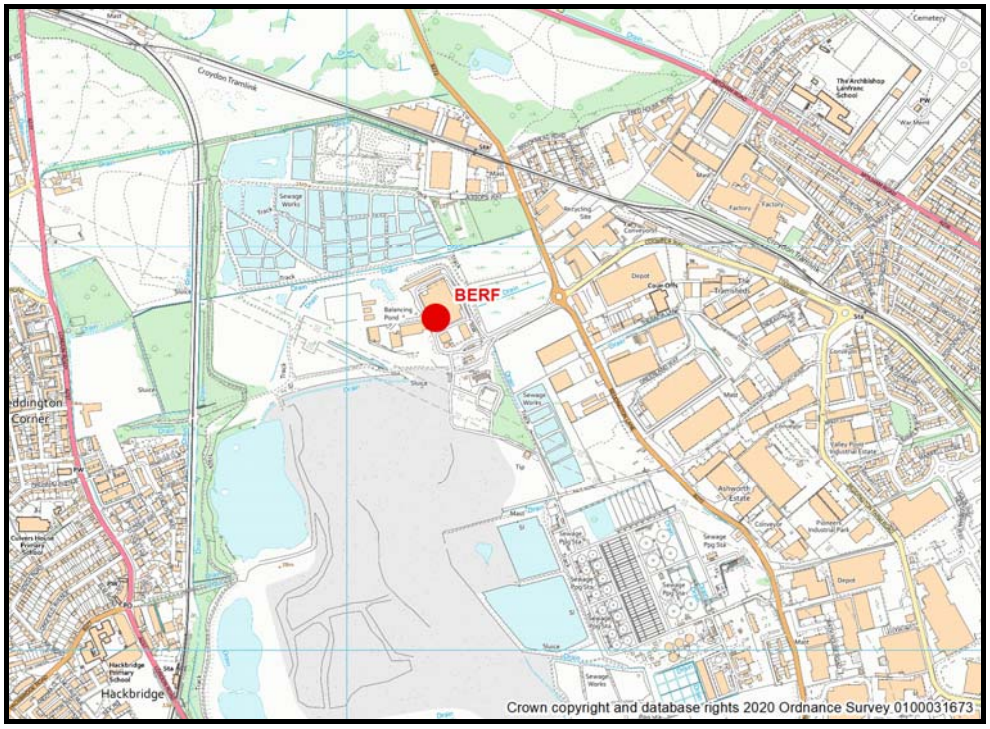
Viridor

BEDDINGTON ENERGY RECOVERY FACILITY

AIR QUALITY ASSESSMENT - UPDATED



October 2022

Report Reference: C71-P03-R03

Independent Air Quality & Odour Specialists

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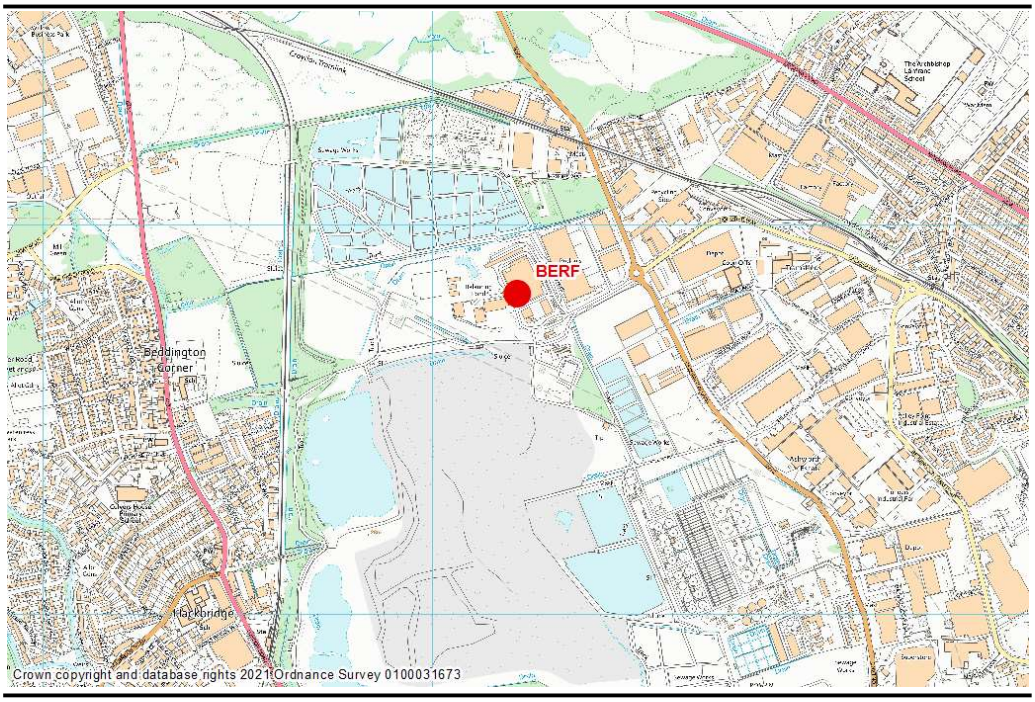
1 INTRODUCTION

1.1 PURPOSE OF THE ASSESSMENT

Gair Consulting Ltd has been commissioned by Viridor South London Limited (Viridor) to provide an air quality assessment of emissions to atmosphere from the Beddington Energy Recover Facility (BERF). The purpose of the assessment is to support a variation to the Environmental Permit (EPR/GP3305LN) for the installation. For the purposes of the assessment, the facility operating as per the permitted capacity is referred to as the 'Permitted Facility' and the facility operating as per the proposed variation is referred to as the 'Proposed Facility'.

The installation is located within the London Borough of Sutton at Beddington Farmlands, which is south of Mitcham Common and north of Beddington Park. The location of the BERF is presented in *Figure 1.1*.

FIGURE 1.1 LOCATION OF THE BEDDINGTON ENERGY RECOVERY FACILITY



The installation is designed to recover energy from residual municipal waste, and from commercial and industrial waste of a similar nature to residual municipal waste, by incineration. Energy is recovered from the installation in the form of electricity, which is exported to the National Grid. There are two waste incineration lines with a mass burn moving grate design.

1.2 SCOPE OF THE ASSESSMENT

Operational impacts associated with the combustion sources have been assessed using a dispersion model to predict the impact at ground level utilising

five years of meteorological data from London Gatwick Airport (2015 to 2019). A comparison between the Permitted Facility and Proposed Facility is provided.

This assessment has considered the impact on human health and sensitive habitat sites.

1.3 STRUCTURE OF THE REPORT

The remainder of this report is presented as follows:

- *Section 2* presents an assessment of baseline conditions for the location.
- *Section 3* provides a description of the assessment methodology and a quantification of emissions to atmosphere during the operation of the installation.
- *Section 4* presents an assessment of the operational impact of emissions on human health and local air quality.
- *Section 5* presents an assessment of the operational impact of emissions on sensitive habitat sites.
- *Section 6* summarises and concludes the air quality assessment.

2 BASELINE CONDITIONS

2.1 INTRODUCTION

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

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

In relation to impacts on humans, the pollutants of interest emitted from the installation are primarily those set out in the Waste Incineration Directive (WID) [1] which has since been recast in the Industrial Emissions Directive (IED) [2].

These are:

- particulate matter (as particulate matter of aerodynamic diameter ≤10µm (PM_{10}));
- gaseous and vaporous organic substances, expressed as total organic carbon (VOCs);
- hydrogen chloride (HCl);
- hydrogen fluoride (HF);
- sulphur dioxide (SO_2);
- oxides of nitrogen (NO_x), the sum of nitric oxide (NO) and nitrogen dioxide (NO_2), expressed as nitrogen dioxide;
- twelve metals: arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr) (as CrIII and CrVI), copper (Cu), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), antimony (Sb), thallium (Tl) and vanadium(V);
- polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (collectively referred to as dioxins and furans); and
- carbon monoxide (CO).

1 Directive 2000/76/EC Of The European Parliament And Of The Council of 4 December 2000 on the incineration of waste

2 Directive 2012/75/EC on industrial emissions (integrated pollution prevention and control (recast) of 24 November 2010

Emissions of $PM_{2.5}$ (particulate matter of aerodynamic diameter ≤2.5µm), polycyclic aromatic hydrocarbons (PAHs), ammonia (NH_3) and polychlorinated biphenyls (PCBs) will also be considered, for the following reasons:

- $PM_{2.5}$ has become an increasingly prominent air pollutant of interest, due to research indicating that $PM_{2.5}$ is associated with impacts to health, and is now subject to a statutory air quality standard in the UK in light of the European Directive on ambient air quality and cleaner air for Europe [3] (referred to as the 2008 Directive).

- PAHs have recently become an increasingly prominent air pollutant of interest and one of the key PAH species, benzo[a]pyrene, is subject to a statutory air quality standard in the UK in light of the 2008 Directive.

- Ammonia (NH_3) contributes to impacts on human health and habitat sites and is emitted as ammonia slip from NO_x abatement equipment. The permit also has an emission limit value for NH_3.

- The Environment Agency generally require an assessment of the emissions of PCBs from this type of facility.

2.2 ASSESSMENT CRITERIA

2.2.1 Non-metals

Air quality assessment levels (AQALs) for the non-metals considered for the assessment are summarised in *Table 2.1* and include UK air quality objectives (AQO), European limit values and Environment Agency Environmental Assessment Levels (EALs). There are no AQALs for dioxins and furans. The impact of emissions of dioxins and furans for the Proposed Facility will be assessed via a human health risk assessment (HHRA) which will consider exposure via direct pathways (inhalation) and indirect pathways (ingestion). The HHRA has been prepared and submitted as part of the variation to the Environmental Permit for the installation.

3 Directive 2008/50/EC Of The European Parliament And Of The Council of 21 May 2008 on ambient air quality and cleaner air for Europe

TABLE 2.1 AIR QUALITY ASSESSMENT LEVELS FOR NON-METALS

Pollutant	Averaging Period	AQAL ($\mu g\ m^{-3}$)	Comments
Nitrogen dioxide (NO_2)	Annual mean	40	UK AQO and EU limit value
	1-hour mean	200	UK AQO and EU limit value, not to be exceeded more than 18 times per annum, equivalent to the 99.8th percentile of 1-hour means
Fine particles (as PM_{10})	Annual mean	40	UK AQO and EU limit value
	24-hour mean	50	UK AQO and EU limit value, not to be exceeded more than 35 times per annum, equivalent to the 90.4th percentile of 24-hour means
Fine particles (as $PM_{2.5}$)	Annual mean	20	EU limit value
Sulphur dioxide (SO_2)	24-hour mean	125	UK AQO and EU limit value, not to be exceeded more than 3 times per annum, equivalent to the 99.2nd percentile of 24-hour means
	1-hour mean	350	UK AQO and EU limit value, not to be exceeded more than 24 times per annum, equivalent to the 99.7th percentile of 1-hour means
	15-minute mean	266	UK AQO, not to be exceeded more than 35 times per annum, equivalent to the 99.9th percentile of 15-minute means
Carbon monoxide (CO)	8-hour mean	10,000	UK AQO and EU limit value
	1-hour mean	30,000	Environment Agency EAL (a)
Hydrogen chloride (HCl)	1-hour mean	750	Environment Agency EAL (a)
Hydrogen fluoride (HF)	Monthly mean	16	Environment Agency EAL (a)
	1-hour mean	160	Environment Agency EAL (a)
TOC (as benzene)	Annual mean	5	AQO and EU limit value
	24-hour mean	30	Environment Agency EAL (a)
PAH (as benzo(a)pyrene	Annual mean	0.001	EU limit value
Ammonia (NH_3)	Annual mean	180	Environment Agency EAL (a)
	1-hour mean	2,500	Environment Agency EAL (a)
Polychlorinated biphenyls (PCBs)	Annual mean	0.2	Environment Agency EAL (a)
	1-hour mean	6	Environment Agency EAL (a)

(a) Environment Agency Environmental Assessment Level (EAL) as provided in their risk assessment guidance (formerly H1)

2.2.2 Trace Metals

For the trace metals considered, there are only UK air quality objectives for lead. For other trace metals, assessment criteria in the form of Environmental Assessment Levels (EALs) are provided by the Environment Agency in their Risk Assessment Guidance (RAG, formerly H1). A summary of the appropriate

criteria for trace metals considered is presented in *Table 2.2*. The World Health Organization (WHO) also provides guidelines for the concentration of some trace metals in air. These are also presented in *Table 2.2*.

TABLE 2.2 AIR QUALITY ASSESSMENT LEVELS AND GUIDELINE VALUES FOR TRACE METALS

Metal	Source	Averaging Period	Value (μg m^{-3})
Antimony (Sb)	EA RAG	1-hour mean	150
		Annual mean	5
Arsenic (As)	EA RAG	Annual mean	0.006
	UK AQO	Annual mean	0.006 (b)
Cadmium (Cd)	UK AQO/WHO (d)	Annual mean	0.005 (b)
Chromium compounds (as Cr)	EA RAG	1-hour mean	150
		Annual mean	5
Chromium VI	EPAQS (a)	Annual mean	0.0002
Cobalt (Co)	Derived from HSE EH40/2002 OEL	Annual mean	1
Copper (Cu)	EA RAG	1-hour mean	200
		Annual mean	10
Lead	UK AQO	Annual mean	0.25
Manganese (Mn)	EA RAG	1-hour mean	1500
	WHO (d)	Annual mean	0.15
Mercury (Hg)	EA RAG	1-hour mean	7.5
		Annual mean	0.25
	WHO (d)	Annual mean	1.0
Nickel (Ni)	EPAQS (a)/ UK AQO	Annual mean	0.02
Thallium (Tl)	Derived from HSE EH40/2002 OEL	Annual mean	1
Vanadium (V)	WHO (d)	24-hour mean	1
	EA RAG	Annual mean	5

(a) Guidelines for Metals and Metalloids in Ambient Air for the Protection of Human Health, EPAQS (May 2009)
(b) Target value for total content in PM_{10} fraction, should be met by 31/12/2012
(c) World Health Organisation WHO, Air quality Guidelines 2000
(d) Additional safety factor of 5 applied to the OEL as this compound has a maximum exposure limit

2.3 LOCAL CONDITIONS

2.3.1 The Dispersion and Dilution of Emissions

For meteorological data to be suitable for dispersion modelling purposes a number of meteorological parameters need to be measured, on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required

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

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

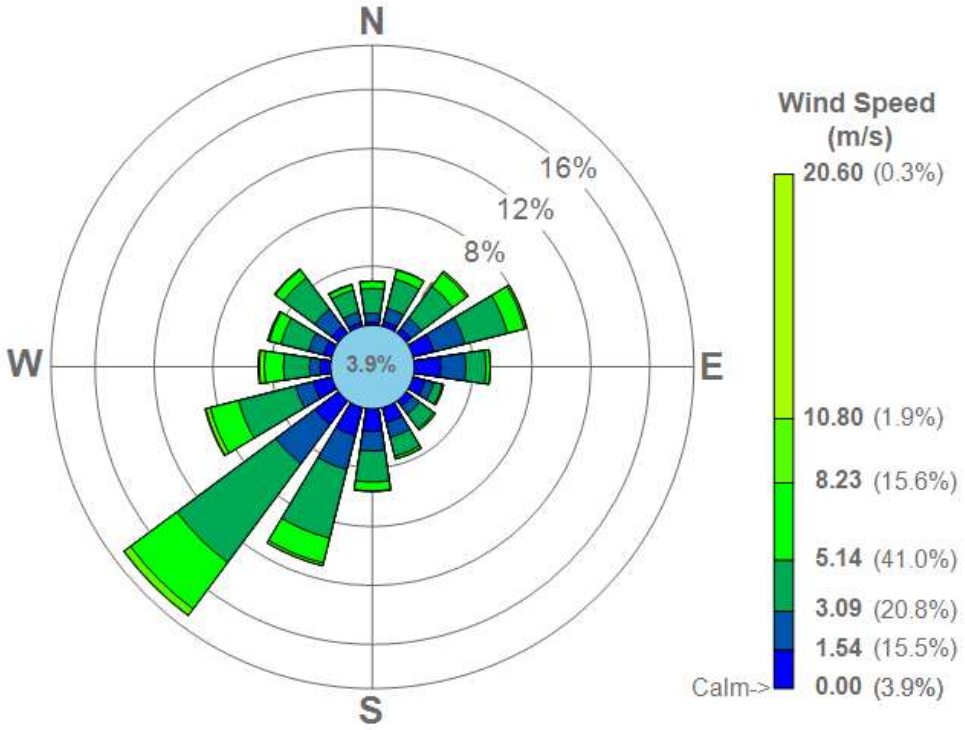
- **Wind direction** determines the broad transport of the emission and the sector of the compass into which the emission is dispersed.
- **Wind speed** will affect low-level emissions by increasing the initial dilution of pollutants in the emission whereas for high-level emissions, such as from a stack, higher winds will bring the plume to ground sooner than otherwise would be the case.
- **Atmospheric stability** is a measure of the turbulence, particularly of the vertical motions present.

2.3.2 Local Wind Climate for the Location

Met Office observing stations are limited and the nearest observing station to the installation site with full data suitable for dispersion modelling is located at London Gatwick Airport approximately 26 km to the south of the site.

Five years of meteorological data for the London Gatwick Airport observing station have been obtained (2015 to 2019) and a wind rose for the five years is presented in *Figure 2.1*.

FIGURE 2.1 WIND ROSE FOR LONDON GATWICK AIRPORT (2015 TO 2019)



The predominant wind direction is from the southwest (18.2%). Calm winds occur for around 3.9% of the time.

2.3.3 Topography

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

The site is located in an area of relatively flat terrain. However, information relating to the topography of the area surrounding the facility has been used in the dispersion modelling to assess the impact of terrain features on the dispersion of emissions.

2.4 BACKGROUND AIR QUALITY

2.4.1 Local Authority Review and Assessment

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

The review and assessment of air quality for the local area is carried out by the London Borough of Sutton (LBoS). The London Borough of Sutton declared the whole borough as an Air Quality Management Area (AQMA) in 2013. The declaration was based on the risk of the objectives for nitrogen dioxide and PM_{10} being exceeded. The most recent report published by LBoS is the Annual Status Report of 2019 [4].

2.4.2 Ambient Air Quality Monitoring

Monitoring of ambient pollutant concentrations is carried out by LBoS at four automatic continuous monitoring locations within the borough. These form part of the London Air Quality Network (LAQN). Monitoring of NO_2 and PM_{10} is carried out at all four locations and monitoring of $PM_{2.5}$ is carried out at one of the sites. Details of the monitoring sites are presented in *Table 2.3*. The Wallington and Worcester Park sites are located 3 km south and 6.7 km west of the site, respectively. The two Beddington Lane monitoring sites are less than

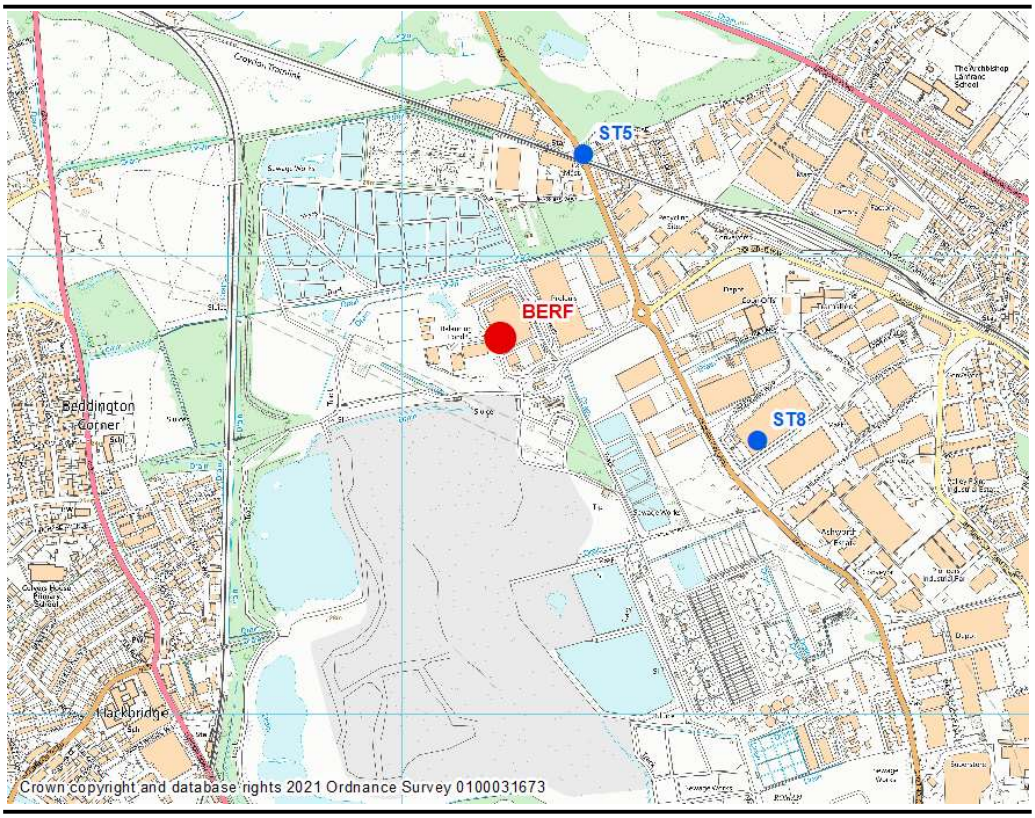
4 London Borough of Sutton Air Quality Annual Status Report for 2019 (July 2020)

1 km from the installation site and will be more representative of air quality at the site. The location of these is provided in *Figure 2.2*.

TABLE 2.3 DETAILS OF AUTOMATIC CONTINUOUS MONITORING SITES

Location	Site Type	Pollutants	Easting	Northing	Distance to Kerb of Nearest Road
ST4. Wallington	Kerbside	NO_2, PM_{10}	528925	163804	0.8 m
ST5. Beddington Lane North	Industrial	NO_2, PM_{10}, $PM_{2.5}$	529400	167224	4.5 m
ST6. Worcester Park	Kerbside	NO_2, PM_{10}	522557	165787	1.3 m
ST8. Beddington Lane	Industrial	NO_2, PM_{10}	529781	166597	N/A

FIGURE 2.2 LOCATION OF THE BEDDINGTON LANE AUTOMATIC MONITORING SITES



In addition, LBoS undertook non-automatic monitoring of NO_2 at twenty nine locations in 2019. Monitoring sites in close proximity to the installation site are described in *Table 2.4* and the locations are presented in *Figure 2.3*.

A summary of pollutant concentrations measured within the borough are presented in LBoS's 2019 Annual Status Report which provides monitoring data for 2019. It should be noted that the ERF was operational during 2019 and the 2019 monitoring data may include a small contribution from the ERF.

FIGURE 2.3 LOCATION OF THE DIFFUSION TUBE MONITORING SITES CLOSE TO THE INSTALLATION SITE

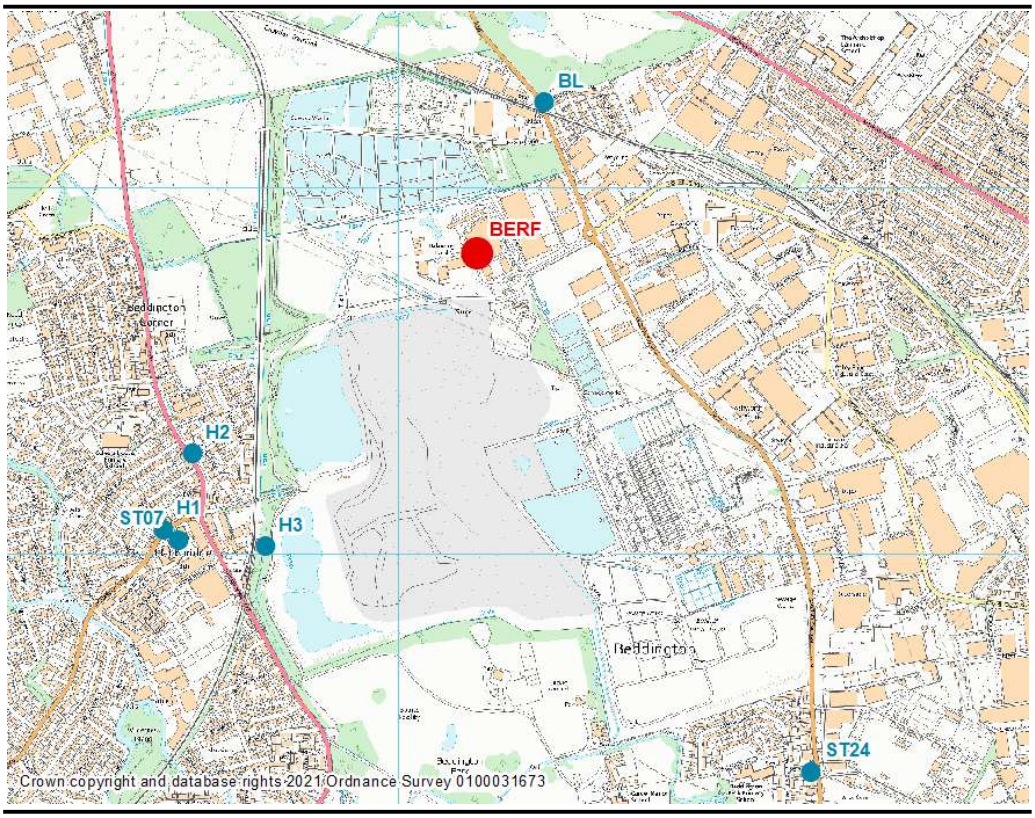


TABLE 2.4 DETAILS OF NITROGEN DIOXIDE DIFFUSION TUBE MONITORING SITES

Location	Site Type	Easting	Northing	Distance to Kerb of Nearest Road
BL. Beddington Lane	Roadside	529400	167235	2 m
H1. Hackbridge Road	Roadside	528373	166077	17 m
H2. Clover Way	Urban background	528437	166275	25 m
H3. 57 London Road	Roadside	528499	166004	5 m
ST07. Hackbridge Primary	Urban background	528401	166038	56 m
ST24. Derry Road	Roadside	530130	165404	2 m

2.4.3 Fine Particles (PM_{10} and $PM_{2.5}$)

A summary of measured concentrations of PM_{10} at the two Beddington Lane monitoring sites for 2016 to 2019 is presented in *Table 2.5*.

For the four-year period, annual mean concentrations of PM_{10} varied between 17 µg m^{-3} and 31 µg m^{-3} (concentrations at ST5 were unusually high in 2017),

well within the annual mean air quality objective of 40 μg m^{-3}. Similarly, the number of exceedances of the 24-hour mean objective were well within the 35 allowed at all monitoring locations.

TABLE 2.5 MEASURED PM_{10} CONCENTRATIONS AT THE BEDDINGTON LANE MONITORING SITES (2016 – 2019)

Monitoring Site	2016	2017	2018	2019
ST5. Beddington Lane North				
Annual Mean PM_{10}	24 (a)	31	22	22
Number of Exceedances of 24-hour Mean	5 (34)(b)	21	2	13
ST8. Beddington Lane				
Annual Mean PM_{10}	23 (a)	23	22	17
Number of Exceedances of 24-hour Mean	8 (37)(b)	5	2	4
(a) Data capture was below 75% and data was annualised in accordance with TG(16)				
(b) Where data capture is less than 75%, value in parentheses is the 90.4th percentile of 24-hour means				

A summary of measured concentrations of $PM_{2.5}$ at the Beddington Lane North monitoring site for 2016 to 2019 is presented in *Table 2.6*.

TABLE 2.6 MEASURED $PM_{2.5}$ CONCENTRATIONS AT BEDDINGTON LANE NORTH (2015 – 2018)

Monitoring Site	2016	2017	2018	2019
ST5. Beddington Lane North				
Annual Mean $PM_{2.5}$	14.4	15.2 (a)	12	11.7
(a) Data capture was below 75% and data was annualised in accordance with TG(16)				

For the four-year period, annual mean concentrations of $PM_{2.5}$ varied between 11.7 μg m^{-3} and 15.2 μg m^{-3}, well within the annual mean air quality objective of 20 μg m^{-3}.

For comparison, ambient background concentrations of PM_{10} and $PM_{2.5}$ for 2020 have been obtained from the Defra UK Background Air Pollution Maps [5]. These 1 km grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites.

For the nine grid squares surrounding the installation site, the mapped 2020 background PM_{10} concentration varies between 15.6 μg m^{-3} and 17.2 μg m^{-3} with a mean of 16.2 μg m^{-3}. This is lower than measured at the Beddington Lane North monitoring site.

5 https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

For the nine grid squares surrounding the installation site, the mapped 2020 background $PM_{2.5}$ concentration varies between 10.7 µg m^{-3} and 11.9 µg m^{-3} with a mean of 11.1 µg m^{-3}. Again, this is lower than measured at the Beddington Lane North monitoring site.

As a worst-case, for the purposes of the assessment the four year average measured concentration of PM_{10} (23.0 µg m^{-3}) and $PM_{2.5}$ (13.3 µg m^{-3}) have been assumed to be representative of measured concentrations in the area around the installation site.

2.4.4 Nitrogen Dioxide (NO_2)

A summary of annual mean concentrations of NO_2 measured by the two Beddington Lane automatic monitoring sites and the nearby diffusion tube sites from 2016 to 2019 is presented in *Table 2.7*.

TABLE 2.7 ANNUAL MEAN CONCENTRATIONS OF NO_2 (µg m^{-3})

Site	Type (a)	2016	2017	2018	2019
ST5. Beddington Lane North	R	36.4	32	36	32
ST8. Beddington Lane	R	30.5	27	30	25
BL. Beddington Lane	UB	34.1	32.2	34.1	29.1
H1. Hackbridge Road	R	33.1	28.9	32.3	32.6
H2. Clover Way	UB	29.1	26.5	29.3	24.3
H3. 57 London Road	R	36.6	32.9	32.4	**44.5**
ST07. Hackbridge Primary	I	22.3	21.9	24.2	20.5
ST24. Derry Road	I	30.6	26.7	30.6	25.7

(a) Key: R = Roadside, K = Kerbside, UB = Urban Background, UC = Urban Centre, I = Industrial

(b) Not available

Except for H3 in 2019 (roadside site), measured concentrations were well below the air quality objective of 40 µg m^{-3}. However, there is no relevant exposure at H3 due to the roadside location. For the Beddington Lane monitoring sites, highest concentrations were measured at the Beddington Lane North automatic monitoring site with a four year mean of 34.1 µg m^{-3}. For the two automatic sites combined, the average four year mean NO_2 concentration is 31.1 µg m^{-3}.

The mapped background NO_2 concentration for the area around the installation site is between 16.2 and 19.5 µg m^{-3} and is substantially lower than measured at the automatic and diffusion tube monitoring sites.

The four year mean NO_2 concentration measured at the two Beddington Lane monitoring sites (31.1 µg m^{-3}) has been used in the assessment to predict the

total environmental concentration of NO_2 for comparison with the air quality objectives/ European limit values.

2.4.5 Sulphur Dioxide (SO_2)

Continuous monitoring of SO_2 concentrations within the local area is not available. The Defra mapped background SO_2 concentrations for the area have been obtained for 2001 and are 3.7 μg m^{-3}. Concentrations of SO_2 are presented for 2001, which is the most recent mapped data available.

For the purposes of the assessment an annual mean SO_2 concentration of 3.7 μg m^{-3} has been assumed.

2.4.6 Carbon Monoxide (CO)

LBoS do not undertake routine monitoring of carbon monoxide within the area. The Defra mapped background CO concentrations for the area surrounding the site indicate annual mean concentrations of 0.47 mg m^{-3} (470 μg m^{-3}) would be appropriate. As for SO_2, these are provided for 2001, which is the most recent mapped data available and represents a worst-case for the area. Applying a year adjustment factor of 0.443 for 2020 gives an annual mean of 208 μg m^{-3}.

Therefore, the background annual mean CO concentration for the area is assumed to be 208 μg m^{-3}.

2.4.7 Hydrogen Fluoride (HF)

Monitoring of ambient levels of hydrogen fluoride is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.5 μg m^{-3} with an elevated background of 3 μg m^{-3} where there are local anthropogenic emission sources [6]. For the purposes of the assessment a background HF concentration of 3 μg m^{-3} has been assumed. This is consistent with measurements carried out around Beddington Lane in 2011.

2.4.8 Hydrogen Chloride (HCl)

Ambient monitoring of hydrogen chloride is carried out as part of the Defra Acid Gases and Aerosol Network (AGAnet) at a number of locations around the UK but these are all rural background monitoring sites. Monitoring of HCl around Beddington Lane was carried out at six sites in 2011 prior to the development of the BERF. Mean concentrations varied between 8.8 and 15.4 μg m^{-3} with a mean of 10.2 μg m^{-3}. For the purposes of the assessment, an annual mean HCl concentration of 10.2 μg m^{-3} has been assumed to be representative of background concentrations at the installation site.

6 Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects, EPAQS (February 2006)

2.4.9 Total Organic Carbon (TOC) as Benzene

No monitoring for benzene is carried out within the local area. Therefore, a background concentration has been obtained from the Defra background map for 2010 (latest mapped data for benzene). The estimated background benzene concentration for the location is derived as 0.64 µg m^{-3}. This is 13% of the annual mean objective concentration of 5 µg m^{-3}.

2.4.10 Poly Aromatic Hydrocarbons (PAHs) as Benzo(a)pyrene

No monitoring for PAHs is carried out within the local area. Monitoring of PAHs is carried out as part of Defra's PAH network. Sampling is carried out at 31 sites across England, Wales, Scotland and Northern Ireland. The nearest monitoring site is located at London Marylebone Road (urban roadside). There is a further monitoring site in Brent (urban background).

For 2016 to 2019, monthly mean benzo(a)pyrene concentrations varied between 0.027 and 0.66 ng m^{-3} at London Brent and between 0.024 and 0.56 µg m^{-3} at London Marylebone Road. Maximum annual mean concentrations for the four-year period were 0.16 ng m^{-3} for both monitoring sites. Therefore, as a worst-case, it is assumed that measured concentrations at the installation site would be comparable to 0.16 ng m^{-3}.

2.4.11 Dioxins and Furans

Monitoring of dioxins and furans is currently carried out by Defra at six locations throughout the UK. These comprise of two urban locations (London and Manchester), three rural sites (High Muffles, Auchencorth Moss and Weybourne in Norfolk) and a semi-rural site at Hazelrigg. However, monitoring at the London Nobel House site ceased in 2017.

A summary of the data for the last four years of measurements at the London site (2014 to 2016) is presented in *Table 2.8*.

TABLE 2.8 SUMMARY OF ANNUAL MEAN PCDD/F CONCENTRATIONS FOR 2013 TO 2016 (fg TEQ m^{-3}) (a)

Year	2013	2014	2015	2016
London	3.5	2.9	4.4	20.8

(a) Where 1 fg m^{-3} (femtogramme per cubic metre) is equivalent to 1 x 10^{-15} g m^{-3} or 1 x 10^{-9} µg m^{-3}

Measured concentrations vary from year to year and are around 3 fg TEQ m^{-3} between 2013 and 2015 but substantially higher in 2016. Therefore, for the purposes of the assessment the average concentration of dioxins and furans measured at the site over the four years (7.9 fg TEQ m^{-3}) is assumed to be representative of the background concentration at the site.

2.4.12 Ammonia (NH_3)

Ambient monitoring of ammonia (NH_3) concentrations is carried out as part of the National Ammonia Monitoring Network (NAMN) at 85 locations around the UK. At the closest monitoring site (London Cromwell Road) the monitored gaseous NH_3 concentration for 2017 to 2019 varied between 2.9 and 3.3 µg m^{-3} with an average for the three years of 3.1 µg m^{-3}. It is assumed that the average of the concentrations (3.1 µg m^{-3}) measured during this three year period is a reasonable estimate of the background NH_3 concentration in the vicinity of the site.

2.4.13 Polychlorinated Biphenyls (PCBs)

Monitoring of PCBs is currently carried out by Defra at six locations in the UK as part of the TOMPs Network including London Nobel House. The average PCB concentration measured at the London site over the last four years (2015 to 2018) varied between 0.042 and 0.12 ng m^{-3} and is assumed that the maximum annual mean is reasonably representative of the baseline PCB concentration at the site and nearby sensitive receptors.

2.4.14 Trace Metals

Monitoring of trace elements has been undertaken by Defra since 1976. Currently the UK Heavy Metals Monitoring Network comprises 25 monitoring sites at predominantly urban locations. In London, monitoring of trace metals is carried out at London Westminster and London Marylebone Road. A summary of average metal concentrations for the three-year period (2017 to 2019) at these two sites is provided in *Table 2.9*.

TABLE 2.9 THREE YEAR MEAN TRACE METAL CONCENTRATIONS AT THE LONDON SITES (2017 TO 2019)

Metal	London Westminster (ng m^{-3})	London Marylebone Road (ng m^{-3})	Assessment Criteria (ng m^{-3})
Antimony (Sb)	Not measured	Not measured	5,000
Arsenic (As)	0.88	0.99	6
Cadmium (Cd)	0.13	0.17	5
Total chromium (Cr)	3.0	9.2	5,000 (CrII/III)
Cobalt (Co)	0.11	0.23	200
Copper (Cu)	15.3	59.4	10,000
Lead (Pb)	6.9	7.2	250
Manganese (Mn)	6.4	17.0	150
Total mercury (Hg)	Not measured	Not measured	250
Nickel (Ni)	0.90	1.8	20
Thallium (Tl)	Not measured	Not measured	1,000
Vanadium (V)	0.85	1.1	5,000

All measured concentrations were below their respective air quality standard. Highest trace metal concentrations over the three-year period were measured at the London Marylebone Road site. Therefore, background trace metal concentrations at the installation site are assumed to be as measured at the London Marylebone Road monitoring site.

2.4.15 Background Concentrations for Comparison with Concentrations Predicted by Detailed Dispersion Modelling

A summary of the annual mean background concentrations that have been used in the assessment is presented in *Table 2.10*.

TABLE 2.10 SUMMARY OF BACKGROUND CONCENTRATIONS FOR THE ASSESSMENT

Pollutant	Averaging Period	Concentration
Particles (PM_{10})	Annual	23.0 µg m^{-3}
	24-Hour	27.1 µg m^{-3} (a)(b)
Particles ($PM_{2.5}$)	Annual	13.3 µg m^{-3}
Nitrogen Dioxide (NO_2)	Annual	31.1 µg m^{-3}
	1-Hour	62.2 µg m^{-3} (a)
Sulphur Dioxide (SO_2)	Annual	3.7 µg m^{-3}
	24-Hour	4.4 µg m^{-3} (a)(b)
	1-Hour	7.4 µg m^{-3} (a)
	15-Minute	9.9 µg m^{-3} (a)(c)
Carbon Monoxide (CO)	Annual	208 µg m^{-3}
	8-Hour	291 µg m^{-3} (a)(d)
	1-Hour	416 µg m^{-3} (a)
Hydrogen Fluoride (HF)	Annual	3.0 µg m^{-3}
	1-Hour	6.0 µg m^{-3} (a)
Hydrogen Chloride (HCl)	Annual	10.2 µg m^{-3}
	1-Hour	20.4 µg m^{-3} (a)
Total Organic Carbon (as Benzene)	Annual	0.64 µg m^{-3}
	24-Hour	0.76 µg m^{-3} (a)(b)
Benzo(a)pyrene	Annual	0.16 ng m^{-3}
Dioxins and Furans (PCDD/Fs)	Annual	7.9 fg m^{-3}
Ammonia (NH_3)	Annual	3.1 µg m^{-3}
	1-Hour	6.2 µg m^{-3} (a)
Polychlorinated biphenyls (PCBs)	Annual	0.12 ng m^{-3}
	1-Hour	0.24 ng m^{-3} (a)
Cadmium (Cd)	Annual	0.17 ng m^{-3}
Thallium (Tl)	No data available	
Mercury (Hg)	No data available	
Arsenic (As)	Annual	0.99 ng m^{-3}
	1-Hour	2.0 ng m^{-3} (a)

TABLE 2.10 SUMMARY OF BACKGROUND CONCENTRATIONS FOR THE ASSESSMENT

Pollutant	Averaging Period	Concentration
Antimony (Sb)	No data available	
Chromium (Cr)	Annual	9.2 ng m^{-3}
	1-Hour	18.4 ng m^{-3} (a)
Cobalt (Co)	Annual	0.23 ng m^{-3}
	1-Hour	0.46 ng m^{-3} (a)
Copper (Cu)	Annual	59.4 ng m^{-3}
	1-Hour	118.8 ng m^{-3} (a)
Lead (Pb)	Annual	7.2 ng m^{-3}
	1-Hour	14.4 ng m^{-3} (a)
Manganese (Mn)	Annual	17.0 ng m^{-3}
	1-Hour	34.0 ng m^{-3} (a)
Nickel (Ni)	Annual	1.8 ng m^{-3}
Vanadium (V)	Annual	1.1 ng m^{-3}
	24-Hour	1.3 ng m^{-3} (a)(b)

(a) 1-hour mean background concentration estimated by multiplying the annual mean by a factor of 2 in accordance with the Risk Assessment Guidance.

(b) 24-hour mean background concentration estimated by multiplying the 1-hour mean by a factor of 0.59 in accordance with the Risk Assessment Guidance.

(c) 15-minute mean background concentration estimated by multiplying the 1-hour mean by a factor of 1.34 in accordance with the Risk Assessment Guidance.

(d) 8-hour mean background concentration estimated by multiplying the 1-hour mean by a factor of 0.70 in accordance with the Risk Assessment Guidance.

3 ASSESSMENT METHODOLOGY FOR OPERATIONAL IMPACTS

3.1 INTRODUCTION

Emissions to air from the installation have been modelled using the UK Air Dispersion Modelling System (ADMS Version 5.2) and a five year meteorological data set from London Gatwick Airport (2015 to 2019).

3.2 SENSITIVE RECEPTORS – HUMAN HEALTH

In addition to presenting the maximum predicted concentrations within the modelling domain, a number of discrete sensitive receptors have been included in the model. The locations of the sensitive receptors considered for this assessment are provided in *Table 3.1* and presented in *Figure 3.1*. These include a number of receptors on Mitcham Road and Beddington Lane where maximum annual mean concentrations are likely to occur.

FIGURE 3.1 LOCATION OF SENSITIVE RECEPTORS CONSIDERED FOR THE ASSESSMENT

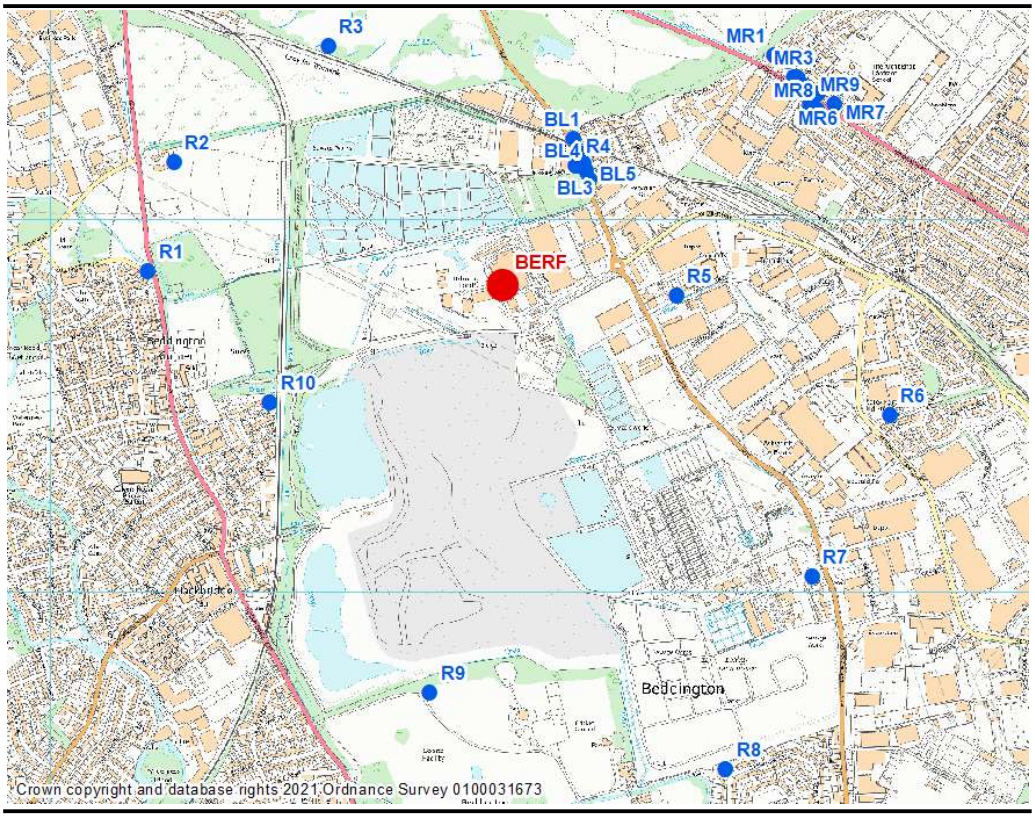


TABLE 3.1 DESCRIPTION OF SENSITIVE RECEPTORS

Label	Receptor	Grid Reference	
R1	London Road	528263	166861
R2	London Rd/Goat Rd	528332	167153
R3	Mitcham Common/Golf	528747	167465
R4	Beddington Lane	529413	167145
R5	North of Therapia Ln	529683	166796
R6	Wimshurst Close	530257	166472
R7	West of Beddington	530049	166041
R8	Crispin Crescent	529816	165522
R9	Beddington Park	529021	165729
R10	Primrose Close	528590	166509
R11	Beddington Lane	529413	167145
BL1	Beddington Lane 1	529407	167215
BL2	Beddington Lane 2	529423	167179
BL3	Beddington Lane 3	529434	167150
BL4	Beddington Lane 4	529440	167132
BL5	Beddington Lane 5	529450	167106
MR1	Mitcham Road 1	529945	167440
MR2	Mitcham Road 2	529985	167425
MR3	Mitcham Road 3	530010	167380
MR4	Mitcham Road 4	530015	167370
MR5	Mitcham Road 5	530035	167355
MR6	Mitcham Road 6	530065	167338
MR7	Mitcham Road 7	530110	167308
MR8	Mitcham Road 8	530063	167295
MR9	Mitcham Road 9	530043	167310
MR10	Mitcham Road 10	530000	167380

3.3 DISPERSION MODELLING OF EMISSIONS

3.3.1 The Dispersion Model

The potential impact of emissions from the installation has been assessed using a dispersion model to predict airborne ground level concentrations of pollutants emitted from the main stack.

The operational impacts from the emission sources have been assessed using the ADMS (Atmospheric Dispersion Modelling System version 5.2) model. ADMS allows for the modelling of dispersion under convective meteorological conditions using a skewed Gaussian concentration distribution. It is able to

simulate the effects of terrain and building downwash simultaneously. It can also calculate concentrations for direct comparison with air quality standards or guidelines and is used to predict the occurrence of visible plumes. It is used extensively in the UK for assessing the air quality impacts of industrial and other polluting processes.

3.3.2 Building Downwash

Structures associated with the installation or nearby buildings may affect the dispersion of emissions from the stack. The installation comprises a number of integrated buildings at various heights with a maximum height above ground level of 39 m. Building downwash effects are likely to occur for buildings in excess of one third of the stack height (28.5 m for a 95 m stack). Details of the building structures that have been included in the dispersion model to allow for building downwash effects are presented in *Table 3.2*. It should be noted that these are the measurements assumed to represent the various buildings for the dispersion modelling rather than the actual dimensions of the buildings.

TABLE 3.2 BUILDINGS INCLUDED IN THE DISPERSION MODEL

Building	Height (m)	Location of Building Centre	X Length (m)	Y Width (m)	Angle (°)
Main building	39	529233, 166848	90	75	154

3.3.3 Grid Size

In addition to assessing the impact of emissions on the 26 discrete receptors identified in *Section 3.2*, the maximum predicted off-site concentration is also determined. Predicted concentrations are calculated across an 8 km by 8 km grid with a 100 m grid resolution (approximately the same as the stack height).

3.3.4 Significance Criteria

Human Health

The Environment Agency's Risk Assessment Guidance specifies criteria to enable the potential significance of an impact to be determined [7]. For the process contribution (PC), the impact is deemed not significant if the annual mean PC is less than 1% of the environmental assessment level (EAL) and the short term PC is less than 10% of the EAL. If either of these criteria is exceeded, they are potentially significant and it is then necessary to consider the total predicted environmental concentration (PEC, which is the PC plus the ambient background concentration).

7 https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit

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

Habitat Sites

The Environment Agency's risk assessment guidance [7] specifies criteria to enable the potential significance of an impact to be determined. For the process contribution (PC), the impact is deemed not significant if the annual mean PC is less than 1% of the critical level (or air quality objective) and the short term PC is less than 10% of the critical level (or air quality objective). If either of these criteria is exceeded, they are not necessarily significant however, it is then necessary to consider the total predicted environmental concentration or deposition (PC plus the background contribution) as discussed above.

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

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

3.4 EMISSION SOURCES

3.4.1 Emission Scenarios

The installation has two separate process streams with emissions via separate stacks. These stacks are sufficiently close that they can be considered as a single source.

3.4.2 Installation Stack Emission Parameters

Emission parameters for the installation are presented in *Table 3.4* for the Permitted Facility and *Table 3.5* for the Proposed Facility. There will be two treatment lines with emissions combined into a single source for the purposes of the modelling. Emissions data for the increased MCR scenario have been provided by Fichtner Consulting Engineers and have been derived from actual stack emission parameters at various loads (e.g. temperature, flow rate, moisture and oxygen content).

TABLE 3.4 SUMMARY OF THE EMISSIONS DATA FOR DISPERSION MODELLING – PERMITTED FACILITY

Parameter	**Combined Emissions for Two Process Lines**	
Number of sources	1	
Stack location grid reference	529220, 166822	
Stack height (m)	95	
Temperature of emission (°C)	138	
Actual flow rate ($m^3 s^{-1}$)	91.75	
Emission velocity at stack exit ($m s^{-1}$)	22.87	
Oxygen content of exhaust (%v/v dry)	9.27	
Moisture content of exhaust (%v/v)	14.93	
Normalised flow rate ($Nm^3 s^{-1}$) (a)	60.88	
Flue/effective stack diameter (m)	2.26	
Pollutant	**Daily Emission Concentration (mg Nm^{-3}) (b)**	**Total Emission Rate (g s^{-1})**
Particles	10	0.61
NOx	165	10.0
SO_2	50	3.0
CO	50	3.0
HF	1	0.061
HCl	10	0.61
TOC	10	0.61
NH_3	12	0.73
PCDD/Fs	0.1 (b)	6.1×10^{-10}
Cadmium and Thallium	0.05	0.0030
Mercury	0.05	0.0030
Other metals (As, Cr, Co, Cu, Pb, Mn, Ni, Sb and V)	0.5	0.030
PAH (as benzo(a)pyrene)	0.0002 (c)	1.2×10^{-5}
Polychlorinated biphenyls (c)	0.005 (d)	3.0×10^{-4}

(a) Reference conditions of 273K, 1 atmosphere, dry and 11% oxygen

(b) Emission concentrations expressed as mg Nm^{-3} (at reference conditions) except for PCDD/Fs which are in ng Nm^{-3} (at reference conditions)

(c) 0.2 µg m^{-3} is the maximum recorded at a UK plant (2019 Waste Incineration BREF, Figure 8.121)

(d) Table 3.8 of the 2006 Waste Incineration BREF states that the annual average total PCBs is less than 0.005 mg/Nm^3 (dry, 11% oxygen, 273K)

It is assumed as a worst-case that emissions are at the emission limit for each pollutant. However, for PAHs and PCBs there are no limits specified within the permit. Therefore, emissions are based on information provided in the Waste Incineration BREF. However, extractive monitoring tests for the two process lines indicated substantially lower emission concentrations based on extractive tests between August 2019 and May 2020. These are summarised in *Annex A*. For PCBs, these represent worst-case conditions as some of the measured concentrations are below the limit of detection of the analysis. For

PCBs, measured concentrations were less than 0.00056 ng m^{-3} (5.6 x 10^{-10} mg Nm^{-3}). For PAHs, measured emissions of benzo(a)pyrene (BaP) were 0.00098 µg m^{-3} (9.8 x 10^{-7} mg Nm^{-3}). In all cases, measured concentrations of BaP were below the detection limit of the analysis. The measured concentration was the mean of six of the eight extractive tests as two tests were excluded as the detection limit for the analysis was in excess of 0.1 µg Nm^{-3} (100 ng Nm^{-3}). Therefore, it is concluded that the adopted emissions for PAHs (as BaP) and PCBs represents a very worst-case.

TABLE 3.5 SUMMARY OF THE EMISSIONS DATA FOR DISPERSION MODELLING – PROPOSED FACILITY

Parameter	**Combined Emissions for Two Process Lines**	
Temperature of emission (°C)	138	
Actual flow rate (m^3 s^{-1})	102.6	
Emission velocity at stack exit (m s^{-1})	25.58	
Oxygen content of exhaust (%v/v dry)	9.19	
Moisture content of exhaust (%v/v)	14.95	
Normalised flow rate (Nm^3 s^{-1}) (a)	68.56	
Pollutant	**Daily Emission Concentration (mg Nm^{-3}) (b)**	**Total Emission Rate (g s^{-1})**
Particles	10	0.69
NOx	165	11.3
SO_2	50	3.4
CO	50	3.4
HF	1	0.069
HCl	10	0.69
TOC	10	0.69
NH_3	12	0.82
PCDD/Fs	0.1 (b)	6.9 x 10^{-10}
Cadmium and Thallium	0.05	0.0034
Mercury	0.05	0.0034
Other metals (As, Cr, Co, Cu, Pb, Mn, Ni, Sb and V)	0.5	0.034
PAH (as benzo(a)pyrene)	0.0002 (c)	1.4 x 10^{-5}
Polychlorinated biphenyls (c)	0.005 (d)	3.4 x 10^{-4}

(a) Reference conditions of 273K, 1 atmosphere, dry and 11% oxygen

(b) Emission concentrations expressed as mg Nm^{-3} (at reference conditions) except for PCDD/Fs which are in ng Nm^{-3} (at reference conditions)

(c) 0.2 µg m^{-3} is the maximum recorded at a UK plant (2019 Waste Incineration BREF, Figure 8.121)

(d) Table 3.8 of the 2006 Waste Incineration BREF states that the annual average total PCBs is less than 0.005 mg/Nm^3 (dry, 11% oxygen, 273K)

Within the IED, emission limits are set for two averaging periods: daily and half-hourly. The half hourly average recognises that short term elevated emissions may occur due to routine process variables. However, over the

longer term the daily average values must be achieved. The air quality standards and guidelines used in this assessment largely refer to averaging periods of one hour or greater. In addition, the UK air quality standards for several pollutants also have a number of 'allowable' occasions in which the limit value may be exceeded within any one calendar year before the standard is deemed to have been breached. Therefore, short term emissions occurring for less than 30 minutes are unlikely to have a significant impact on short term air quality, particularly as the number of excursions of the emission concentrations to the 30 minute value is effectively limited by the Directive. On this basis, the initial impact assessment is based upon daily average values for emissions from the installation plant. A sensitivity analysis is also provided for the emissions at the half-hourly emission limit values (refer *Section 4.4*).

3.4.3 Trace Metal Emissions

Within the IED, emissions of metals are divided into three groups. The total emission of metals within each group is not permitted to exceed the prescribed emission limit set for the group. For the purposes of the modelling, initially the assumption is made that each metal is emitted as 100% of the total emission for the group. This allows the initial screening out of metals that do not pose a significant risk even based on very worst-case assumptions. In reality, this assumption is clearly highly conservative and is likely to greatly overestimate the actual impacts associated with emissions of metals. In accordance with Environment Agency guidance [8], where metals cannot be considered to be 'not significant' a further step, with a less conservative assumption is applied, whereby metals are assessed based on maximum emissions of these metals derived from data from other operational facilities, as provided by the Environment Agency. The emissions data used for this purpose are presented in *Table 3.6*. For the Group 3 metals, the maximum emission for the operational facilities is used.

TABLE 3.6 SUMMARY OF METAL EMISSIONS FROM WASTE COMBUSTION FACILITIES

Metal Species	IED Limit (mg Nm^{-3})	Maximum Emission as %age of Limit
Antimony	0.5	2.3%(a)
Arsenic	0.5	5.0%(a)
Cadmium	0.05	2.7%(b)
Chromium	0.5	18.4%(a)
Chromium VI	0.5	0.03%(a)
Cobalt	0.5	1.1%(a)
Copper	0.5	5.8%(a)
Lead	0.5	10.1%(a)

8 Environment Agency (June 2016) Guidance on Assessing Group 3 Metal Stack Emissions from Incinerators (Version 4)

TABLE 3.6 SUMMARY OF METAL EMISSIONS FROM WASTE COMBUSTION FACILITIES

Metal Species	IED Limit (mg Nm^{-3})	Maximum Emission as %age of Limit
Manganese	0.5	12.0%(a)
Mercury	0.05	6.4%(b)
Nickel	0.5	11.0%(a)(c)
Thallium	0.05	2.7%(b)
Vanadium	0.5	1.2%(a)

(a) Environment Agency guidance for Group 3 metals, maximum of data

(b) ERM report for Defra (WR0608) on emissions from waste management facilities

(c) Third highest concentrations as highest two measurements are outliers

The Expert Panel on Air Quality Standards (EPAQS) has published a recommended air quality guideline for chromium, which has been adopted in this assessment. This guideline value is based upon the carcinogenic risk of exposure to hexavalent chromium (CrVI), whereas the majority of chromium emissions from waste combustion occur in the trivalent form (CrIII) (which is a non-carcinogen). The EPAQS report [9] suggests that CrVI may constitute between 10% and 20% of total chromium in the atmosphere. These factors have been used in the assessment to estimate the maximum emissions of CrVI and therefore allow meaningful comparison with the EPAQS guideline. Therefore, for CrVI the following is assumed:

- for initial screening, CrVI is assumed to comprise 20% of the Group 3 emission limit;
- for typical emissions, CrVI is assumed to comprise 0.03% of the Group 3 emission limit in accordance with the Environment Agency guidance.

9 Expert Panel on Air Quality Standards (2009) Metals and Metalloids

4 PREDICTED OPERATIONAL IMPACT ON HUMAN HEALTH

4.1 INTRODUCTION

In *Section 4.2*, the predicted impact of emissions to air from the Proposed Facility are compared with those for the Permitted Facility. Results are presented for the maximum predicted concentration anywhere within the model domain. For each averaging period (e.g. annual mean, maximum hourly mean etc.), the result presented is the maximum for the five years of meteorological data used for dispersion modelling purposes. A number of assumptions have been made to characterise the emission source and the surrounding environment into which these emissions are emitted. Worst-case assumptions have been adopted to avoid underestimating the predicted impact of emissions on air quality. In particular, it is assumed that the installation operates continuously at the maximum permissible emission limits and results are presented for the worst-case meteorological year.

In addition, the impact of the Proposed Facility at sensitive receptors is provided in *Section 4.3*.

4.2 COMPARISON OF THE PERMITTED FACILITY AND THE PROPOSED FACILITY

4.2.1 Long-term Impacts

A comparison of long-term impacts between the Permitted Facility and the Proposed Facility is provided in *Table 4.1*. Predicted concentrations for the Proposed Facility are 3.3% higher than predicted for the Permitted Facility. Although emission rates increase by 12.6% for the Proposed Facility, the impact is offset by the increased emission velocity resulting in increased momentum and improved dispersion for the Proposed Facility.

Except for arsenic and chromium VI, the change in concentrations is less than 1% of the respective AQALs and would be assessed as not significant. However, it is assumed that arsenic is emitted at the emission limit value for the group 3 metals (0.5 mg Nm^{-3}) and that hexavalent chromium is 20% of the group 3 limit. For typical emission concentrations (refer *Section 3.4.3*), the change in concentration would be as follows:

- 0.0048 ng m^{-3} for arsenic (0.1% of the AQAL of 6 ng m^{-3}); and
- 0.000029 ng m^{-3} for chromium VI (<0.1% of the AQAL of 0.2 ng m^{-3}).

4.2.2 Short-term Impacts

A comparison of short-term impacts between the Permitted Facility and the Proposed Facility is provided in *Table 4.2*.

TABLE 4.1: COMPARISON OF LONG-TERM (ANNUAL MEAN) IMPACTS FOR THE PERMITTED FACILITY AND THE PROPOSED FACILITY

Pollutant	Units	AQAL	Permitted Facility		Proposed Facility		Comparison Proposed & Permitted Facility		
			PC (µg m^{-3})	%age AQAL	PC (µg m^{-3})	%age AQAL	Change in PC (µg m^{-3})	Change as %age of Permitted Facility	Change as %age AQAL
PM_{10}	µg m^{-3}	40	0.059	0.1%	0.061	0.2%	0.0019	3.3%	0.0%
$PM_{2.5}$	µg m^{-3}	20	0.059	0.3%	0.061	0.3%	0.0019	3.3%	0.0%
NO_2	µg m^{-3}	40	0.68	1.7%	0.70	1.8%	0.022	3.3%	0.1%
HF	µg m^{-3}	16	0.0059	0.0%	0.0061	0.0%	0.00019	3.3%	0.0%
NH_3	µg m^{-3}	180	0.071	0.0%	0.073	0.0%	0.0023	3.3%	0.0%
VOCs (as benzene)	µg m^{-3}	5	0.059	1.2%	0.061	1.2%	0.0019	3.3%	0.0%
PAH (as BaP)	ng m^{-3}	1	0.0012	0.1%	0.0012	0.1%	0.000038	3.3%	0.0%
Dioxins/ furans	fg m^{-3}	N/A	0.59	-	0.61	-	0.019	3.3%	-
Cadmium (Cd)	ng m^{-3}	5	0.29	5.9%	0.30	6.1%	0.0096	3.3%	0.2%
Thallium (Tl)	ng m^{-3}	1,000	0.29	0.0%	0.30	0.0%	0.0096	3.3%	0.0%
Mercury (Hg)	ng m^{-3}	250	0.29	0.1%	0.30	0.1%	0.0096	3.3%	0.0%
Antimony (Sb)	ng m^{-3}	5,000	2.9	0.1%	3.0	0.1%	0.096	3.3%	0.0%
Arsenic (As)	ng m^{-3}	6	2.9	48.3%	3.0	50.0%	0.096	3.3%	1.6%
Chromium (Cr)	ng m^{-3}	5,000	2.9	0.1%	3.0	0.1%	0.096	3.3%	0.0%
Cobalt (Co)	ng m^{-3}	1,000	2.9	0.3%	3.0	0.3%	0.096	3.3%	0.0%
Copper (Cu)	ng m^{-3}	10,000	2.9	0.0%	3.0	0.0%	0.096	3.3%	0.0%
Manganese (Mn)	ng m^{-3}	150	2.9	2.0%	3.0	2.0%	0.096	3.3%	0.1%
Nickel (Ni)	ng m^{-3}	20	2.9	14.7%	3.0	15.2%	0.096	3.3%	0.5%
Lead (Pb)	ng m^{-3}	250	2.9	1.2%	3.0	1.2%	0.096	3.3%	0.0%

TABLE 4.1: COMPARISON OF LONG-TERM (ANNUAL MEAN) IMPACTS FOR THE PERMITTED FACILITY AND THE PROPOSED FACILITY

Pollutant	Units	AQAL	Permitted Facility		Proposed Facility		Comparison Proposed & Permitted Facility		
			PC (µg m^{-3})	%age AQAL	PC (µg m^{-3})	%age AQAL	Change in PC (µg m^{-3})	Change as %age of Permitted Facility	Change as %age AQAL
Vanadium (V)	ng m^{-3}	5,000	2.9	0.1%	3.0	0.1%	0.096	3.3%	0.0%
PCBs	ng m^{-3}	200	0.029	0.0%	0.030	0.0%	0.00096	3.3%	0.0%
Chromium VI (a)	ng m^{-3}	0.2	0.59	294.3%	0.61	304.0%	0.019	3.3%	9.6%

(a) Assumes that 20% of total chromium is in the hexavalent form

TABLE 4.2: COMPARISON OF SHORT-TERM IMPACTS FOR THE PERMITTED FACILITY AND THE PROPOSED FACILITY

Pollutant	Averaging Period	Units	AQAL	Permitted Facility		Proposed Facility		Comparison Proposed & Permitted Facility		
				PC (µg m^{-3})	%age AQAL	PC (µg m^{-3})	%age AQAL	Change in PC (µg m^{-3})	Change as %age of Permitted Facility	Change as %age AQAL
PM_{10}	24-hour mean (90.4th%ile)	µg m^{-3}	50	0.18	0.4%	0.19	0.4%	0.0058	3.2%	0.0%
NO_2	1-hour (99.8th %ile)	µg m^{-3}	200	4.3	2.1%	4.5	2.2%	0.20	4.6%	0.1%
SO_2	24-hour (99.2nd %ile)	µg m^{-3}	125	2.1	1.7%	2.2	1.8%	0.081	3.8%	0.1%
SO_2	1-hour (99.7th %ile)	µg m^{-3}	350	3.5	1.0%	3.7	1.1%	0.15	4.3%	0.0%
SO_2	15-minute (99.9th %ile)	µg m^{-3}	266	4.4	1.7%	4.6	1.7%	0.18	4.1%	0.1%
CO	8-hour	µg m^{-3}	10,000	3.5	0.0%	3.6	0.0%	0.064	1.8%	0.0%
CO	1-hour	µg m^{-3}	30,000	5.7	0.0%	5.9	0.0%	0.17	2.9%	0.0%
HF	1-hour	µg m^{-3}	160	0.11	0.1%	0.12	0.1%	0.0033	2.9%	0.0%
HCl	1-hour	µg m^{-3}	750	1.1	0.2%	1.2	0.2%	0.033	2.9%	0.0%
NH_3	1-hour	µg m^{-3}	2,500	1.4	0.1%	1.4	0.1%	0.040	2.9%	0.0%
VOCs as benzene	24-hour	µg m^{-3}	30	0.49	1.6%	0.52	1.7%	0.032	6.6%	0.1%
Hg	1-hour	ng m^{-3}	7,500	5.7	0.1%	5.9	0.1%	0.17	2.9%	0.0%
Sb	1-hour	ng m^{-3}	150,000	57.1	0.0%	58.8	0.0%	1.7	2.9%	0.0%
As	1-hour	ng m^{-3}	15,000	57.1	0.4%	58.8	0.4%	1.7	2.9%	0.0%
Cr	1-hour	ng m^{-3}	150,000	57.1	0.0%	58.8	0.0%	1.7	2.9%	0.0%
Cu	1-hour	ng m^{-3}	200,000	57.1	0.0%	58.8	0.0%	1.7	2.9%	0.0%
Mn	1-hour	ng m^{-3}	1,500,000	57.1	0.0%	58.8	0.0%	1.7	2.9%	0.0%
V	24-hour	ng m^{-3}	1,000	24.6	2.5%	26.2	2.6%	1.6	6.6%	0.2%
PCBs	1-hour	ng m^{-3}	6,000	0.57	0.0%	0.59	0.0%	0.017	2.9%	0.0%

For short-term concentrations, the change in concentration for the Proposed Facility compared to the Permitted Facility varies between 1.8% and 6.6% depending on the averaging period. However, the change relative to the AQALs is very small and is 0.2% at most (24-hour vanadium). The change in concentrations for all emissions is less than 10% of the respective AQALs and would be assessed as not significant in accordance with the Environment Agency's risk assessment guidance.

4.3 DETAILED DISPERSION MODELLING RESULTS – PROPOSED FACILITY

4.3.1 Introduction

A comparison of the Permitted Facility and the Proposed Facility indicates that long-term and short-term changes in concentrations would be assessed as not significant in accordance with the Environment Agency's risk assessment guidance. However, for some pollutants the impact of the Proposed Facility alone cannot be assessed as not significant for some pollutants (annual mean NO_2, VOCs (as benzene), cadmium, arsenic, manganese, nickel, lead and chromium VI). Therefore, a more detailed analysis of the Proposed Facility emissions is provided.

4.3.2 PM_{10}

Predicted ground level concentrations of PM_{10} arising as a result of the Proposed Facility emissions are presented in *Table 4.3*. This assumes that all particles emitted by the installation are less than 10 µm in diameter. Maximum predicted concentrations are provided as well as predicted concentrations at discrete receptors. The significance of the impacts are assessed with regard to Environment Agency guidance.

Maximum predicted concentrations occur to the northeast of the installation close to residential properties on Mitcham Road. Relative to the air quality objectives, maximum concentrations are assessed as 'not significant' as follows:

- 0.2% of the annual mean; and
- 0.4% of the 90.4th percentile of 24-hour means.

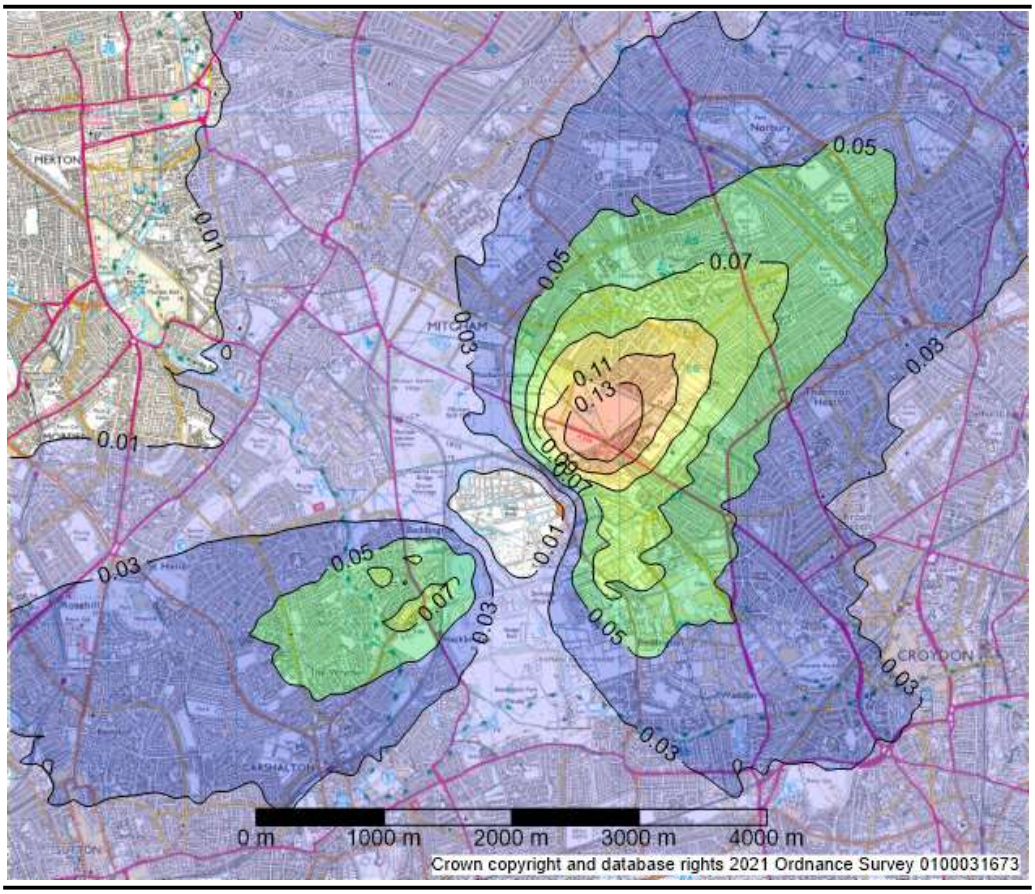
TABLE 4.3 MAXIMUM PREDICTED PM_{10} CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean		90.4th Percentile of 24-hour Means	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum	0.061	0.2%	0.19	0.4%
R1. London Road	0.007	0.0%	0.03	0.1%
R2. Goat Road	0.005	0.0%	0.02	0.0%
R3. Mitcham Common	0.007	0.0%	0.03	0.1%
R4. Beddington Lane	0.008	0.0%	0.03	0.1%
R5. North of Therapia Lane	0.010	0.0%	0.04	0.1%
R6. Wimshurst Close	0.019	0.0%	0.08	0.2%
R7. West of Beddington	0.019	0.0%	0.08	0.2%
R8. Crispin Crescent	0.011	0.0%	0.04	0.1%
R9. Beddington Park	0.016	0.0%	0.06	0.1%
R10. Primrose Close	0.021	0.1%	0.09	0.2%
R11. Beddington Lane	0.008	0.0%	0.03	0.1%
Max BL1 to BL5	0.012	0.0%	0.04	0.1%
Max MR1 to MR10	0.058	0.1%	0.19	0.4%
Maximum off-site (PC) (a)	0.061 (0.2%)		0.19 (0.4%)	
Assumed background	23.0		27.1	
Total concentration (PEC) (a)	23.1 (57.7%)		27.3 (54.7%)	
Air Quality Objective	40		50	
Significance	*Not significant*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard				

The maximum annual mean PEC is 23.1 µg m^{-3}, which is 57.7% of the AQO of 40 µg m^{-3}. The maximum 90.4th percentile of 24-hour means PEC is 27.3 µg m^{-3}, which is 54.7% of the 24-hour mean AQO of 50 µg m^{-3}. Therefore, it is considered very unlikely that an exceedance of either of the AQO for PM_{10} will occur. Therefore, it is concluded that emissions of PM_{10} from the installation are 'not significant'.

Predicted 90.4th percentiles of 24-hour mean concentrations of PM_{10} are presented as a contour plot in *Figure 4.1* for the most recent meteorological year (2019). Highest 24-hour mean concentrations (as the 90.4th percentile) occur to the north and east of the site.

FIGURE 4.1 PREDICTED 90.4TH PERCENTILE OF 24-HOUR MEAN PM_{10} CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3}) - 2019



4.3.3 $PM_{2.5}$

Predicted ground level concentrations of $PM_{2.5}$ for the Proposed Facility are presented in *Table 4.4*. As a worst-case, these have been calculated on the basis that all particles are within the $PM_{2.5}$ fraction. Predicted annual mean concentrations of $PM_{2.5}$ are presented as a contour plot in *Figures 4.2*.

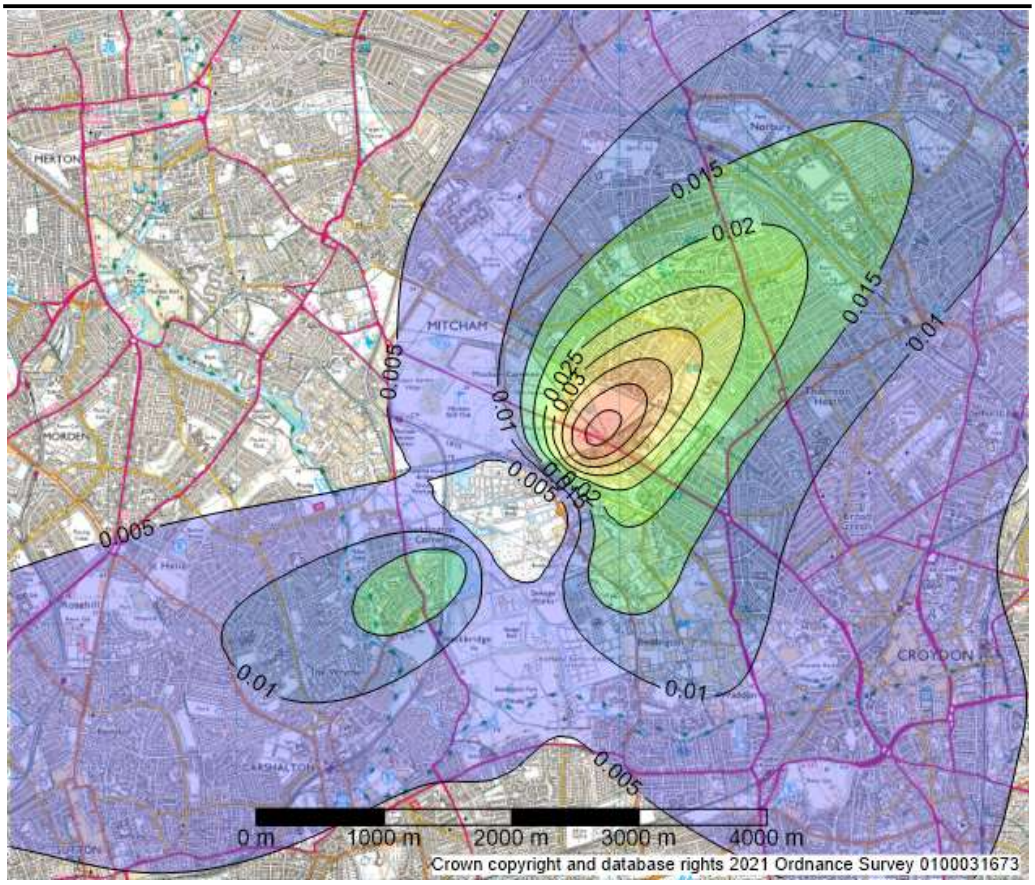
TABLE 4.4 MAXIMUM PREDICTED $PM_{2.5}$ CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean	
	PC (µg m^{-3})	%age AQO
Maximum	0.061	0.3%
R1. London Road	0.007	0.0%
R2. Goat Road	0.005	0.0%
R3. Mitcham Common	0.007	0.0%
R4. Beddington Lane	0.008	0.0%
R5. North of Therapia Lane	0.010	0.0%
R6. Wimshurst Close	0.019	0.1%
R7. West of Beddington	0.019	0.1%

TABLE 4.4 MAXIMUM PREDICTED $PM_{2.5}$ CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean	
	PC (µg m^{-3})	%age AQO
R8. Crispin Crescent	0.011	0.1%
R9. Beddington Park	0.016	0.1%
R10. Primrose Close	0.021	0.1%
R11. Beddington Lane	0.008	0.0%
Max BL1 to BL5	0.012	0.1%
Max MR1 to MR10	0.058	0.3%
Maximum off-site (PC) (a)	0.061 (0.3%)	
Assumed background	13.3	
Total concentration (PEC) (a)	13.4 (66.8%)	
EU limit value	20	
Significance	*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard		

FIGURE 4.2 PREDICTED ANNUAL MEAN $PM_{2.5}$ CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3}) - 2019



The maximum predicted off-site concentration is 0.3% of the EU limit value, which is assessed as 'not significant' at less than 1% of the AQO. The maximum off-site PEC (including the estimated background $PM_{2.5}$ concentration) is 13.4 µg m^{-3}, which is 66.8% of the EU limit value. Therefore, predicted concentrations of $PM_{2.5}$ with the addition of background concentrations are well below the EU limit value of 20 µg m^{-3}. Therefore, it is concluded that emissions of $PM_{2.5}$ from the Proposed Facility are 'not significant'.

4.3.4 Nitrogen Dioxide

Predicted annual and hourly mean ground level concentrations of NO_2 arising as a result of emissions from the installation are presented in *Table 4.5*. Maximum predicted concentrations are provided along with predicted concentrations for the discrete receptors. The significance of the impacts are assessed with regard to Environment Agency guidance.

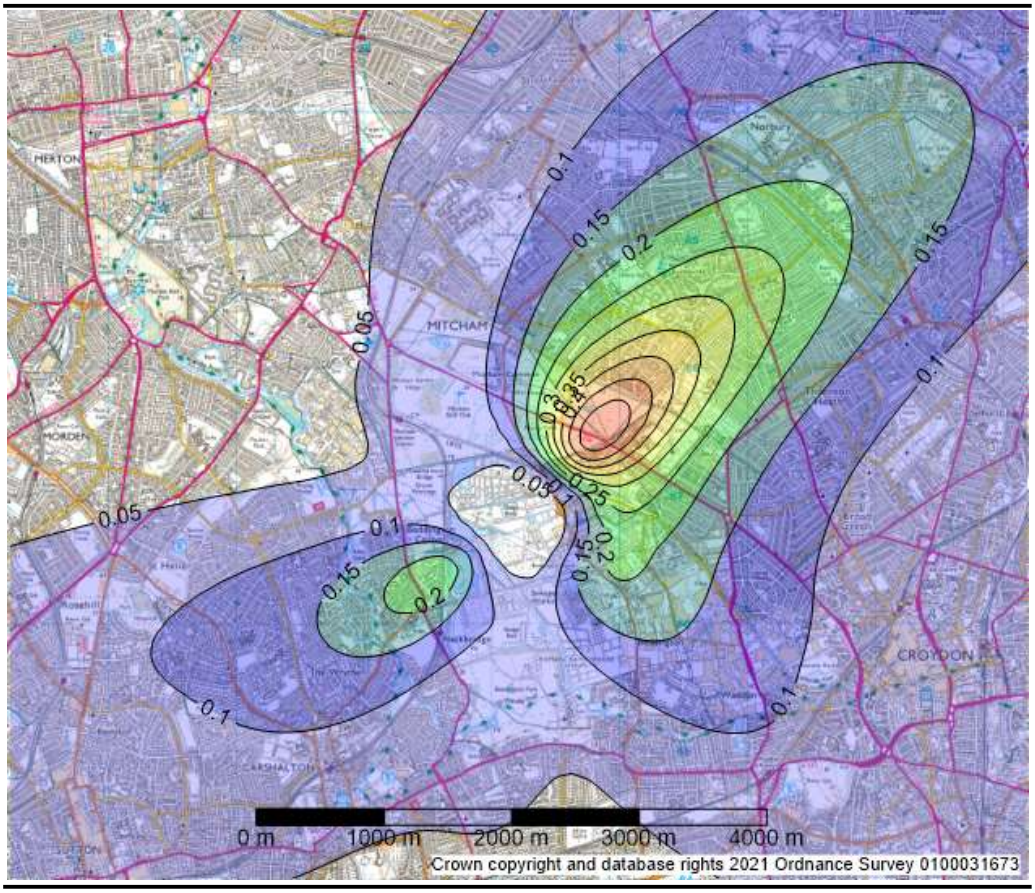
TABLE 4.5 MAXIMUM PREDICTED NO_2 CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean		99.8th Percentile of 1-hour Means	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum	0.70	1.8%	4.5	2.2%
R1. London Road	0.08	0.2%	3.4	1.7%
R2. Goat Road	0.06	0.1%	3.1	1.6%
R3. Mitcham Common	0.08	0.2%	3.5	1.8%
R4. Beddington Lane	0.09	0.2%	3.0	1.5%
R5. North of Therapia Lane	0.11	0.3%	3.6	1.8%
R6. Wimshurst Close	0.22	0.5%	3.2	1.6%
R7. West of Beddington	0.22	0.5%	3.2	1.6%
R8. Crispin Crescent	0.12	0.3%	2.5	1.3%
R9. Beddington Park	0.18	0.5%	3.2	1.6%
R10. Primrose Close	0.25	0.6%	4.1	2.1%
R11. Beddington Lane	0.09	0.2%	3.0	1.5%
Max BL1 to BL5	0.14	0.4%	3.5	1.8%
Max MR1 to MR10	0.67	1.7%	3.7	1.8%
Maximum off-site (PC) (a)	0.70 (1.8%)		4.5 (2.2%)	
Assumed background	31.1		62.2	
Total concentration (PEC) (a)	31.8 (79.5%)		76.7 (33.3%)	
Air Quality Objective	40		200	
Significance	*Potentially significant*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard				

Guidance issued by the Environment Agency's Air Quality Assessment and Modelling Unit (AQMAU) [10] indicates that an initial screening approach would be to assume that 100% of annual average and 50% of peak hourly average concentrations of NO_x are in the form of NO_2. For a more detailed worst-case assessment such as this, the guidance recommends a conversion rate of 70% and 35% for annual and hourly concentrations respectively.

Predicted annual mean and predicted hourly mean (as the 99.8th percentile) ground level concentrations are also presented as contour plots in *Figure 4.3* and *Figure 4.4*, respectively.

FIGURE 4.3 PREDICTED ANNUAL MEAN NO_2 CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3}) - 2019

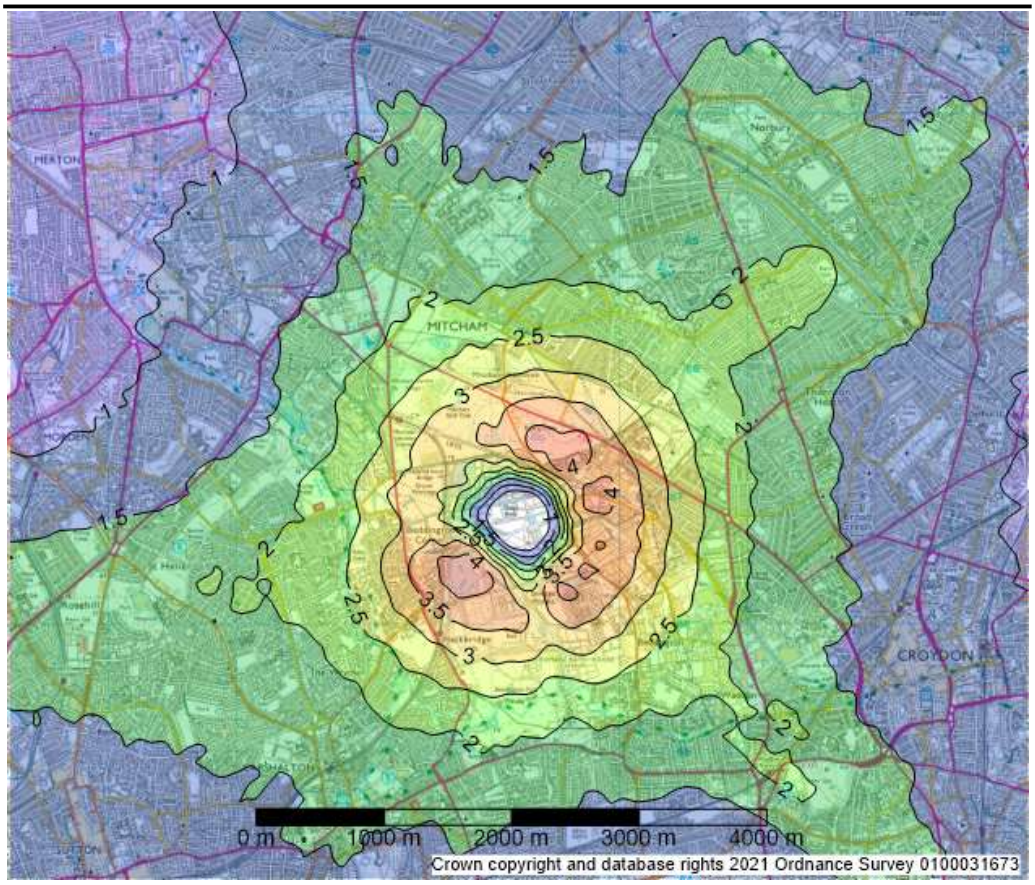


Maximum predicted annual mean concentrations occur to the northeast of the installation close to residential properties on Mitcham Road. Relative to the annual mean air quality objectives, maximum concentrations are 1.8% of the AQO and would be assessed as 'potentially significant'. Predicted short-term concentrations are less than 10% of the AQO and would be assessed as 'not significant'.

10 Conversion Ratios for NO_x and NO_2, Air Quality Modelling and Assessment Unit of the Environment Agency (undated)

The maximum annual mean PEC is 31.8 µg m^{-3}, which is 79.5% of the AQO of 40 µg m^{-3} and there is a risk that the AQO may be exceeded due to emissions from the installation (PEC > 70% of the AQO). However, worst-case assumptions have been adopted for the assessment including continuous operation of the BERF with NO_x emissions at the limit, worst-case meteorological data and a conservative assessment of the background concentration. Therefore, it is concluded that emissions of NO_x from the installation would not result in an exceedance of the annual mean AQO for NO_2.

FIGURE 4.4 PREDICTED 99.8TH PERCENTILE OF HOURLY MEAN NO_2 CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3}) - 2019



4.3.5 Sulphur Dioxide

Predicted ground level concentrations of SO_2 arising as a result of emissions from the installation are presented in *Table 4.6*. Maximum predicted concentrations are provided, and the significance of the impact is assessed according to the Environment Agency guidance.

TABLE 4.6 MAXIMUM PREDICTED SO_2 CONCENTRATIONS FOR THE PROPOSED FACILITY ($\mu g\ m^{-3}$)

Receptor/Parameter	99.2nd Percentile of 24-hour Means		99.7th Percentile of 1-hour means		99.9th Percentile of 15-minute Means	
	PC ($\mu g\ m^{-3}$)	%age AQO	PC ($\mu g\ m^{-3}$)	%age AQO	PC ($\mu g\ m^{-3}$)	%age AQO
Maximum	2.2	1.8%	3.7	1.1%	4.6	1.7%
R1. London Road	0.6	0.5%	2.8	0.8%	3.3	1.2%
R2. Goat Road	0.7	0.5%	2.5	0.7%	3.3	1.3%
R3. Mitcham Common	0.8	0.6%	2.9	0.8%	3.8	1.4%
R4. Beddington Lane	0.6	0.5%	2.4	0.7%	4.0	1.5%
R5. North of Therapia Lane	0.8	0.6%	3.0	0.9%	3.9	1.5%
R6. Wimshurst Close	0.9	0.7%	2.7	0.8%	3.2	1.2%
R7. West of Beddington	1.2	1.0%	2.7	0.8%	3.1	1.2%
R8. Crispin Crescent	0.8	0.6%	2.2	0.6%	2.6	1.0%
R9. Beddington Park	1.1	0.9%	2.7	0.8%	3.2	1.2%
R10. Primrose Close	1.6	1.2%	3.5	1.0%	4.0	1.5%
R11. Beddington Lane	0.6	0.5%	2.4	0.7%	4.0	1.5%
Max BL1 to BL5	0.8	0.6%	2.9	0.8%	4.2	1.6%
Max MR1 to MR10	1.8	1.4%	3.1	0.9%	3.6	1.3%
Maximum off-site (PC) (a)	2.2 (1.8%)		3.7 (1.1%)		4.6 (1.7%)	
Assumed background	4.4		7.4		9.9	
Total concentration (PEC) (a)	6.6 (5.3%)		11.1 (3.2%)		14.5 (5.4%)	
Air Quality Objective	125		350		266	
Significance	*Not significant*		*Not significant*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard						

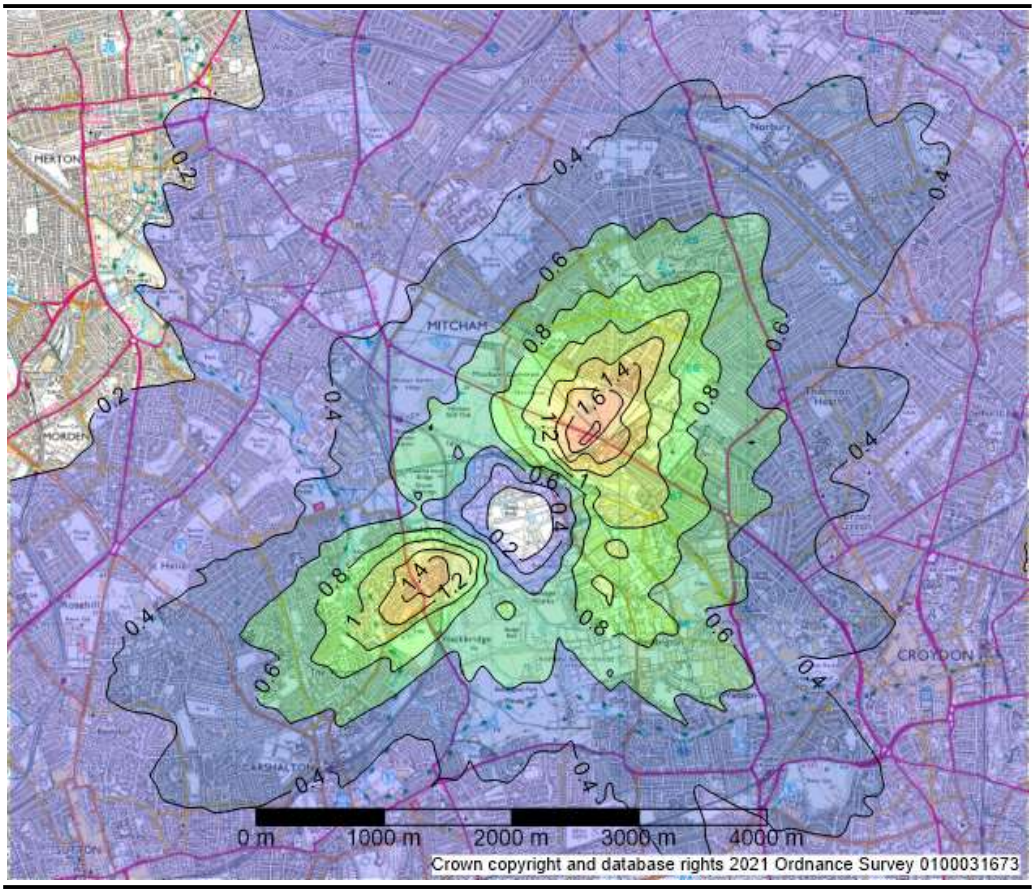
Predicted 99.2nd percentile of 24-hour mean ground level concentrations of SO_2 are also presented as a contour plot in *Figure 4.5.*

Predicted ground level SO_2 concentrations are well within the relevant AQO. Compared to the AQO for SO_2, predicted maximum concentrations may be summarised as follows:

- 1.8% of the 24-hour mean AQO for SO_2;
- 1.1% of the 1-hour mean AQO for SO_2; and
- 1.7% of the 15-minute mean AQO for SO_2.

The predicted short-term SO_2 concentrations are all 10% or less of the relevant AQO, therefore according to the Environment Agency guidance the impact of SO_2 emissions from the Proposed Facility is assessed as 'not significant'.

FIGURE 4.5 PREDICTED 99.2ND PERCENTILE OF 24-HOUR MEAN SO_2 CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3}) - 2019



4.3.6 Carbon Monoxide

Predicted ground level concentrations of CO arising as a result of emissions from the Proposed Facility are presented in *Table 4.7*. Maximum predicted concentrations are provided, and the significance of the impact is assessed according to the Environment Agency guidance.

Predicted ground level CO concentrations are well within the relevant AQALs. At worst, the maximum off-site 8-hour mean is less than 0.1% of the AQO, which is assessed as 'not significant'. The 1-hour mean is also less than 0.1% of the AQAL and also assessed as 'not significant'.

TABLE 4.7 MAXIMUM PREDICTED CO CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Maximum 8-Hour Mean		Maximum 1-Hour Mean	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum	3.6	<0.1%	5.9	<0.1%
R1. London Road	2.1	<0.1%	3.4	<0.1%
R2. Goat Road	2.1	<0.1%	3.4	<0.1%
R3. Mitcham Common	2.5	<0.1%	3.9	<0.1%
R4. Beddington Lane	2.3	<0.1%	5.1	<0.1%
R5. North of Therapia Lane	2.9	<0.1%	5.0	<0.1%
R6. Wimshurst Close	2.3	<0.1%	3.2	<0.1%
R7. West of Beddington	2.2	<0.1%	3.0	<0.1%
R8. Crispin Crescent	2.6	<0.1%	2.6	<0.1%
R9. Beddington Park	2.3	<0.1%	3.0	<0.1%
R10. Primrose Close	2.8	<0.1%	4.3	<0.1%
R11. Beddington Lane	2.3	<0.1%	5.1	<0.1%
Max BL1 to BL5	2.5	<0.1%	5.3	<0.1%
Max MR1 to MR10	2.8	<0.1%	3.5	<0.1%
Maximum off-site (PC) (a)	3.6 (<0.1%)		5.9 (<0.1%)	
Assumed background	291		416	
Total concentration (PEC) (a)	295 (2.9%)		422 (1.4%)	
AQO/AQAL	10,000		30,000	
Significance	*Not significant*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard				

4.3.7 Hydrogen Chloride and Hydrogen Fluoride

Predicted ground level concentrations of HCl and HF arising as a result of emissions from the Proposed Facility are presented in *Table 4.8*.

TABLE 4.8 MAXIMUM PREDICTED HF AND HCL CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	HF Annual Mean		HF Maximum Hourly Mean		HCl Maximum Hourly Mean	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum	0.0061	<0.1%	0.12	0.1%	1.2	0.2%
R1. London Road	0.0007	<0.1%	0.07	0.0%	0.7	0.1%
R2. Goat Road	0.0005	<0.1%	0.07	0.0%	0.7	0.1%
R3. Mitcham Common	0.0007	<0.1%	0.08	0.0%	0.8	0.1%
R4. Beddington Lane	0.0008	<0.1%	0.10	0.1%	1.0	0.1%

TABLE 4.8 MAXIMUM PREDICTED HF AND HCL CONCENTRATIONS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	HF Annual Mean		HF Maximum Hourly Mean		HCl Maximum Hourly Mean	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
R5. North of Therapia Lane	0.0010	<0.1%	0.10	0.1%	1.0	0.1%
R6. Wimshurst Close	0.0019	<0.1%	0.06	0.0%	0.6	0.1%
R7. West of Beddington	0.0019	<0.1%	0.06	0.0%	0.6	0.1%
R8. Crispin Crescent	0.0011	<0.1%	0.05	0.0%	0.5	0.1%
R9. Beddington Park	0.0016	<0.1%	0.06	0.0%	0.6	0.1%
R10. Primrose Close	0.0021	<0.1%	0.09	0.1%	0.9	0.1%
R11. Beddington Lane	0.0008	<0.1%	0.10	0.1%	1.0	0.1%
Max BL1 to BL5	0.0012	<0.1%	0.11	0.1%	1.1	0.1%
Max MR1 to MR10	0.0058	<0.1%	0.07	0.0%	0.7	0.1%
Maximum off-site (PC) (a)	0.0061 (<0.1%)		0.12 (0.1%)		1.2 (0.2%)	
Assumed background	3.0		6.0		20.4	
Total concentration (PEC) (a)	3.0 (18.8%)		6.1 (3.8%)		21.6 (2.9%)	
AQAL	16		160		750	
Significance	*Not significant*		*Not significant*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard						

Compared to the relevant AQAL, predicted maximum concentrations are very small and less than 1% of the AQAL and emissions from the installation are assessed as 'not significant'.

4.3.8 Total Organic Carbon

Predicted annual mean concentrations of TOC (as benzene) arising as a result of emissions from the Proposed Facility are presented in *Table 4.9*.

TABLE 4.9 MAXIMUM PREDICTED CONCENTRATIONS OF BENZENE FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean		Maximum 24-Hour Mean	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum	0.061	1.2%	0.52	1.7%
R1. London Road	0.007	0.1%	0.27	0.9%
R2. Goat Road	0.005	0.1%	0.26	0.9%
R3. Mitcham Common	0.007	0.1%	0.24	0.8%
R4. Beddington Lane	0.008	0.2%	0.22	0.7%
R5. North of Therapia Lane	0.010	0.2%	0.25	0.8%
R6. Wimshurst Close	0.019	0.4%	0.22	0.7%
R7. West of Beddington	0.019	0.4%	0.25	0.8%
R8. Crispin Crescent	0.011	0.2%	0.20	0.7%
R9. Beddington Park	0.016	0.3%	0.38	1.3%
R10. Primrose Close	0.021	0.4%	0.43	1.4%
R11. Beddington Lane	0.008	0.2%	0.22	0.7%
Max BL1 to BL5	0.012	0.2%	0.29	1.0%
Max MR1 to MR10	0.058	1.2%	0.44	1.5%
Maximum off-site (PC) (a)	0.061 (1.2%)		0.52 (1.7%)	
Assumed background	0.64		0.76	
Total concentration (PEC) (a)	0.70 (14.0%)		1.3 (4.3%)	
AQO/AQAL	5		30	
Significance	*AQO likely to be met*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard				

Maximum predicted ground level TOC (assuming all benzene as a worst case) concentrations are well within the annual mean AQO. The maximum off-site concentration is 1.2% of the long-term objective and is 'potentially significant' according to the Environment Agency guidance. However, the background concentration in the vicinity of the site is 0.64 µg m^{-3}, which gives a maximum PEC of 0.70 µg m^{-3}, just 14.0% of the AQO. These are for the worst-case assumptions adopted for the assessment. Therefore, it is concluded that it is likely that the AQO would be met. Predicted maximum 24-hourly mean concentrations are all less than 10% of the short term AQAL and would be assessed as 'not significant'.

4.3.9 Benzo(a)pyrene

Predicted annual mean concentrations of PAHs (as benzo(a)pyrene) arising as a result of emissions from the Proposed Facility are presented in *Table 4.10*.

TABLE 4.10 MAXIMUM PREDICTED BENZO(A)PYRENE CONCENTRATIONS FOR THE PROPOSED FACILITY (ng m^{-3})

Receptor/Parameter	Annual Mean	
	PC (ng m^{-3})	%age AQO
Maximum	0.0012	0.1%
R1. London Road	0.0001	0.0%
R2. Goat Road	0.0001	0.0%
R3. Mitcham Common	0.0001	0.0%
R4. Beddington Lane	0.0002	0.0%
R5. North of Therapia Lane	0.0002	0.0%
R6. Wimshurst Close	0.0004	0.0%
R7. West of Beddington	0.0004	0.0%
R8. Crispin Crescent	0.0002	0.0%
R9. Beddington Park	0.0003	0.0%
R10. Primrose Close	0.0004	0.0%
R11. Beddington Lane	0.0002	0.0%
Max BL1 to BL5	0.0002	0.0%
Max MR1 to MR10	0.0012	0.1%
Maximum off-site (PC) (a)	0.0012 (0.1%)	
Assumed background	0.16	
Total concentration (PEC) (a)	0.16 (16.0%)	
AQAL	1	
Significance	*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard		

Maximum predicted ground level benzo(a)pyrene concentrations are well within the annual mean AQAL. The maximum off-site concentration is 0.1% of the AQAL and is assessed as 'not significant'.

4.3.10 Dioxins and Furans

Maximum predicted ground level concentrations of dioxins and furans arising as a result of emissions from the Proposed Facility are presented in *Table 4.11*. There are no air quality standards available for dioxins and furans with which to compare predicted concentrations. The health impacts associated with the emissions from the Proposed will be considered in the human health risk assessment which will accompany the variation to the environmental permit application for the installation.

TABLE 4.11 MAXIMUM PREDICTED DIOXIN AND FURAN CONCENTRATIONS FOR THE PROPOSED FACILITY (fg I-TEQ m^{-3})

Receptor/Parameter	Annual Mean
	PC (fg I-TEQ m^{-3})
Maximum	0.61
R1. London Road	0.07
R2. Goat Road	0.05
R3. Mitcham Common	0.07
R4. Beddington Lane	0.08
R5. North of Therapia Lane	0.10
R6. Wimshurst Close	0.19
R7. West of Beddington	0.19
R8. Crispin Crescent	0.11
R9. Beddington Park	0.16
R10. Primrose Close	0.21
R11. Beddington Lane	0.08
Max BL1 to BL5	0.12
Max MR1 to MR10	0.58
Maximum off-site (PC) (a)	0.61
Assumed background	7.9
Total concentration (PEC) (a)	8.5
Air Quality Standard	-
Significance	-

Without an air quality standard, it is not possible to determine the significance of the emissions with respect to dioxins and furans. However, maximum predicted annual mean concentrations are 7.7% of the assumed background concentration of 7.9 fg m^{-3}.

4.3.11 Ammonia

Predicted annual mean and maximum hourly mean concentrations of NH_3 arising as a result of emissions from the Proposed Facility are presented in *Table 4.12*.

TABLE 4.12 MAXIMUM PREDICTED CONCENTRATIONS OF AMMONIA FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean		Maximum 1-Hour Mean	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum	0.073	<0.1%	1.4	0.1%
R1. London Road	0.009	<0.1%	0.8	0.0%
R2. Goat Road	0.006	<0.1%	0.8	0.0%
R3. Mitcham Common	0.008	<0.1%	0.9	0.0%
R4. Beddington Lane	0.009	<0.1%	1.2	0.0%
R5. North of Therapia Lane	0.012	<0.1%	1.2	0.0%
R6. Wimshurst Close	0.022	<0.1%	0.8	0.0%
R7. West of Beddington	0.022	<0.1%	0.7	0.0%
R8. Crispin Crescent	0.013	<0.1%	0.6	0.0%
R9. Beddington Park	0.019	<0.1%	0.7	0.0%
R10. Primrose Close	0.026	<0.1%	1.0	0.0%
R11. Beddington Lane	0.009	<0.1%	1.2	0.0%
Max BL1 to BL5	0.015	<0.1%	1.3	0.1%
Max MR1 to MR10	0.070	<0.1%	0.8	0.0%
Maximum off-site (PC) (a)	0.073 (<0.1%)		1.4 (0.1%)	
Assumed background	3.1		6.2	
Total concentration (PEC) (a)	3.2 (1.8%)		7.6 (0.3%)	
AQAL	180		2,500	
Significance	*Not significant*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard				

Maximum predicted ground level NH_3 concentrations are well within the annual mean and hourly mean AQAL. The maximum off-site annual mean concentration is less than 0.1% of the AQAL and is assessed as 'not significant'. The maximum hourly mean NH_3 concentration is 0.1% of the AQAL and would also be assessed as 'not significant'.

4.3.12 Polychlorinated Biphenyls

Predicted annual mean and maximum hourly mean concentrations of total PCBs arising as a result of emissions from the Proposed Facility are presented in *Table 4.13*.

TABLE 4.13 MAXIMUM PREDICTED CONCENTRATIONS OF PCBS FOR THE PROPOSED FACILITY (ng m^{-3})

Receptor/Parameter	Annual Mean		Maximum 1-Hour Mean	
	PC (ng m^{-3})	%age AQO	PC (ng m^{-3})	%age AQO
Maximum	0.030	<0.1%	0.59	<0.1%
R1. London Road	0.004	<0.1%	0.34	<0.1%
R2. Goat Road	0.003	<0.1%	0.34	<0.1%
R3. Mitcham Common	0.003	<0.1%	0.39	<0.1%
R4. Beddington Lane	0.004	<0.1%	0.51	<0.1%
R5. North of Therapia Lane	0.005	<0.1%	0.50	<0.1%
R6. Wimshurst Close	0.009	<0.1%	0.32	<0.1%
R7. West of Beddington	0.009	<0.1%	0.30	<0.1%
R8. Crispin Crescent	0.005	<0.1%	0.26	<0.1%
R9. Beddington Park	0.008	<0.1%	0.30	<0.1%
R10. Primrose Close	0.011	<0.1%	0.43	<0.1%
R11. Beddington Lane	0.004	<0.1%	0.51	<0.1%
Max BL1 to BL5	0.006	<0.1%	0.53	<0.1%
Max MR1 to MR10	0.029	<0.1%	0.35	<0.1%
Maximum off-site (PC) (a)	0.030 (<0.1%)		0.59 (<0.1%)	
Assumed background	0.12		0.24	
Total concentration (PEC) (a)	0.15 (<0.1%)		0.83 (<0.1%)	
AQAL	200		6000	
Significance	*Not significant*		*Not significant*	
(a) Values in parentheses are the percentages of the air quality standard				

Maximum predicted ground level PCB concentrations are well within the annual mean and hourly mean AQALs. The maximum off-site annual mean concentration is <0.1% of the AQAL and is assessed as 'not significant'. The maximum hourly mean PCB concentration is also <0.1% of the AQAL and would also be assessed as 'not significant'.

4.3.13 Cadmium, Thallium and Mercury

Maximum predicted annual mean ground level concentrations of cadmium, thallium and mercury arising as a result of emissions from the Proposed Facility are presented in *Table 4.14*. This represents the screening of metals where it is assumed that each metal is emitted at the maximum concentration for the entire group.

The impact for thallium and mercury is described as 'not significant' and these can be screened out from further assessment. For cadmium, the contribution of the installation is 6.1% of the AQAL. However, when combined with

background concentrations the PEC is only 9.5% of the AQAL and can also be screened out from further assessment.

Mercury also has a short term AQAL (expressed as a maximum hourly mean). Maximum predicted hourly mean concentrations for Hg are presented in *Table 4.15* and the significance is assessed using Environment Agency short-term significance criteria.

TABLE 4.14 MAXIMUM PREDICTED ANNUAL MEAN CONCENTRATIONS OF Cd, Tl and Hg FOR THE PROPOSED FACILITY EMISSIONS FOR MAXIMUM EMISSION LIMITS (ng m^{-3})

Parameter	Cadmium	Thallium	Mercury
Maximum off-site (PC) (a)	0.30 (6.1%)	0.30 (<0.1%)	0.30 (0.1%)
Assumed background	0.17	- (b)	- (b)
Total concentration (PEC) (a)	0.47 (9.5%)	- (b)	- (b)
AQAL	5	1,000	250
Significance	*AQO likely to be met*	*Not significant*	*Not significant*
(a) Values in parentheses are the percentages of the air quality standard (b) No background information available for thallium			

TABLE 4.15 MAXIMUM PREDICTED HOURLY MEAN CONCENTRATIONS OF Hg FOR THE PROPOSED FACILITY EMISSIONS FOR MAXIMUM EMISSION LIMITS (ng m^{-3})

Parameter	Mercury
Maximum off-site (PC) (a)	5.9 (0.1%)
Assumed background	- (b)
Total concentration (PEC) (a)	- (b)
AQAL	7,500
Significance	*Not significant*
(a) Values in parentheses are the percentages of the air quality standard (b) No background information available for thallium	

Predicted maximum hourly concentrations of Hg are well below 10% of the AQAL. Therefore, the impact of emissions on short term ground level concentrations is assessed as 'not significant'.

4.3.14 Other Trace Metals

Screening of Metals – Annual Mean

Assuming each metal is emitted at the emission limit for the group (0.5 mg Nm^{-3}), maximum predicted ground level concentrations are as follows:

- 3.0 ng m^{-3} as the maximum annual mean;
- 58.8 ng m^{-3} as the maximum hourly mean; and

- 26.2 ng m^{-3} as the maximum 24-hour mean.

For the annual mean predictions, an assessment of the impact of each metal is presented in *Table 4.16*.

TABLE 4.16 PREDICTED IMPACT ON ANNUAL MEAN CONCENTRATIONS ARISING FROM EMISSIONS FROM THE PROPOSED FACILITY AT MAXIMUM EMISSION LIMITS

Trace Metal	PC (%age AQS)	PEC (ng m^{-3}) (a)	AQAL (ng m^{-3})	Significance
Antimony	0.1%	3.0 (0.1%)	5,000	Not significant
Arsenic	50.7%	4.0 (67.2%)	6	Not significant
Chromium III	0.1%	12.2 (0.2%)	5,000	Not significant
Chromium VI	304%	2.4 (1224%)	0.2	**Further assessment**
Cobalt	0.3%	3.3 (0.3%)	1,000	Not significant
Copper	<0.1%	62.4 (0.6%)	10,000	Not significant
Manganese	2.0%	20.0 (13.4%)	150	No further assessment
Nickel	15.2%	4.8 (24.2%)	20	No further assessment
Lead	1.2%	10.2 (4.1%)	250	No further assessment
Vanadium	0.1%	4.1 (0.1%)	5,000	Not significant

(a) Values in parentheses are the percentages of the air quality standard

(b) Assumes that background and predicted concentrations of CrVI are 20% of total Cr

For antimony, arsenic, chromium III, cobalt, copper, manganese, lead, nickel and vanadium it is concluded that these can be screened out from further assessment as it is very unlikely that the AQALs would be exceeded even for the very worst-case assumptions adopted for this screening exercise. Therefore, it is concluded that the impact of emissions of these metals from the Proposed Facility would be 'not significant'.

For chromium VI, the PC is 304% and the PEC is 1224% of the AQAL. Therefore, chromium VI cannot be screened out and should be assessed further.

Screening of Metals – Short-term Concentrations

Some of the trace metals considered have short-term AQAL (expressed as hourly or 24-hourly concentrations). For these, an assessment of the impact of each metal is presented in *Table 4.17* with the significance assessed using the Environment Agency's criteria for short term concentrations.

TABLE 4.17 PREDICTED IMPACT ON SHORT-TERM CONCENTRATIONS ARISING FROM EMISSIONS FROM THE PROPOSED FACILITY AT MAXIMUM EMISSION LIMITS

Trace Metal	PC (%age AQS)	AQAL (ng m^{-3}) (a)	Significance
Antimony	<0.1%	150,000	Not significant
Arsenic	0.4%	15,000	Not significant
Chromium III	<0.1%	150,000	Not significant
Copper	<0.1%	200,000	Not significant
Manganese	<0.1%	1,500,000	Not significant
Vanadium	2.6%	1,000	Not significant
(a) Hourly mean concentration except for vanadium which is the 24-hour mean			

Predicted short-term concentrations are 10% or less of the relevant AQALs and would be assessed as 'not significant' in accordance with the Environment Agency guidance. Therefore, it can be concluded that all metals can be screened out from further assessment with respect to short-term predicted concentrations.

Further Analysis of Annual Mean Chromium VI

Using the maximum typical emission concentrations (as identified in *Table 3.5* in *Section 3.4.2*) for chromium VI, the predicted impact of emissions from the Proposed Facility are summarised in *Table 4.18*.

TABLE 4.18 MAXIMUM PREDICTED ANNUAL MEAN CONCENTRATIONS OF CrVI CONCENTRATIONS FOR THE PROPOSED FACILITY FOR TYPICAL EMISSIONS (ng m^{-3})

Parameter	Chromium VI
Maximum off-site (PC) (a)	0.00090 (0.5%)
Assumed background	1.84
Total concentration (PEC) (a)	1.84 (920%)
AQAL	0.2
Significance	*Not significant*
(a) Values in parentheses are the percentages of the air quality standard	

For chromium VI, predicted concentrations (PC) are 0.5% of the AQAL but the assumed background concentration of 1.84 ng m^{-3} is 920% of the AQAL. However, this is derived assuming the background chromium VI concentration is 20% of the total chromium background concentration and is assumed to be very worst-case. Therefore, on the basis that the installation contributes 0.5% to the AQAL, the emission is assessed as 'not significant'. Furthermore, the assumptions adopted are also worst-case with respect to the worst-case meteorological year and maximum predicted concentration within the domain network.

Therefore, it can be concluded that trace metal emissions from the installation would not have a significant impact on local air quality or human health.

4.4 EMISSIONS AT THE HALF-HOURLY EMISSION LIMIT VALUES

The dispersion modelling results presented in *Sections 4.2* and *4.3* and have been predicted assuming that the Permitted Facility and/or Proposed Facility are operating for all hours in the year with the pollutant concentrations exactly at the daily emission limit value prescribed within the permit. This is an extreme assumption, especially for the annual average concentrations, since the BERF could never operate with release rates as high as this in practice and remain compliant with legislation.

Short term peak concentrations may arise if the BERF emits pollutants at levels approaching the half hourly IED limit values. These pollutants are particulate matter, nitrogen dioxide, sulphur dioxide, hydrogen chloride, hydrogen fluoride and carbon monoxide and have the following half-hourly emission limit values:

- total dust – 30 mg Nm^{-3} (10 mg Nm^{-3} 97% compliance);
- total organic carbon – 20 mg Nm^{-3} (10 mg Nm^{-3} 97% compliance);
- hydrogen chloride – 60 mg Nm^{-3} (10 mg Nm^{-3} 97% compliance);
- hydrogen fluoride – 4 mg Nm^{-3} (2 mg Nm^{-3} 97% compliance),
- sulphur dioxide – 200 mg Nm^{-3} (50 mg Nm^{-3} 97% compliance);
- oxides of nitrogen – 400 mg Nm^{-3} (200 mg Nm^{-3} 97% compliance); and
- carbon monoxide – 100 mg m^{-3}.

Such excursions above daily limit values are permitted for only 3% of a year. The probability of such occasions occurring at the same time as the meteorological conditions that produce the highest one hour mean ground level concentrations is unlikely. It is also assumed that both lines emit simultaneously at the half-hourly limits which is also highly unlikely to occur. On the basis of these worst-case assumptions, maximum predicted short-term concentrations for emissions at the half hourly limit values are provided in *Table 4.19* for the Proposed Facility. It should be noted that these results represent an extreme worst-case as for some of the pollutants (NO_2, SO_2 and PM_{10}) there are a number of allowable exceedances of the AQO limit value.

TABLE 4.19 MAXIMUM PREDICTED SHORT-TERM CONCENTRATIONS AT THE HALF-HOURLY EMISSION LIMIT VALUES FOR THE PROPOSED FACILITY

Pollutant	Predicted Concentration (PC) (µg m^{-3})	Percentage of the AQO/AQAL
NO_2 (maximum 1-hour)	16.5	8.2%
SO_2 (maximum 15-minute)	31.5	11.8%
SO_2 (maximum 1-hour)	23.5	6.7%
SO_2 (maximum 24-hour)	10.5	8.4%
PM_{10} (maximum 24-hour)	1.6	3.1%
HCl (maximum 1-hour)	7.1	0.9%
HF (maximum 1-hour)	0.47	0.3%
CO (maximum 8-hour)	7.1	0.1%
CO (maximum 1-hour)	11.8	0.0%

Predicted concentrations are between 0.1% and 11.8% of the short term AQAL. Highest concentrations relative to the AQAL are predicted for SO_2 (as the maximum 15-minute mean). On the basis of these worst-case results, it is very unlikely that the AQAL would be exceeded. Therefore, it is concluded that emissions at the half hourly limits would not have a significant impact on air quality even assuming worst case dispersion conditions occurring during periods of elevated emissions.

4.5 SENSITIVITY ANALYSIS

4.5.1 Introduction

For the detailed assessment provided in *Section 4.3*, a conservative approach has been undertaken in order to avoid underestimating the impact of the Proposed Facility on local air quality. This has included emissions at the maximum permissible ELV, the worst-case meteorological year for each averaging period and continuous operation of the Proposed Facility at full load. The effect of varying some of these parameters is considered. This sensitivity analysis has been carried out for emissions of NO_x as this is considered to be the key pollutant emitted from the BERF. Predicted concentrations of NO_2 are provided as the maximum predicted and the maximum discrete receptor concentration for the annual mean and the 99.8th percentile of hourly means.

4.5.2 Meteorological Data

Dispersion modelling for five years of meteorological data for London Gatwick Airport was undertaken. Results presented in *Section 4.3* are the highest predicted for each averaging period. A comparison of predicted concentrations of NO_2 for each of the five years is presented in *Table 4.20* as the maximum predicted and the maximum receptor concentration.

For the annual mean, predicted concentrations for the five years are quite variable with the lowest concentration (2018) being only 60% of the highest concentration (2015). The average for the five years is 0.55 µg m^{-3} (1.4% of the AQO) and is 78% of the predicted concentration for 2015.

TABLE 4.20 PREDICTED NO_2 CONCENTRATIONS FOR ANNUAL METEOROLOGICAL DATA SETS FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean		99.8th Percentile of 1-hour Means	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum Predicted Concentration				
2015 LGW	**0.70**	1.8%	4.3	2.1%
2016 LGW	0.52	1.3%	4.3	2.2%
2017 LGW	0.54	1.4%	4.4	2.2%
2018 LGW	0.42	1.1%	4.3	2.2%
2019 LGW	0.54	1.4%	**4.5**	2.2%
Maximum Receptor Concentration				
2015 LGW	**0.67**	1.7%	3.7	1.8%
2016 LGW	0.52	1.3%	3.6	1.8%
2017 LGW	0.53	1.3%	4.0	2.0%
2018 LGW	0.42	1.0%	**4.1**	2.1%
2019 LGW	0.51	1.3%	4.1	2.0%

London Heathrow Airport would be an alternative meteorological data set for the purposes of the dispersion modelling assessment. A comparison of predicted concentrations for 2015 for Gatwick and Heathrow is provided in *Table 4.21*.

TABLE 4.21 PREDICTED NO_2 CONCENTRATIONS FOR GATWICK AND HEATHROW AIRPORT FOR THE PROPOSED FACILITY (µg m^{-3})

Receptor/Parameter	Annual Mean		99.8th Percentile of 1-hour Means	
	PC (µg m^{-3})	%age AQO	PC (µg m^{-3})	%age AQO
Maximum predicted 2015 London Gatwick	0.70	1.8%	4.3	2.1%
Maximum predicted 2015 London Heathrow	0.64	1.6%	4.0	2.0%
Maximum receptor 2015 London Gatwick	0.67	1.7%	3.7	1.8%
Maximum receptor 2015 London Heathrow	0.59	1.5%	3.6	1.8%

For both annual mean and hourly mean concentrations, predicted maximum concentrations for London Gatwick Airport are higher than for London

Heathrow Airport. However, these differences are relatively small at 0.3% of the respective AQO at most.

4.5.3 Surface Roughness

Within ADMS surface roughness is defined for the site and for the selected meteorological station. For the detailed modelling, the site surface roughness was defined as 0.7 m and for the meteorological station 0.3 m. The effect of varying these on the model results has been determined with values of 0.5 m and 1.0 m tested for the site and 0.2 m and 0.5 m tested for the meteorological station. A summary of these results is compared to the original results for the Proposed Facility in *Table 4.22*.

TABLE 4.22 PREDICTED NO_2 CONCENTRATIONS FOR VARYING SURFACE ROUGHNESS VALUES FOR THE PROPOSED FACILITY (μg m^{-3})

Receptor/Parameter	Annual Mean		99.8th Percentile of 1-hour Means	
	PC (μg m^{-3})	%age AQO	PC (μg m^{-3})	%age AQO
Maximum Predicted Concentration				
2015 LGW, Site 0.7 m, Met 0.3 m	0.70	1.8%	4.3	2.1%
2015 LGW, Site 0.5 m, Met 0.3 m	0.64	1.6%	4.1	2.1%
2015 LGW, Site 1.0 m, Met 0.3 m	0.75	1.9%	4.4	2.2%
2015 LGW, Site 0.7 m, Met 0.2 m	0.66	1.6%	4.4	2.2%
2015 LGW, Site 0.7 m, Met 0.5 m	0.74	1.9%	4.0	2.0%
2015 LGW, Site 1.0 m, Met 0.5 m	0.83	2.1%	4.2	2.1%
Maximum Receptor Concentration				
2015 LGW, Site 0.7 m, Met 0.3 m	0.67	1.7%	3.7	1.8%
2015 LGW, Site 0.5 m, Met 0.3 m	0.61	1.5%	3.7	1.8%
2015 LGW, Site 1.0 m, Met 0.3 m	0.71	1.8%	3.7	1.9%
2015 LGW, Site 0.7 m, Met 0.2 m	0.62	1.5%	3.8	1.9%
2015 LGW, Site 0.5 m, Met 0.5 m	0.72	1.8%	3.6	1.8%
2015 LGW, Site 1.0 m, Met 0.5 m	0.78	2.0%	3.7	1.8%

Increasing the surface roughness length for the site and for the meteorological station has the effect of increasing the predicted annual mean concentrations. However, compared to the original settings these changes are relatively small, at most 0.3% of the annual mean AQO. Increasing the roughness length for both the site and the meteorological station (site 1.0 m and meteorological station 0.5 m) has the biggest impact. For the hourly mean, the changes are small at 0.1% of the short-term AQO.

4.5.4 Summary

The sensitivity analysis has demonstrated that varying the assumptions made for the assessment does not significantly vary the predicted concentrations for most choices. The most variable parameter was the selection of meteorological year where predicted concentrations for the worst-case year are 0.70 μg m^{-3} compared to an average for the five years of 0.55 μg m^{-3}. Therefore, the highest concentration is 27% higher than the average. For the detailed assessment provided, the maximum predicted concentration for each averaging period and each receptor was presented for the five years of meteorological data. Therefore, it is concluded that the assessment provided is robust and representative of worst-case conditions.

5 PREDICTED OPERATIONAL IMPACT ON HABITAT SITES

5.1 INTRODUCTION

The Environment Agency's Risk Assessment Guidance states that the impact of emissions to air on vegetation and ecosystems should be assessed for the following habitat sites within 10 km of the source:

- Special Areas of Conservation (SACs) and candidate SACs (cSACs) designated under the EC Habitats Directive [11];
- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive [12]; and
- Ramsar Sites designated under the Convention on Wetlands of International Importance [13].

Within 2 km of the source:

- Sites of Special Scientific Interest (SSSI) established by the 1981 Wildlife and Countryside Act;
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR);
- Local Wildlife Sites (LWS); and
- Ancient Woodland (AW).

SACs and SPAs are included in an EU-wide network of protected sites called Natura 2000 [14]. The EC Habitats Directive and Wild Birds Directive have been transposed into UK law by the Habitats Regulations [15].

5.2 SENSITIVE HABITATS

Within 2 km of the installation site there are six LNR and fourteen LWS. Cranmer Green and the Spinney are designated as both LNR and LWS providing a total of eighteen locally designated sites. These include Beddington Farmlands which is being restored into a mosaic of important habitats and wildlife and is a LWS designated as a Site of Importance for Nature

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

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

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

14 www.natura.org

15 The Conservation (Natural Habitats, &c.) Regulations 1994. The Conservation (Natural Habitats, &c.) (Amendment) Regulations 1997 (Statutory Instrument 1997 No. 3055), The Conservation (Natural Habitats, &c.) (Amendment) (England) Regulations 2000 (Statutory Instrument 2000 No. 192)

Conservation (SINC). A summary of the habitat sites included in the assessment is provided in *Table 5.1*. For Beddington Farmlands, Mitcham Common and Beddington Park, the maximum predicted impact anywhere within each habitat site is determined based on the assumed area of the habitat site. The Upper River Wandle LWS is a linear feature and has been represented in the model by fifteen receptor points. The location of the habitats within 2 km of the BERF and the assumed area of the Beddington Farmlands, Mitcham Common and Beddington Park habitat sites is provided in *Figure 5.1*.

In addition, to the locally designated habitat sites, there are two European habitat sites within 10 km of the installation (Richmond Park SAC and Wimbledon Common SAC). Richmond Park SAC has been represented in the model by nine receptor points and Wimbledon Common SAC by eleven receptor points.

FIGURE 5.1 LOCATION OF LNR AND LWS WITHIN 2 KM OF THE INSTALLATION

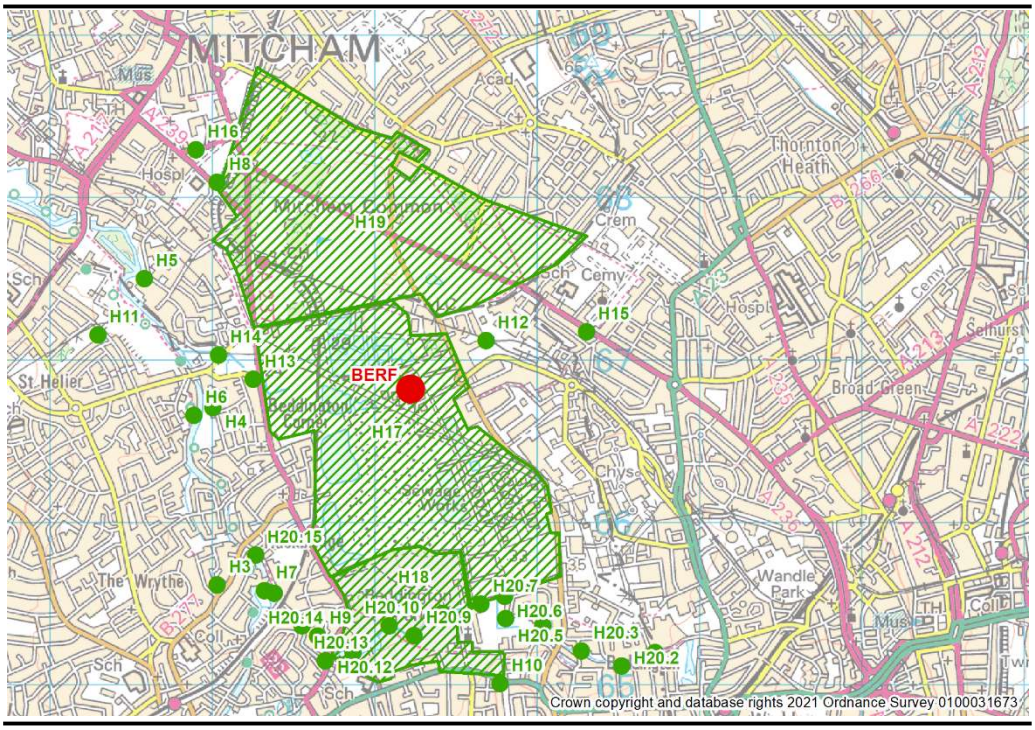


TABLE 5.1 DESCRIPTION OF HABITATS CONSIDERED FOR THE AIR QUALITY ASSESSMENT

Ref.	Name	Location	
		Direction from Site	Distance (km)
H1	Richmond Park SAC	NW	9.6
H2	Wimbledon Common SAC	NW	7.0
H3	The Spinney, Carshalton LNR/LWS	SW	1.7
H4	Spencer Road Wetlands LNR	W	1.2
H5	Bennett's Hole LNR	WNW	1.8

TABLE 5.1 DESCRIPTION OF HABITATS CONSIDERED FOR THE AIR QUALITY ASSESSMENT

Ref.	Name	Location	
		Direction from Site	Distance (km)
H6	Wandle Valley Wetland LNR	W	1.3
H7	Wilderness Island LNR	SSW	1.5
H8	Cranmer Green LNR/LWS	NW	1.7
H9	Caraway Place Pond LWS	SSW	1.6
H10	Queen Elizabeth Walk LWS	S	1.9
H11	Revesby Road Wood LWS	W	1.9
H12	Therapia Lane Rough LWS	ENE	0.6
H13	Mill Green LWS	W	1.0
H14	Land North of Goat Road LWS	W	1.2
H15	Croydon Cemetery Complex LWS	ENE	1.1
H16	Canons Pond LWS	NW	2.0
H17	Beddington Farmlands LWS	Adjacent to the site	
H18	Beddington Park LWS	S	1.0
H19	Mitcham Common LWS	N	0.5
H20	Upper River Wandle LWS	S and SW	1.4

5.3 CRITICAL LEVELS AND CRITICAL LOADS

5.3.1 Introduction

There are many impacts on ecosystems associated with elevated levels of atmospheric nitrogen and its deposition to sensitive habitats. The most important of these are [16]:

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

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

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

5.3.2 Critical Levels

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

The 2008 Air Quality Directive set limit values for the protection of vegetation and ecosystems and these have been adopted by the Air Quality Strategy, but are not currently set in Regulations. The current critical levels, limit values and objectives are summarised in *Table 5.2*.

TABLE 5.2 CRITICAL LEVELS, LIMIT VALUES AND OBJECTIVES FOR THE PROTECTION OF VEGETATION AND ECOSYSTEMS

	Description	Averaging Period	Concentration (μg m^3)
Nitrogen Oxides			
EU Directive on Ambient Air Quality / 2010 Air Quality Standards Regulations	Critical Level / Limit Value	Annual mean	30
Environment Agency Risk Assessment Guidance	Critical Level	Daily mean	75
Ammonia			
Environment Agency Risk Assessment Guidance	Critical Level for ecosystems dominated by lichens and bryophytes	Annual mean	1
	Critical Level for all other ecosystems	Annual mean	3
Sulphur Dioxide			
Environment Agency Risk Assessment Guidance	Critical Level for ecosystems dominated by lichens and bryophytes	Annual mean	10
	Critical Level for all other ecosystems	Annual mean	20
Hydrogen Fluoride			
Environment Agency Risk Assessment Guidance	Critical Level	Weekly mean	<0.5
	Critical Level	Daily mean	<5

5.3.3 Critical Loads

Introduction

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

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

Eutrophication

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

Critical loads for eutrophication at the identified sensitive habitat receptors, obtained from the Air Pollution Information System (APIS) [17] are summarised in *Annex B*. Critical loads are only available for SSSI and European sites. Therefore, for the locally designated sites assumptions have been made based on the habitats present within each.

Acidification

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

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

The critical load of acidification is defined by a critical load function which describes the relationship between the relative contributions of sulphur (S) and

17 www.apis.co.uk

nitrogen (N) to the total acidification. The critical load function is defined by the following parameters:

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

The values of these parameters (as provided by APIS) for the selected habitat receptors are presented in *Annex B*.

5.4 BACKGROUND DEPOSITION FLUXES AND AIRBORNE CONCENTRATIONS

Information on background nutrient nitrogen deposition, acidification and airborne concentrations of NO_x, NH_3 and SO_2 have been obtained from information provided by the Centre for Ecology and Hydrology (CEH) and available from the Air Pollution Information System (APIS) website. These are provided in *Annex B*.

APIS is able to provide an indication of background nutrient nitrogen deposition and acidification by geographical location and habitat type. The estimates are made from 5 km resolution mapped data, which are derived from a combination of modelling studies and measured deposition and acidification rates [18]. There is an inherent level of uncertainty resulting from this process, particularly in areas with significant emissions sources. However, in the absence of local measurements, the APIS data provides a useful benchmark for comparison with deposition and acidification rates predicted by the dispersion model. A summary of the background fluxes provided by APIS for habitat sites selected for the assessment is presented in *Annex B*.

5.5 CALCULATION OF ACID AND NUTRIENT NITROGEN DEPOSITION

The deposition of acid and nutrient nitrogen is not directly modelled but is derived from the concentration predicted at each sensitive ecological receptor for each pollutant of interest. The derivation is based upon Environment Agency guidance (AQTAG06) [19] and uses the conversion factors set out in *Table 5.3*. The factors take into account the difference in deposition velocity and mechanisms experienced in woodlands, and grasslands and other non-arboreal areas. For HCl, the acidification is assigned to sulphur.

18 Transboundary Air Pollution: Acidification, Eutrophication, and Ground Level Ozone in the UK, NEGTAP, EPG 1/3/153, 2001

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

TABLE 5.3 FACTORS FOR CONVERSION OF ANNUAL MEAN CONCENTRATIONS TO NUTRIENT NITROGEN AND ACID DEPOSITION

Pollutant	Deposition Velocity – Grasslands ($m\ s^{-1}$)	Deposition Velocity – Woodlands ($m\ s^{-1}$)	Conversion Factor ($\mu g\ m^{-2}\ s^{-1}$ to $kg\ N\ ha^{-1}\ year^{-1}$)	Conversion Factor ($\mu g\ m^{-2}\ s^{-1}$ to $keq\ ha^{-1}\ year^{-1}$)
SO_2	0.012	0.024	-	9.84
NO_x as NO_2	0.0015	0.003	96	6.84
NH_3	0.02	0.03	260	18.5
HCl	0.025	0.06	-	8.63

AQTAG06 states that the wet deposition of SO_2, NO_2 and NH_3 is 'not significant' within a short range. However, wet deposition of HCl should be considered where a process emits these species. It is considered that within a few kilometres of the source, the wet deposition rate is comparable to the dry deposition rate and with increasing distance, the wet deposition fraction becomes a smaller fraction of the total HCl deposition. As a worst-case, the wet-to-dry deposition ratio is assumed to be 1 at all the identified habitat sites. Therefore, the HCl wet deposition is equivalent to the HCl dry deposition rate (i.e. the total deposition of HCl is twice the dry deposition rate of HCl).

5.6 PREDICTED IMPACT OF EMISSIONS ON HABITAT SITES

5.6.1 Airborne Concentrations of NO_x, NH_3, SO_2 and HF

Introduction

Predicted maximum concentrations of NO_x, NH_3, SO_2 and HF are presented in *Tables 5.4* to *5.9*, respectively. Maximum concentrations are compared to the relevant critical levels. Results for each habitat are presented for the worst-case meteorological year. Results are presented as a percentage of the relevant critical levels for both the Permitted Facility and the Proposed Facility.

NO_x

There are two critical levels for NO_x based on annual mean (*Table 5.4*) and 24-hour mean (*Table 5.5*) concentrations.

For NO_x, predicted annual mean concentrations at the two SAC sites are less than 1% of the critical level of 30 $\mu g\ m^{-3}$. At all LNR/LWS predicted annual mean concentrations are all less than 100% of the critical level. The change in annual mean concentrations between the Permitted Facility and the Proposed Facility is very small and less than 0.1% of the critical level for the majority of habitat sites.

TABLE 5.4 MAXIMUM PREDICTED ANNUAL MEAN NO_x CONCENTRATIONS AT HABITAT SITES

Habitat	PC (µg m^{-3})		PC (%age of the Critical Level	
	Permitted Facility	Proposed Facility	Permitted Facility	Proposed Facility
Richmond Park SAC	0.016	0.017	0.1%	0.1%
Wimbledon Common SAC	0.021	0.023	0.1%	0.1%
The Spinney LNR/LWS	0.24	0.25	0.8%	0.8%
Spencer Road Wetlands LNR	0.15	0.16	0.5%	0.5%
Bennett's Hole LNR	0.057	0.060	0.2%	0.2%
Wandle Valley Wetland LNR	0.16	0.16	0.5%	0.5%
Wilderness Island LNR	0.26	0.28	0.9%	0.9%
Cranmer Green LNR/LWS	0.076	0.08	0.3%	0.3%
Caraway Place Pond LWS	0.20	0.21	0.7%	0.7%
Queen Elizabeth Walk LWS	0.12	0.12	0.4%	0.4%
Revesby Road Wood LWS	0.070	0.073	0.2%	0.2%
Therapia Lane Rough LWS	0.46	0.45	1.5%	1.5%
Mill Green LWS	0.12	0.12	0.4%	0.4%
Land North of Goat Road LWS	0.091	0.094	0.3%	0.3%
Croydon Cemetery Complex LWS	0.44	0.46	1.5%	1.5%
Canons Pond LWS	0.069	0.073	0.2%	0.2%
Beddington Farmlands LWS	0.35	0.36	1.2%	1.2%
Beddington Park LWS	0.26	0.27	0.9%	0.9%
Mitcham Common LWS	0.94	0.97	3.1%	3.2%
Upper River Wandle LWS	0.28	0.30	0.9%	1.0%
Critical Level (µg m^{-3})	*30*			

The 24-hour mean concentrations are also less than 10% of the short-term critical level of 75 µg m^{-3}, except at Beddington Farmlands LWS and Mitcham Common LWS. For the Proposed Facility, the process contribution is less than 1% and 10% of the long-term and short-term critical levels at the European sites and less than 100% of the critical levels at the local wildlife sites. Therefore, the impact of emissions from the Proposed Facility on these habitats would be assessed as 'not significant'.

TABLE 5.5 MAXIMUM PREDICTED 24-HOUR MEAN NO_x CONCENTRATIONS AT HABITAT SITES

Habitat	PC (µg m^{-3})		PC (%age of the Critical Level	
	Permitted Facility	Proposed Facility	Permitted Facility	Proposed Facility
Richmond Park SAC	0.50	0.55	0.7%	0.7%
Wimbledon Common SAC	0.67	0.73	0.9%	1.0%
The Spinney LNR/LWS	4.2	4.6	5.5%	6.1%
Spencer Road Wetlands LNR	3.5	3.5	4.7%	4.7%
Bennett's Hole LNR	2.2	2.4	2.9%	3.1%
Wandle Valley Wetland LNR	3.4	3.4	4.6%	4.6%
Wilderness Island LNR	4.6	4.9	6.1%	6.6%
Cranmer Green LNR/LWS	2.1	2.3	2.8%	3.0%
Caraway Place Pond LWS	3.1	3.3	4.1%	4.4%
Queen Elizabeth Walk LWS	3.0	3.3	4.0%	4.4%
Revesby Road Wood LWS	2.3	2.5	3.0%	3.3%
Therapia Lane Rough LWS	5.1	5.3	6.8%	7.1%
Mill Green LWS	4.2	4.3	5.5%	5.8%
Land North of Goat Road LWS	3.7	3.9	5.0%	5.2%
Croydon Cemetery Complex LWS	4.3	4.6	5.7%	6.2%
Canons Pond LWS	1.9	2.0	2.5%	2.7%
Beddington Farmlands LWS	7.8	8.4	10.5%	11.1%
Beddington Park LWS	6.1	6.4	8.1%	8.5%
Mitcham Common LWS	7.8	8.4	10.4%	11.2%
Upper River Wandle LWS	5.2	5.7	6.9%	7.6%
Critical Level (µg m^{-3})	*75*			

NH_3

The appropriate critical level to apply to each habitat depends on whether the habitat supports lichens/bryophytes. Based on information provided by APIS, the critical level for the Richmond Park SAC would be 3 µg m^{-3} but the more stringent critical level (1 µg m^{-3}) would apply to Wimbledon Common SAC. For

the locally designated habitat sites the more stringent critical level has been used.

TABLE 5.6 MAXIMUM PREDICTED AIRBORNE NH_3 CONCENTRATIONS AT HABITAT SITES

Habitat	PC (µg m^{-3})		PC (%age of the Critical Level	
	Permitted Facility	Proposed Facility	Permitted Facility	Proposed Facility
Richmond Park SAC	0.0011	0.0013	<0.1%	<0.1%
Wimbledon Common SAC	0.0016	0.0017	0.2%	0.2%
The Spinney LNR/LWS	0.017	0.018	1.7%	1.8%
Spencer Road Wetlands LNR	0.011	0.011	1.1%	1.1%
Bennett's Hole LNR	0.0042	0.0044	0.4%	0.4%
Wandle Valley Wetland LNR	0.011	0.012	1.1%	1.2%
Wilderness Island LNR	0.019	0.020	1.9%	2.0%
Cranmer Green LNR/LWS	0.0055	0.0058	0.6%	0.6%
Caraway Place Pond LWS	0.014	0.015	1.4%	1.5%
Queen Elizabeth Walk LWS	0.0084	0.0090	0.8%	0.9%
Revesby Road Wood LWS	0.0051	0.0053	0.5%	0.5%
Therapia Lane Rough LWS	0.033	0.033	3.3%	3.3%
Mill Green LWS	0.0084	0.0086	0.8%	0.9%
Land North of Goat Road LWS	0.0066	0.0068	0.7%	0.7%
Croydon Cemetery Complex LWS	0.032	0.033	3.2%	3.3%
Canons Pond LWS	0.0050	0.0053	0.5%	0.5%
Beddington Farmlands LWS	0.026	0.026	2.6%	2.6%
Beddington Park LWS	0.019	0.020	1.9%	2.0%
Mitcham Common LWS	0.069	0.071	6.9%	7.1%
Upper River Wandle LWS	0.020	0.022	2.0%	2.2%
Critical Level	*1 - 3*			

Highest concentrations are predicted for Mitcham Common LWS and are 6.9% of the critical level of 1 µg m^{-3} for the Permitted Facility and 7.1% for the Proposed Facility. The change in annual mean concentrations between the Permitted Facility and the Proposed Facility is very small and less than 0.2% of the critical level for the majority of habitat sites. For all European habitat sites, predicted concentrations are less than 1% of the critical level and for LWS less

than 100% of the critical level. Therefore, the impacts would be assessed as 'not significant'.

SO_2

Predicted annual mean concentrations of SO_2 are compared to the more stringent critical level of 10 µg m^{-3} in *Table 5.7*.

TABLE 5.7 MAXIMUM PREDICTED AIRBORNE SO_2 CONCENTRATIONS AT HABITAT SITES

Habitat	PC (µg m^{-3})		PC (%age of the Critical Level	
	Permitted Facility	Proposed Facility	Permitted Facility	Proposed Facility
Richmond Park SAC	0.0048	0.0052	<0.1%	0.1%
Wimbledon Common SAC	0.0065	0.0071	0.1%	0.1%
The Spinney LNR/LWS	0.072	0.076	0.7%	0.8%
Spencer Road Wetlands LNR	0.047	0.048	0.5%	0.5%
Bennett's Hole LNR	0.017	0.018	0.2%	0.2%
Wandle Valley Wetland LNR	0.048	0.049	0.5%	0.5%
Wilderness Island LNR	0.079	0.083	0.8%	0.8%
Cranmer Green LNR/LWS	0.023	0.024	0.2%	0.2%
Caraway Place Pond LWS	0.060	0.063	0.6%	0.6%
Queen Elizabeth Walk LWS	0.035	0.037	0.4%	0.4%
Revesby Road Wood LWS	0.021	0.022	0.2%	0.2%
Therapia Lane Rough LWS	0.14	0.14	1.4%	1.4%
Mill Green LWS	0.035	0.036	0.4%	0.4%
Land North of Goat Road LWS	0.028	0.028	0.3%	0.3%
Croydon Cemetery Complex LWS	0.13	0.14	1.3%	1.4%
Canons Pond LWS	0.021	0.022	0.2%	0.2%
Beddington Farmlands LWS	0.11	0.11	1.1%	1.1%
Beddington Park LWS	0.078	0.081	0.8%	0.8%
Mitcham Common LWS	0.29	0.29	2.9%	2.9%
Upper River Wandle LWS	0.085	0.090	0.9%	0.9%
Critical Level	*10 - 20*			

Highest concentrations are predicted for Mitcham Common LWS and are 2.9% of the critical level of 10 µg m^{-3} for the Proposed Facility. The change in annual mean concentrations between the Permitted Facility and the Proposed Facility

is very small and less than 0.1% of the critical level for the majority of habitat sites. For the European habitat sites, predicted concentrations are less than 1% of the critical level and for the LWS less than 100% of the critical level. Therefore, the impacts would be assessed as 'not significant'.

HF

For the weekly mean (*Table 5.8*), highest concentrations are predicted at Mitcham Common LWS and are 4.0% of the critical level of 0.5 µg m^{-3} for the Proposed Facility.

TABLE 5.8 MAXIMUM PREDICTED WEEKLY AIRBORNE HF CONCENTRATIONS AT HABITAT SITES

Habitat	PC (µg m^{-3})		PC (%age of the Critical Level	
	Permitted Facility	Proposed Facility	Permitted Facility	Proposed Facility
Richmond Park SAC	0.0010	0.0011	0.2%	0.2%
Wimbledon Common SAC	0.0013	0.0014	0.3%	0.3%
The Spinney LNR/LWS	0.011	0.012	2.3%	2.4%
Spencer Road Wetlands LNR	0.0065	0.0070	1.3%	1.4%
Bennett's Hole LNR	0.0028	0.0030	0.6%	0.6%
Wandle Valley Wetland LNR	0.0066	0.0071	1.3%	1.4%
Wilderness Island LNR	0.0098	0.0104	2.0%	2.1%
Cranmer Green LNR/LWS	0.0040	0.0043	0.8%	0.9%
Caraway Place Pond LWS	0.0068	0.0072	1.4%	1.4%
Queen Elizabeth Walk LWS	0.0073	0.0080	1.5%	1.6%
Revesby Road Wood LWS	0.0027	0.0029	0.5%	0.6%
Therapia Lane Rough LWS	0.0093	0.0094	1.9%	1.9%
Mill Green LWS	0.0050	0.0051	1.0%	1.0%
Land North of Goat Road LWS	0.0043	0.0045	0.9%	0.9%
Croydon Cemetery Complex LWS	0.0099	0.0104	2.0%	2.1%
Canons Pond LWS	0.0034	0.0037	0.7%	0.7%
Beddington Farmlands LWS	0.019	0.019	3.7%	3.9%
Beddington Park LWS	0.018	0.018	3.5%	3.7%
Mitcham Common LWS	0.019	0.020	3.8%	4.0%
Upper River Wandle LWS	0.014	0.015	2.8%	3.0%
Critical Level	*0.5*			

At the locally designated sites, predicted concentrations are well below the Environment Agency's criterion of 100%. At the European habitat sites, predicted weekly mean concentrations are well below 1% of the critical level. Therefore, it is concluded that weekly mean PC's at these habitats would be 'not significant' for either the Permitted Facility or the Proposed Facility.

TABLE 5.9 MAXIMUM PREDICTED 24-HOUR AIRBORNE HF CONCENTRATIONS AT HABITAT SITES

Habitat	PC (μg m^{-3})		PC (%age of the Critical Level	
	Permitted Facility	Proposed Facility	Permitted Facility	Proposed Facility
Richmond Park SAC	0.0030	0.0033	0.1%	0.1%
Wimbledon Common SAC	0.0041	0.0044	0.1%	0.1%
The Spinney LNR/LWS	0.025	0.028	0.5%	0.6%
Spencer Road Wetlands LNR	0.021	0.021	0.4%	0.4%
Bennett's Hole LNR	0.013	0.014	0.3%	0.3%
Wandle Valley Wetland LNR	0.021	0.021	0.4%	0.4%
Wilderness Island LNR	0.028	0.030	0.6%	0.6%
Cranmer Green LNR/LWS	0.013	0.014	0.3%	0.3%
Caraway Place Pond LWS	0.019	0.020	0.4%	0.4%
Queen Elizabeth Walk LWS	0.018	0.020	0.4%	0.4%
Revesby Road Wood LWS	0.014	0.015	0.3%	0.3%
Therapia Lane Rough LWS	0.031	0.032	0.6%	0.6%
Mill Green LWS	0.025	0.026	0.5%	0.5%
Land North of Goat Road LWS	0.023	0.024	0.5%	0.5%
Croydon Cemetery Complex LWS	0.026	0.028	0.5%	0.6%
Canons Pond LWS	0.011	0.012	0.2%	0.2%
Beddington Farmlands LWS	0.048	0.051	1.0%	1.0%
Beddington Park LWS	0.037	0.039	0.7%	0.8%
Mitcham Common LWS	0.047	0.051	0.9%	1.0%
Upper River Wandle LWS	0.031	0.034	0.6%	0.7%
Critical Level	*5*			

Predicted 24-hour mean HF concentrations (*Table 5.9*) at all habitat sites are assessed as 'not significant' as the PC's are all less than 10% of the critical level of 5 μg m^{-3}.

The change in concentration between the Permitted Facility and Proposed Facility is very small at 0.1% of the critical levels at most.

5.6.2 Acidification

Deposition of sulphur and nitrogen compounds cause acidification, and both have been taken into account in assessing the acidification impacts of the installation on the habitat sites. The critical load for acidification is defined by three quantities CLmaxS, CLmaxN and CLminN. The critical load function tool provided by APIS has been used to assess the likelihood of exceedance of the critical load based on the nitrogen and sulphur PCs and PECs. For HCl, the acidification is assigned as sulphur. A summary of the predicted PCs is provided in *Table 5.10* and the predicted deposition as a proportion of the critical load function is provided in *Table 5.11*.

TABLE 5.10 MAXIMUM PREDICTED SULPHUR AND NITROGEN PCS FOR ACIDIFICATION IMPACTS

Habitat	Permitted Facility		Proposed Facility	
	PC S (keq $ha^{-1}a^{-1}$)	PC N (keq $ha^{-1}a^{-1}$)	PC S (keq $ha^{-1}a^{-1}$)	PC N (keq $ha^{-1}a^{-1}$)
Richmond Park SAC	0.0021	0.00096	0.0023	0.0010
Wimbledon Common SAC	0.0013	0.00079	0.0014	0.00087
The Spinney LNR/LWS	0.032	0.014	0.034	0.015
Spencer Road Wetlands LNR	0.0096	0.0057	0.0098	0.0059
Bennett's Hole LNR	0.0077	0.0035	0.0081	0.0037
Wandle Valley Wetland LNR	0.021	0.0096	0.022	0.0098
Wilderness Island LNR	0.035	0.016	0.037	0.017
Cranmer Green LNR/LWS	0.010	0.0046	0.011	0.0049
Caraway Place Pond LWS	0.027	0.012	0.028	0.013
Queen Elizabeth Walk LWS	0.016	0.0070	0.017	0.0075
Revesby Road Wood LWS	0.0095	0.0043	0.0097	0.0044
Therapia Lane Rough LWS	0.061	0.028	0.061	0.028
Mill Green LWS	0.016	0.0071	0.016	0.0072
Land North of Goat Road LWS	0.012	0.0055	0.013	0.0057
Croydon Cemetery Complex LWS	0.059	0.027	0.062	0.028
Canons Pond LWS	0.0092	0.0042	0.0098	0.0045
Beddington Farmlands LWS	0.022	0.013	0.022	0.013
Beddington Park LWS	0.035	0.016	0.036	0.016
Mitcham Common LWS	0.13	0.057	0.13	0.059
Upper River Wandle LWS	0.038	0.017	0.040	0.018

TABLE 5.11 PREDICTED ACID DEPOSITION AS A PROPORTION OF THE CRITICAL LOAD FUNCTION

Habitat	Permitted Facility		Proposed Facility	
	PC	PEC	PC	PEC
Richmond Park SAC	0.3%	218%	0.3%	218%
Wimbledon Common SAC	0.2%	161%	0.3%	161%
The Spinney LNR/LWS	2.1%	103%	2.3%	103%
Spencer Road Wetlands LNR	Not sensitive			
Bennett's Hole LNR	0.5%	101%	0.5%	101%
Wandle Valley Wetland LNR	1.4%	102%	1.5%	102%
Wilderness Island LNR	2.4%	103%	2.5%	103%
Cranmer Green LNR/LWS	0.7%	101%	0.7%	101%
Caraway Place Pond LWS	1.8%	102%	1.9%	102%
Queen Elizabeth Walk LWS	1.1%	101%	1.1%	102%
Revesby Road Wood LWS	0.6%	101%	0.7%	101%
Therapia Lane Rough LWS	4.2%	105%	4.1%	105%
Mill Green LWS	1.1%	101%	1.1%	101%
Land North of Goat Road LWS	0.8%	101%	0.9%	101%
Croydon Cemetery Complex LWS	4.0%	104%	4.2%	105%
Canons Pond LWS	0.6%	101%	0.7%	101%
Beddington Farmlands LWS	2.6%	93%	2.7%	93%
Beddington Park LWS	2.3%	103%	2.4%	103%
Mitcham Common LWS	8.6%	109%	8.8%	109%
Upper River Wandle LWS	2.6%	103%	2.7%	103%

Spencer Road Wetlands LNR is assumed to be represented by fens, marsh and swamp which are not sensitive to acidification impacts. Highest impacts are predicted at the Mitcham Common LWS and are 8.8% of the critical load for the Proposed Facility. This exceeds the 1% threshold but is well below the Environment Agency's 100% threshold for locally designated habitat sites. For the European sites, predicted acidification rates are well below 1% of the critical load for each site and the impact would be assessed as 'not significant' for the Permitted Facility and the Proposed Facility.

The change in the acidification rate between the Permitted Facility and the Proposed Facility is very small at 0.2% of the critical loads at most.

5.6.3 Nutrient Nitrogen Deposition

Predicted nutrient nitrogen deposition for the habitat sites is presented in *Table 5.12* and the predicted deposition as a proportion of the critical load is provided in *Table 5.13.*

TABLE 5.12 MAXIMUM PREDICTED NUTRIENT NITROGEN DEPOSITION AT HABITAT SITES

Habitat	Permitted Facility (kg N $ha^{-1}a^{-1}$)		Proposed Facility (kg N $ha^{-1}a^{-1}$)	
	PC	PEC	PC	PEC
Richmond Park SAC	0.013	28.41	0.015	28.41
Wimbledon Common SAC	0.011	16.91	0.012	16.91
The Spinney LNR/LWS	0.20	28.62	0.21	28.63
Spencer Road Wetlands LNR	0.081	15.62	0.082	15.62
Bennett's Hole LNR	0.049	28.47	0.052	28.47
Wandle Valley Wetland LNR	0.14	28.56	0.14	28.56
Wilderness Island LNR	0.22	28.64	0.24	28.66
Cranmer Green LNR/LWS	0.065	28.48	0.069	28.49
Caraway Place Pond LWS	0.17	28.59	0.18	28.60
Queen Elizabeth Walk LWS	0.099	28.52	0.105	28.53
Revesby Road Wood LWS	0.060	28.48	0.062	28.48
Therapia Lane Rough LWS	0.39	28.81	0.39	28.81
Mill Green LWS	0.099	28.52	0.101	28.52
Land North of Goat Road LWS	0.078	28.50	0.080	28.50
Croydon Cemetery Complex LWS	0.38	28.80	0.39	28.81
Canons Pond LWS	0.059	28.48	0.063	28.48
Beddington Farmlands LWS	0.18	15.72	0.19	15.73
Beddington Park LWS	0.22	28.64	0.23	28.65
Mitcham Common LWS	0.81	29.23	0.83	29.25
Upper River Wandle LWS	0.24	28.66	0.25	28.67

Highest nutrient nitrogen deposition relative to the habitat specific critical loads occurs for Mitcham Common LWS and is 8.3% of the critical load of 10 kg N $ha^{-1}a^{-1}$ for the Proposed Development. This exceeds the 1% criterion but is well below the 100% Environment Agency criterion for locally designated habitat sites. At the European habitat sites, predicted nutrient nitrogen deposition rates are well below 1% of the respective critical loads and would be assessed as 'not significant'. For all habitats, the background nutrient nitrogen deposition rates substantially exceed the lower critical loads.

TABLE 5.13 PREDICTED NUTRIENT NITROGEN DEPOSITION AS A PROPORTION OF THE LOWEST CRITICAL LOAD

Habitat	Permitted Facility		Proposed Facility	
	PC	PEC	PC	PEC
Richmond Park SAC	0.1%	284%	0.1%	284%
Wimbledon Common SAC	0.1%	169%	0.1%	169%
The Spinney LNR/LWS	2.0%	286%	2.1%	286%
Spencer Road Wetlands LNR	0.8%	156%	0.8%	156%
Bennett's Hole LNR	0.5%	285%	0.5%	285%
Wandle Valley Wetland LNR	1.4%	286%	1.4%	286%
Wilderness Island LNR	2.2%	286%	2.4%	287%
Cranmer Green LNR/LWS	0.6%	285%	0.7%	285%
Caraway Place Pond LWS	1.7%	286%	1.8%	286%
Queen Elizabeth Walk LWS	1.0%	285%	1.1%	285%
Revesby Road Wood LWS	0.6%	285%	0.6%	285%
Therapia Lane Rough LWS	3.9%	288%	3.9%	288%
Mill Green LWS	1.0%	285%	1.0%	285%
Land North of Goat Road LWS	0.8%	285%	0.8%	285%
Croydon Cemetery Complex LWS	3.8%	288%	3.9%	288%
Canons Pond LWS	0.6%	285%	0.6%	285%
Beddington Farmlands LWS	1.8%	157%	1.9%	157%
Beddington Park LWS	2.2%	286%	2.3%	286%
Mitcham Common LWS	8.1%	292%	8.3%	293%
Upper River Wandle LWS	2.4%	287%	2.5%	287%

The change in the nutrient nitrogen deposition rate between the Permitted Facility and the Proposed Facility is very small at 0.2% of the critical loads at most.

6 SUMMARY AND CONCLUSIONS

6.1 SUMMARY

The air quality assessment has considered the emissions to air from the Energy Recovery Facility and the impact of emissions on human health and habitat sites. The assessment supports a variation to the Environmental Permit for the installation for a proposed increase in the maximum continuous rating (MCR) of 10%.

Dispersion modelling of emissions from the Permitted Facility (MCR of 100%) and the Proposed Facility (MCR of 110%) has been undertaken using the UK ADMS (Version 5.2) model and five years of meteorological data from London Gatwick Airport. As a worst-case, emissions from the BERF have been assumed to be at the maximum permissible limits prescribed in the Environmental Permit for the installation.

Ground level concentrations for substances emitted from the BERF are compared to air quality objectives, environmental assessment levels and existing air quality. The following substances have been included in the assessment:

- fine particles (PM_{10} and $PM_{2.5}$);
- the oxides of nitrogen (NO_x);
- sulphur dioxide (SO_2);
- carbon monoxide (CO);
- hydrogen fluoride (HF);
- hydrogen chloride (HCl);
- total organic carbon (TOC) as benzene;
- poly aromatic hydrocarbons (PAHs) as benzo(a)pyrene;
- dioxins and furans (PCDD/Fs);
- polychlorinated biphenyls (PCBs);
- ammonia (NH_3);
- trace metals: cadmium (Cd), Thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

For sensitive habitat sites, which includes two European sites within 10 km of the installation site, the impact of airborne NO_x, NH_3, SO_2 and HF have been assessed as well as acidification and nutrient nitrogen deposition. Predicted concentrations and deposition rates have been compared to background

information and relevant critical levels and critical loads for the sensitive habitats identified.

A comparison between the predicted concentrations for the Permitted Facility and the Proposed Facility has been provided. Emissions from the Proposed Facility will be 12.6% higher compared to the Permitted Facility. However, due to the increase in the emission velocity and improved dispersion, predicted annual mean concentrations only increase by 3.3%. Short-term concentrations increase by between 1.8% and 6.6% depending on the averaging period. As a proportion of the respective AQALs, the change between the Permitted Facility and Proposed Facility is less than 1% for long-term concentrations and less than 10% for short-term concentrations. Therefore, the changes would be assessed as not significant.

As predicted concentrations are higher for the Proposed Facility, a more detailed analysis of this has been provided. For the majority of the pollutants considered, the impact on human health was assessed as 'not significant' in accordance with the Environment Agency's Risk Assessment Guidance. For NO_2, the annual mean PC (at 1.8% of the AQO) exceeded 1% of the AQO. The PEC is 79.5% of the AQO and there is a risk that the AQO may be exceeded due to emissions from the Proposed Facility (PEC > 70% of the AQO). However, worst-case assumptions have been adopted for the assessment including continuous operation of the BERF with NO_x emissions at the limit, worst-case meteorological conditions and a conservative assessment of the background concentration. Furthermore, the change in concentration for the Proposed Facility compared to the Permitted Facility is only 0.1% of the AQO. Therefore, it is concluded that emissions of NO_x from the Proposed Facility would not result in an exceedance of the annual mean AQO for NO_2.

For European habitat sites, the impact of emissions from the Proposed Facility were assessed as 'not significant'. For locally designated sites, predicted impacts were well below the Environment Agency's 100% criterion for locally designated habitat sites. In addition, the change in concentration for the Proposed Facility compared to the Permitted Facility is 0.2% or less of the critical levels and critical loads for all habitat sites.

6.2 CONCLUSIONS

The results of the air quality assessment indicate that the impact of the change in the maximum continuous rating for the installation would be 'not significant' with respect to human health or habitat sites.

ANNEX A

OVERVIEW OF EXTRACTIVE TEST RESULTS

Beddington ERF - Extractive Monitoring

Below the limit of detection | Excluded from average | Where concentration below LoD, concentration assumed to be at the LoD

		A1 Aug-19	A1 Nov-19	A1 Apr-20	A1 May-20	A2 Aug-19	A2 Nov-19	A2 Apr-20	A2 May-20	Average
Actual flow	Am3/s	50.86	41.67	50.02	49.73	49.37	46.77	50.13	46.95	48.19
Normalised flow	Nm3/s	31.40	19.44	31.34	31.01	31.62	28.25	31.18	29.84	29.26
Temperature	oC	140	137	146	142	139	142	140	138	140.41
Moisture	%v/v	17.4	14.2	13.7	15.3	16.2	13.7	14.5	16.3	15.16
Oxygen	%v/v dry	9.2	12.6	9.2	9.1	8.8	10.2	9.5	9.1	9.71
Dioxins (TEQ WHO Humans, LOD)	ng/Nm3	0.00087	0.019	0.012	0.0079	0.00027	0.0078	0.015	0.0031	0.0082
PCBs (TEQ WHO Humans LOD)	ng/Nm3	0.00015	0.0013	0.00061	0.000602	0.000017	0.000837	0.00077	0.000221	0.00056
PAHs (Defra 16)	ug/Nm3	2.8	1.0	0.24	0.12	2.7	0.29	0.2	0.12	
BaP	ug/Nm3	0.17	0.0021	0.0005	0.00089	0.16	0.00084	0.00071	0.00082	0.00098

Dioxins/Furans	ng	%age	ng	%age	ng	%age	ng	%age	ng	%age	ng	%age	ng	%age	ng	%age	Average %age
TetraCDD, 2,3,7,8-	0.0004	7.6%	0.0028	4.6%	0.0018	1.7%	0.0017	3.8%	0.0005	30.2%	0.0012	2.7%	0.006	4.9%	0.0021	12.8%	5.1%
PentaCDD, 1,2,3,7,8-	0.00149	28.3%	0.0167	27.3%	0.0173	16.0%	0.0142	32.0%	0.0005	30.2%	0.0115	25.4%	0.028	22.9%	0.0031	18.9%	23.7%
HexaCDD, 1,2,3,4,7,8-	0.00007	1.3%	0.0023	3.8%	0.0029	2.7%	0.0013	2.9%	0.00004	2.4%	0.0019	4.2%	0.0037	3.0%	0.0003	1.8%	3.1%
HexaCDD, 1,2,3,6,7,8-	0.00043	8.2%	0.0057	9.3%	0.0058	5.4%	0.0032	7.2%	0.000054	3.3%	0.0039	8.6%	0.0106	8.7%	0.0007	4.3%	7.2%
HexaCDD, 1,2,3,7,8,9-	0.00016	3.0%	0.0037	6.0%	0.0041	3.8%	0.0015	3.4%	0.00004	2.4%	0.0024	5.3%	0.0061	5.0%	0.0004	2.4%	4.3%
HeptaCDD, 1,2,3,4,6,7,8-	0.0003	5.7%	0.003	4.9%	0.0062	5.7%	0.0013	2.9%	0.000051	3.1%	0.0025	5.5%	0.0078	6.4%	0.0006	3.7%	4.9%
OctaCDD, 1,2,3,4,6,7,8,9-	0.000011	0.2%	0.0001	0.2%	0.0004	0.4%	0	0.0%	0.0000032	0.2%	0.0001	0.2%	0.0002	0.2%	0	0.0%	0.2%
TetraCDF, 2,3,7,8-	0.00018	3.4%	0.0014	2.3%	0.0023	2.1%	0.001	2.3%	0.00004	2.4%	0.0012	2.7%	0.0045	3.7%	0.0012	7.3%	3.4%
PentaCDF, 1,2,3,7,8-	0.00008	1.5%	0.0006	1.0%	0.0009	0.8%	0.0005	1.1%	0.000012	0.7%	0.0004	0.9%	0.0014	1.1%	0.0004	2.4%	1.2%
PentaCDF, 2,3,4,7,8-	0.00083	15.7%	0.0118	19.3%	0.022	20.3%	0.0109	24.5%	0.00027	16.3%	0.0101	22.3%	0.0267	21.8%	0.0045	27.4%	22.6%
HexaCDF, 1,2,3,4,7,8-	0.00035	6.6%	0.0031	5.1%	0.0108	10.0%	0.0023	5.2%	0.00001	0.6%	0.0025	5.5%	0.0068	5.6%	0.0008	4.9%	6.0%
HexaCDF, 1,2,3,6,7,8-	0.00032	6.1%	0.0036	5.9%	0.0089	8.2%	0.0025	5.6%	0.00001	0.6%	0.0026	5.8%	0.0071	5.8%	0.001	6.1%	6.2%
HexaCDF, 2,3,4,6,7,8-	0.00049	9.3%	0.005	8.2%	0.0138	12.7%	0.0032	7.2%	0.0001	6.0%	0.0039	8.6%	0.0096	7.8%	0.0008	4.9%	8.2%
HexaCDF, 1,2,3,7,8,9-	0.00004	0.8%	0.0004	0.7%	0.0014	1.3%	0.0002	0.5%	0.00001	0.6%	0.0002	0.4%	0.0009	0.7%	0.0003	1.8%	0.9%
HeptaCDF, 1,2,3,4,6,7,8-	0.00011	2.1%	0.0009	1.5%	0.0067	6.2%	0.0005	1.1%	0.000014	0.8%	0.0007	1.5%	0.0023	1.9%	0.0002	1.2%	2.2%
HeptaCDF, 1,2,3,4,7,8,9-	9.60E-06	0.2%	0.0001	0.2%	0.0018	1.7%	0.0001	0.2%	0.000001	0.1%	0.0001	0.2%	0.0005	0.4%	0	0.0%	0.4%
OctaCDF, 1,2,3,4,6,7,8,9-	8.00E-07	0.0%	0	0.0%	0.0012	1.1%	0	0.0%	0.0000015	0.1%	0	0.0%	0.0001	0.1%	0	0.0%	0.2%
																	Averge
Total dioxins (ng)	0.0029	54.3%	0.0343	56.0%	0.0385	35.5%	0.0232	52.3%	0.0012	71.7%	0.0235	52.0%	0.0624	51.0%	0.0072	43.9%	
Total furans (ng)	0.0024	45.7%	0.0269	44.0%	0.0698	64.5%	0.0212	47.7%	0.00047	28.3%	0.02170	48.0%	0.05990	49.0%	0.00920	56.1%	
Total (ng)	0.0053	100.0%	0.0612	100.0%	0.1083	100.0%	0.0444	100.0%	0.0017	100.0%	0.0452	100.0%	0.1223	100.0%	0.0164	100.0%	

ANNEX B

SUMMARY OF HABITAT CRITICAL LEVELS, CRITICAL LOADS AND BACKGROUND INFORMATION

TABLE B1: SUMMARY OF SENSITIVE ECOLOGICAL RECEPTORS AND BASELINE INFORMATION – AIRBORNE EXPOSURE

Ref.	Designation	Name	Easting (m)	Northing (m)	NO_x (μg m^{-3})		SO_2 (μg m^{-3})		NH_3 (μg m^{-3})		HF (μg m^{-3})	
					CL (a)	Baseline	CL (a)	Baseline	CL (a)	Baseline	CL (a)	Baseline
H1	SAC	Richmond Park (b)	Nine receptors		30 (c) 75 (d)	28.8 34.0	10	1.3	3	1.8	0.5 (e) 5 (f)	3.0 3.5
H2	SAC	Wimbledon Common (b)	Eleven receptors		30 (c) 75 (d)	31.9 37.6	10	1.2	1	1.9	0.5 (e) 5 (f)	3.0 3.5
H3	LNR/LWS	The Spinney, Carshalton	528032	165615								
H4	LNR	Spencer Road Wetlands	528007	166705								
H5	LNR	Bennett's Hole	527582	167500								
H6	LNR	Wandle Valley Wetland	527887	166660								
H7	LNR	Wilderness Island	528322	165580								
H8	LNR/LWS	Cranmer Green	528032	168095								
H9	LWS	Caraway Place Pond	528650	165301								
H10	LWS	Queen Elizabeth Walk	529774	165008								
H11	LWS	Revesby Road Wood	527297	167154	30 (c) 75 (d)	28.1 33.2	10	1.6	1	1.8	0.5 (e) 5 (f)	3.0 3.5
H12	LWS	Therapia Lane Rough	529689	167120								
H13	LWS	Mill Green	528254	166882								
H14	LWS	Land North of Goat Road	528041	167030								
H15	LWS	Croydon Cemetery Complex	530307	167173								
H16	LWS	Canons Pond	527900	168294								
H17	LWS	Beddington Farmlands	Polygon receptors									
H18	LWS	Beddington Park										
H19	LWS	Mitcham Common										
H20	LWS	Upper River Wandle (b)	Fifteen receptors									

(a) Critical level

(b) Due to the size and/or proximity of these habitats to the proposed facility, a number of receptor locations have been identified in order to assess the maximum impact on the habitat sites

(c) Annual mean

(d) Daily mean critical level. Baseline daily mean concentration is calculated by multiplying the annual mean by 2 to derive the one hour mean and then by 0.59 to derive the 24 hour mean

(e) Weekly mean critical level.

(f) Daily mean critical level.

TABLE B2: SUMMARY OF SENSITIVE ECOLOGICAL RECEPTORS AND BASELINE INFORMATION – ACIDIFICATION AND NITROGEN DEPOSITION

Ref.	Designation	Name	Direction	Distance (km)	Acid Deposition (keq ha^{-1} a^{-1})					Nutrient Nitrogen Deposition (kg N ha^{-1} a^{-1}) (d)	
					CL (a)(c)			Baseline		CL (a)	Baseline
					CLminN	CLmaxN	CLmaxS	N	S		
H1	SAC	Richmond Park (b)(d)	NW	9.6	0.36	1.009	1.72	2.0	0.33	10 – 20	28.40
H2	SAC	Wimbledon Common (b)(e)	NW	7.0	0.642	0.872	0.23	1.2	0.25	10 – 20	16.90
H3	LNR/LWS	The Spinney, Carshalton (g)	SW	15.0	0.357	2.151	1.794	2.03	0.2	10 – 20	28.42
H4	LNR	Spencer Road Wetlands (h)	W	1.2	Not sensitive			-	-	10 – 15	15.54
H5	LNR	Bennett's Hole (g)	WNW	1.8	0.357	2.151	1.794	2.03	0.2	10 – 20	28.42
H6	LNR	Wandle Valley Wetland (g)	W	1.3							
H7	LNR	Wilderness Island (g)	SSW	1.5							
H8	LNR/LWS	Cranmer Green (g)	NW	1.7							
H9	LWS	Caraway Place Pond (g)	SSW	1.6							
H10	LWS	Queen Elizabeth Walk (g)	S	1.9							
H11	LWS	Revesby Road Wood (g)	W	1.9							
H12	LWS	Therapia Lane Rough (g)	ENE	0.6							
H13	LWS	Mill Green (g)	W	1.0							
H14	LWS	Land North of Goat Road (g)	W	1.2							
H15	LWS	Croydon Cemetery Complex (g)	ENE	1.1							
H16	LWS	Canons Pond (g)	NW	2.0							
H17	LWS	Beddington Farmlands (i)	Adjacent to site		0.438	1.338	0.9	1.11	0.16	10 - 15	15.54
H18	LWS	Beddington Park (g)	S	1.0	0.357	2.151	1.794	2.03	0.2	10 – 20	28.42
H19	LWS	Mitcham Common (g)	N	0.5							
H20	LWS	Upper River Wandle (b)(g)	S and SW	1.4							

(a)	Critical load (as obtained from APIS, April 2021)
(b)	Due to the size and/or proximity of these habitats to the proposed facility, a number of receptor locations have been identified in order to assess the maximum impact on the habitat sites
(c)	Acid Deposition Critical Loads are presented in terms of N and S components where CL function information is available. All baseline and critical load values are from the APIS database (as of October 2020).
(d)	Most sensitive habitat provided by APIS as broadleaved deciduous woodland.
(e)	Most sensitive habitat provided by APIS as Northern Atlantic wet heaths with Erica tetralix.
(f)	Nutrient Nitrogen Critical Loads are presented in terms of a range. The assessment is undertaken against both the upper and lower critical load. The baseline and critical load values are from the APIS database as of October 2020.
(g)	Site specific information not provided by APIS, assumed to be represented as broadleaved, mixed and yew woodland
(h)	Site specific information not provided by APIS, assumed to be represented as fens, marsh and swamp
(i)	Site specific information not provided by APIS, assumed to be acid grassland

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