level PEC is well below the EAL for all pollutants.

6.2 Ecological Receptors

Predicted concentrations have been assessed at the sensitive ecological receptors identified in Section 4.1.2.



6.2.1 Critical Levels

The predicted impacts on C_{Le} are presented in Table 6-4 below. PECs are presented where the assessment criteria is exceeded in consideration of PC alone.

The findings are as follows:

- the NO_x and SO_2 annual PC is well below 1% of the C_{Le} at ER1 and ER2;
- the NO_x and HF 24-hour PC is well below 10% of the C_{Le} at ER1 and ER2;
- the HF weekly PEC is below 70% of the C_{Le} at ER1; and
- the HF weekly PC is well below 1% of the C_{Le} at ER2.

Therefore in regard to C_{Le} it can be concluded that the predicted PC/PEC will result in 'no likely damage' at ER1 and 'no likely significant effects' at ER2.

Table 6-4: Predicted Impact on Critical Levels

Site	Averaging Period	Applied C_{Le} ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of C_{Le}	PEC ($\mu g/m^3$)	PEC as % of C_{Le}
ER1 (SSSI)	NO_x annual	30	0.12	0.4%	-	-
	NO_x 24-hour	75	1.26	1.7%	-	-
	SO_2 annual	10	0.001	<0.1%	-	-
	HF weekly	0.5	0.013	2.6%	0.063	12.6%
	HF 24-hour	5.0	0.025	0.5%	-	-
ER2 (SPA / Ramsar)	NO_x annual	30	<0.01	<0.1%	-	-
	NO_x 24-hour	75	0.72	1.0%	-	-
	SO_2 annual	10	<0.001	<0.1%	-	-
	HF weekly	0.5	0.001	0.1%	-	-
	HF 24-hour	5.0	0.001	<0.1%	-	-

6.2.2 Critical Loads

The predicted impacts on C_{Lo} are presented in Table 6-5 and Table 6-6 below. PECs are not presented as the assessment criteria is not exceeded.

The nitrogen deposition PC is below 1% of the C_{Lo} at ER1 and ER2. The acid deposition PC is below 1% of the C_{Lo} at ER2, and the habitats at ER1 are not considered sensitive to acid deposition. Therefore with regard to deposition it can be concluded that the PC will result in 'no likely damage' at ER1 and 'no likely significant effects' at ER2.

Table 6-5: Impact on Nitrogen Critical Load

Site	Habitat Class	Applied C_{Lo} (Kg N/ha/yr)	PC (Kg N/ha/yr)	PC as % of C_{Le}
ER1	Grassland and Reed, swamp or fen	10	0.013	0.1%
ER2	Northern wet heath	5	<0.001	<0.1%



Table 6-6: Impact on Acid Critical Load

Site	Habitat Class	Applied C_{Lo} (Keg/ha/yr)	PC (Keg /ha/yr) (A)	PC as % of C_{Le}
ER1	Grassland and Reed, swamp or fen	Not sensitive ^(B)		
ER2	Northern wet heath	5.032	<0.001	<0.1%
Table notes: (A) Process Contribution inclusive of contributions from N (NO_x) and S (SO_2 and HF). (B) A critical load for acidification has not been assigned for this feature, in reference to the APIS website. As such, this assessment has considered that this feature is not sensitive to acid deposition.				

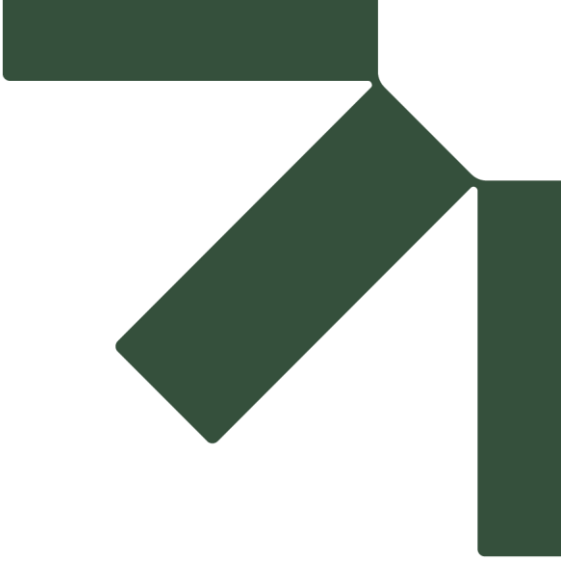


7.0 Conclusions

The conclusions of the dispersion modelling assessment of emissions to air from the proposed sample preparation plant at the existing BRM facility in Northfleet are as follows:

- there are no exceedances of long-term EALs at human receptors;
- there are no exceedances of short-term impacts at human receptors;
- the maximum predicted annual mean PC for NO₂ across the Dartford AQMA No.2 is well below 1% of the EAL and can be considered insignificant;
- the maximum predicted annual mean ground level PC for PM₁₀ at any area of relevant public exposure across the Northfleet Industrial Area AQMA is well below 1% of the EAL and can be considered insignificant; and
- impacts at ecological receptors will result in 'no likely damage' at the Swanscombe Peninsula SSSI and 'no likely significant effects' at the Thames Estuary & Marshes SPA / Ramsar site.





Appendix A Results Tables

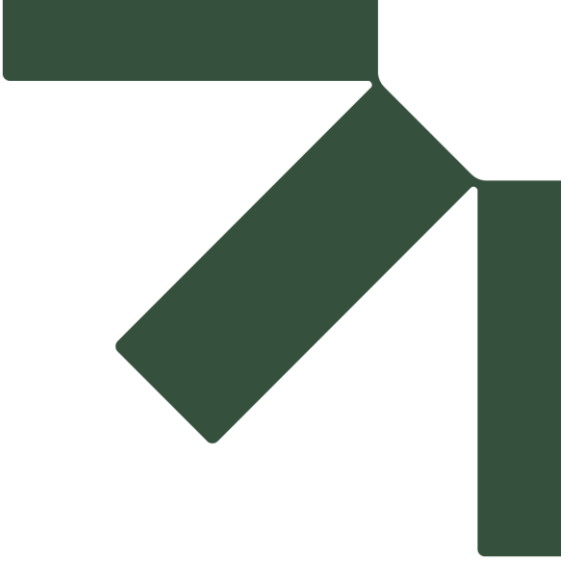
Table A-1: Long-term NO₂ Impacts at Sensitive Receptors

Receptor	NO ₂ Annual Mean (µg/m ³)			
	PC	PC as % of AQAL	PEC	PEC as % of AQAL
DR1	0.04	0.1%	35.3	88.3%
DR2	0.04	0.1%	35.3	88.3%
DR3	0.03	<0.1%	35.3	88.3%
DR4	0.03	<0.1%	35.3	88.3%
DR5	0.03	<0.1%	35.3	88.3%
DR6	0.03	<0.1%	35.3	88.3%
DR7	0.03	<0.1%	35.3	88.3%
DR8	0.03	<0.1%	35.3	88.3%
DR9	0.03	<0.1%	35.3	88.3%
DR10	0.03	<0.1%	35.3	88.3%
DR11	0.03	<0.1%	35.3	88.3%
DR12	0.03	<0.1%	35.3	88.3%
DR13	0.03	<0.1%	35.3	88.3%
DR14	0.03	<0.1%	35.3	88.3%
DR15	0.03	<0.1%	35.3	88.3%
DR16	0.03	<0.1%	35.3	88.3%
DR17	0.03	<0.1%	35.3	88.3%
DR18	0.02	<0.1%	35.3	88.3%
DR19	0.02	<0.1%	35.3	88.3%
DR20	0.05	<0.1%	35.3	88.4%
DR21	0.05	<0.1%	35.3	88.4%
DR22	0.03	<0.1%	35.3	88.3%
DR23	0.03	<0.1%	35.3	88.3%
DR24	0.02	<0.1%	35.3	88.3%
DR25	0.03	<0.1%	35.3	88.3%
DR26	0.03	<0.1%	35.3	88.3%
DR27	0.03	<0.1%	35.3	88.3%
DR28	0.03	<0.1%	35.3	88.3%
DR29	0.02	<0.1%	35.3	88.3%
DR30	0.02	<0.1%	35.3	88.3%
DR31	0.02	<0.1%	35.3	88.3%



Receptor	NO ₂ Annual Mean (µg/m ³)			
	PC	PC as % of AQAL	PEC	PEC as % of AQAL
DR32	0.01	<0.1%	35.3	88.3%
DR33	0.02	<0.1%	35.3	88.3%
DR34	0.02	<0.1%	35.3	88.3%
DR35	0.02	<0.1%	35.3	88.3%
DR36	0.02	<0.1%	35.3	88.3%
Dartford AQMA No.2	0.04	0.1%	35.3	88.4%

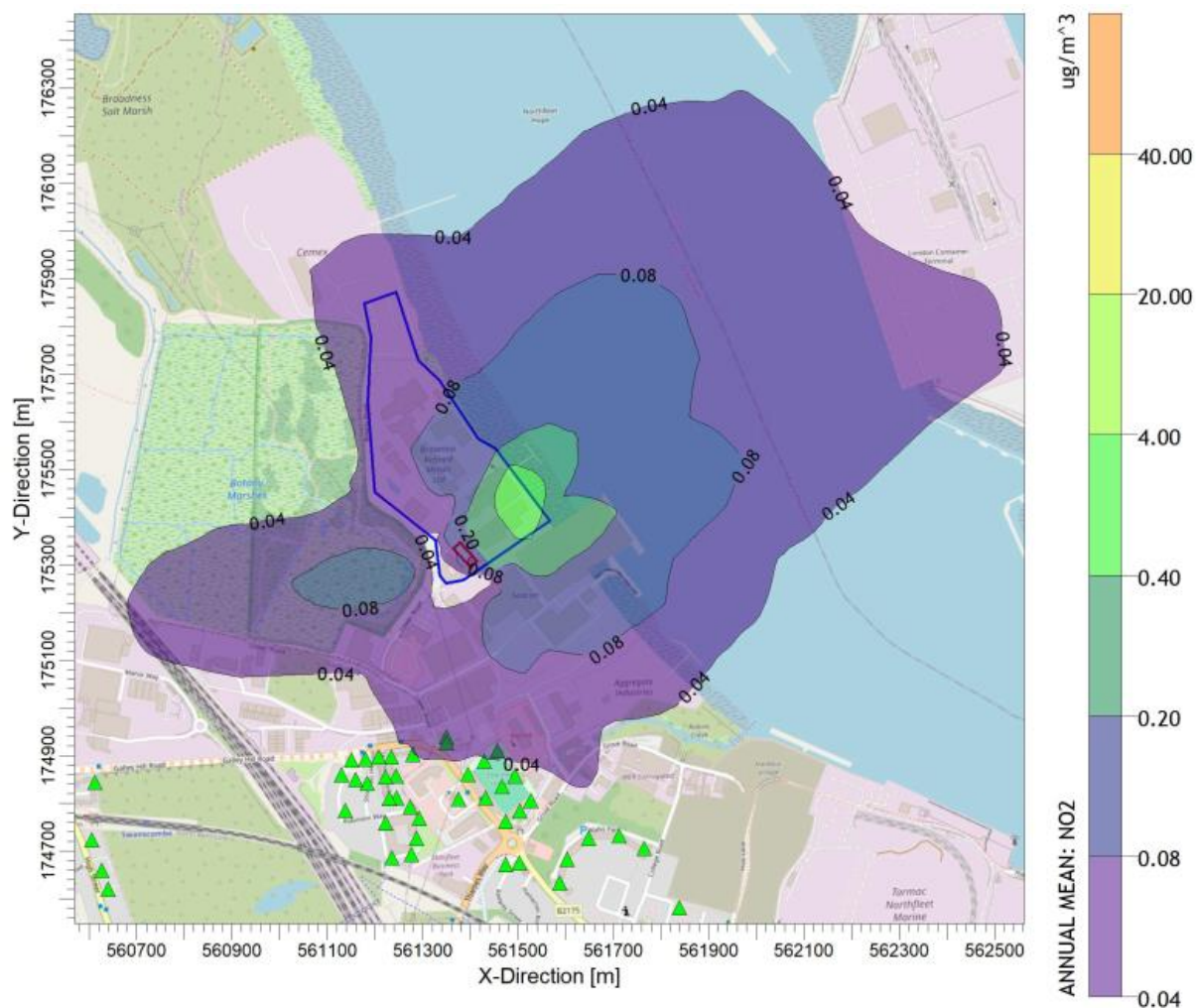




Appendix B Isopleth Plots

Isopleth plots for pollutants which cannot be considered insignificant in consideration of maximum predicted ground level impacts (see Section 6.1) are presented below.

Figure B-1: Predicted Annual Mean NO₂ (5-year Average)





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