Knauf Insulation Limited

Knauf St Helens Permit Variation

Air Quality Assessment

WSP Environment & Infrastructure Solutions UK Limited – January 2024

Report for

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Executive summary

Purpose of this report

Knauf Insulation aim to vary the Consolidated Environmental Permit (EPR/BQ4335IC/V007), to accommodate changes to assets and infrastructure associated with a significant refurbishment project at the St Helens facility (“the Site”).

Emissions associated with the proposed modifications will be discharged via stacks currently installed at the Site. An assessment of the impact of emissions to air associated with the modifications is required to determine the variance between the current and anticipated pollutant inventory for releases to air at the St Helens Site.

The impact assessment demonstrated that exceedances of any AQS/AQO/EAL are unlikely at the local receptors identified to protect human health. With regards to ecological receptors, the assessment demonstrated that there are no exceedance of the ambient pollution concentration and deposition levels. Therefore, the impact of Site emissions on human and ecological receptors is insignificant.

Contents

1. Introduction

1.1 Background, aims and objectives

Knauf Insulation aim to vary the Consolidated Environmental Permit (EPR/BQ4335IC/V007), to accommodate changes to assets and infrastructure associated with a significant refurbishment project at the St Helens facility (“the Site”).

Emissions associated with the proposed modifications will be discharged via stacks currently installed at the Site. An assessment of the impact of emissions to air associated with the modifications is required to determine the variance between the current and anticipated pollutant inventory for releases to air at the St Helens Site.

1.2 Site description

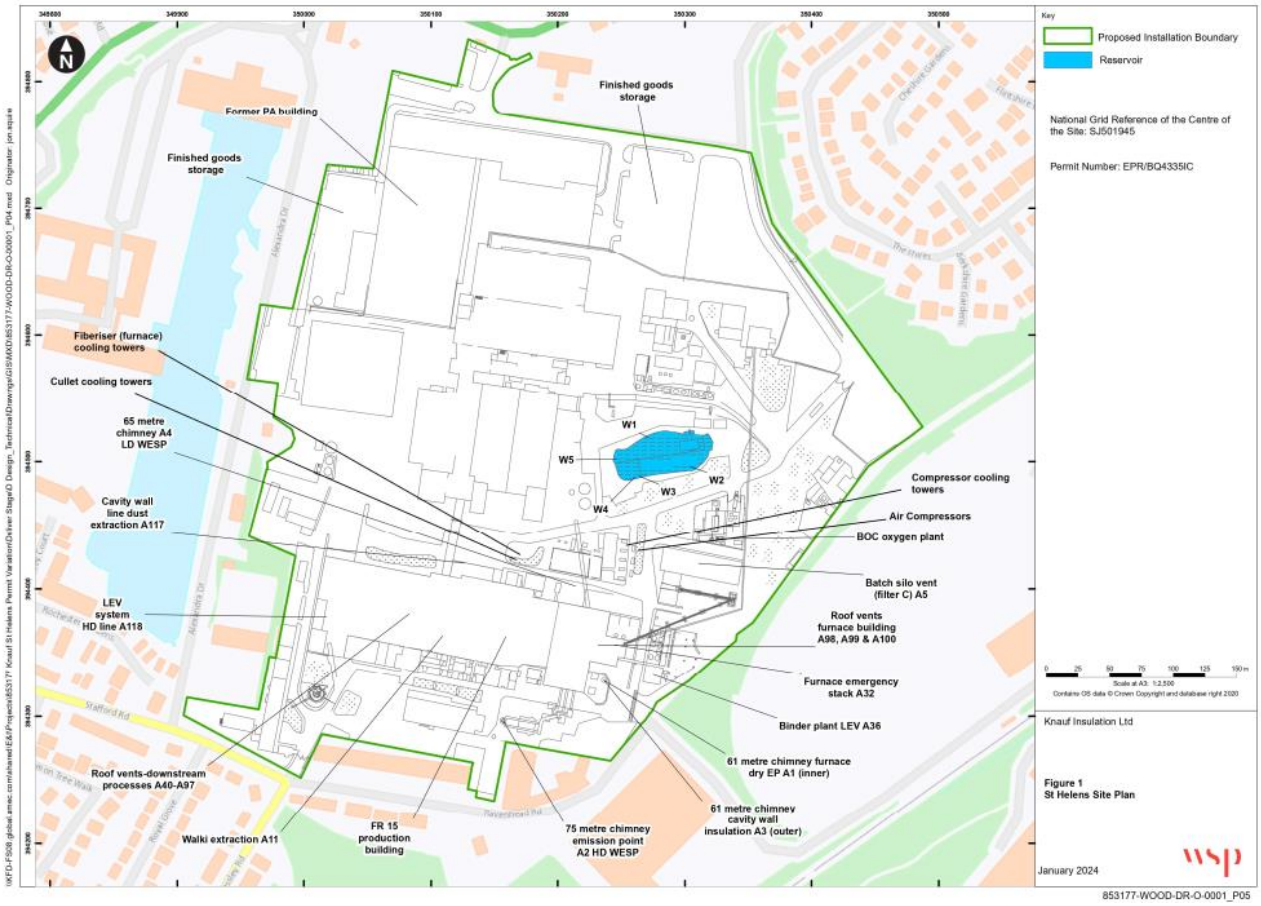
The Site is located at to grid reference SJ 50121 94365, As shown in Figure 1.1, the location of the installation continues to be located within a largely suburban setting, with residential receptors on the installation boundary to the North-East, North, North-West, South-West and South of the installation. Although beyond the initial two rows of housing to the south is undeveloped until Elm Road/Heathfield Avenue at between 400 and 600m from the installation boundary.

The area to the west of the facility has the Alexandra Lake followed by office blocks with residential populations beyond that at approximately 250m from the installation boundary. The area to the east is predominantly industrial.

The proposed installation boundary is presented in Figure 1.2.

Figure 1.1 Site location

Figure 1.2 Proposed installation boundary



1.3 Sources of information

The information used in this report is shown in Table 1.1.

Table 1.1 Sources of information

Item	Source
Process and Emissions Data	Knauf Insulation
Site Layout	Knauf Insulation
Baseline Air Quality	Government bodies; Local Authorities and third parties
Ordnance Survey Maps	Open Street Maps
Meteorological Data	Atmospheric Dispersion Modelling Limited

1.4 Report structure

The remainder of this report is set out in Table 1.2.

Table 1.2 Report structure

Section	Aims and Objectives
Section 2	Details the assessment criteria
Section 3	Describes the dispersion model, assessment methodology, model inputs and assumptions used in the assessment
Section 4	Details the ambient air quality in the area
Section 5	Presents an assessment of the potential air quality impacts arising from the site emissions
Section 6	Contains a summary and conclusions of the assessment

2. Assessment criteria

2.1 Relevant Legislation and Guidance

EU Legislation

Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

Directive 2008/50/EC (the 'Directive'), which came into force in June 2008, consolidates existing EU-wide air quality legislation (with the exception of Directive 2004/107/EC) and provides a new regulatory framework for $PM_{2.5}$.

The Directive sets limits, or target levels, for selected pollutants that are to be achieved by specific dates and details procedures EU Member States should take in assessing ambient air quality. The limit and target levels relate to concentrations in ambient air. At Article 2(1), the Directive defines ambient air as:

> *"…outdoor air in the troposphere, excluding workplaces as defined by Directive 89/654/EEC where provisions concerning health and safety at work apply and to which members of the public do not have regular access."*

In accordance with Article 2(1), Annex III, Part A, paragraph 2 details locations where compliance with the limit values does not need to be assessed:

> *"Compliance with the limit values directed at the protection of human health shall not be assessed at the following locations:*
>
> *a) any locations situated within areas where members of the public do not have access and there is no fixed habitation;*
>
> *b) in accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and*
>
> *c) on the carriageway of roads; and on the central reservation of roads except where there is normally pedestrian access to the central reservation."*

UK legislation

The Air Quality Standards Regulations 2010

The Air Quality Standards Regulations 2010 (the 'Regulations') came into force on 11 June 2010 and transpose EU Directive 2008/50/EC into UK legislation. The Directive's limit values are transposed into the Regulations as 'Air Quality Standards' (AQS) with attainment dates in line with the Directive.

These standards are legally binding concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects of sensitive groups or on ecosystems.

Similar to Directive 2008/50/EC, the Regulations define ambient air as:

> *"…outdoor air in the troposphere, excluding workplaces where members of the public do not have regular access."*

with direction provided in Schedule 1, Part 1, Paragraph 2 as to where compliance with the AQS' does not need to be assessed:

> *"Compliance with the limit values directed at the protection of human health does not need to be assessed at the following locations:*
>
> *a) any location situated within areas where members of the public do not have access and there is no fixed habitation;*
>
> *b) on factory premises or at industrial locations to which all relevant provisions concerning health and safety at work apply; and*
>
> *c) on the carriageway of roads and on the central reservation of roads except where there is normally pedestrian access to the central reservation."*

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The 2007 Air Quality Strategy for England, Scotland Wales and Northern Ireland provides a framework for improving air quality at a national and local level and supersedes the previous strategy published in 2000.

Central to the Air Quality Strategy are health-based criteria for certain air pollutants; these criteria are based on medical and scientific reports on how and at what concentration each pollutant affects human health. The objectives derived from these criteria are policy targets often expressed as a maximum ambient concentration not to be exceeded, without exception or with a permitted number of exceedances, within a specified timescale. At paragraph 22 of the 2007 Air Quality Strategy, the point is made that the objectives are:

> *"…a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except where they mirror any equivalent legally binding limit values…"*

The air quality objectives (AQOs), based on a selection of the objectives in the Air Quality Strategy, were incorporated into UK legislation through the Air Quality Regulations 2000, as amended.

Paragraph 4(2) of The Air Quality (England) Regulations 2000 states:

> *"The achievement or likely achievement of an air quality objective prescribed by paragraph (1) shall be determined by reference to the quality of air at locations –*
>
> *a) which are situated outside of buildings or other natural or man-made structures above or below ground; and*
>
> *b) where members of the public are regularly present."*

Consequently, compliance with the AQOs should focus on areas where members of the general public are present over the entire duration of the concentration averaging period specific to the relevant objective.

The Environment Act 1995 (Revised by The Environment Act 2021)

Part IV of the Environment Act 1995 requires that Local Authorities periodically review air quality within their individual areas. This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government's AQOs.

To carry out an air quality Review and Assessment under the LAQM process, the Government recommends a three-stage approach. This phased review process uses initial simple screening

methods and progresses through to more detailed assessment methods of modelling and monitoring in areas identified to be at potential risk of exceeding the objectives in the Regulations.

Review and assessments of local air quality aim to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government's air quality objectives by the required dates.

For the purposes of determining the focus of Review and Assessment, Local Authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

Where the assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an AQMA. The declaration of an AQMA requires the Local Authority to implement an Air Quality Action Plan (AQAP), to reduce air pollution concentrations so that the required AQOs are met.

The Environment Act 2021 presents the new environmental programme. It aims to improve air and water quality, tackle waste, increase recycling, halt the decline of species and improve the natural environment. The Act establishes legally binding duty to the government to bring two new targets in Secondary legislation in October 2022. These include reducing the annual mean levels of fine particles ($PM_{2.5}$) and reducing public exposure to $PM_{2.5}$.

Other guideline values

In the absence of statutory standards for the other prescribed substances that may be found in the emissions, there are several sources of applicable air quality guidelines.

Air Quality Guidelines for Europe, the World Health Organization (WHO)

The aim of the WHO Air Quality Guidelines for Europe (WHO, 2021) provide a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. These guidelines are intended to provide guidance and information to international, national and local authorities making risk management decisions, particularly in setting air quality standards.

Environmental Assessment Levels (EALs)

The Environment Agency's Air emissions risk assessment for your environmental permit guidance provides methods for quantifying the environmental impacts of emissions to all media. It contains long and short-term Environmental Assessment Levels (EALs) and Environmental Quality Standards (EQS) for releases to air derived from a number of published UK and international sources. For the pollutants considered in this study, these EALs and EQS are equivalent to the AQS and AQOs set in force by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

2.2 Air quality impacts of the process

The atmospheric emissions of the following pollutants have been identified as requiring detailed dispersion modelling and include all pollutants with Emission Limit Values (ELVs) set out in the current permit for the Site:

- Sulphur dioxide (SO_2);
- Nitrogen dioxide (NO_2);
- Particulate matter (PM_{10} and $PM_{2.5}$);

- Carbon Monoxide (CO);
- Hydrogen Chloride (HCl);
- Hydrogen Fluoride (HF);
- Arsenic (As), Cobalt (Co), Nickel (Ni), Cadmium (Cd), Selenium (Se), Chromium VI (CrVI), Antimony (Sb), Lead (Pb), Chromium III (CrIII), Copper (Cu), Manganese (Mn), Vanadium (V), Tin (Sn) and their compounds (total);
- As, Co, Ni, Cd, Se, CrVI and their compounds (total);
- Phenol;
- Formaldehyde;
- Ammonia (NH_3); and
- Volatile Organic Compounds (VOCs) (assessed as Benzene).

2.3 Criteria appropriate to the assessment

Air Quality Standards, Objectives, Guidelines and Critical Levels

Table 2.1 and Table 2.2 sets out those AQS, AQOs and EALs that are relevant to this assessment. There is currently no AQS/AQO/EAL for Cobalt and Tin.

Table 2.1 Air Quality Standards, Objectives and Environmental Assessment Levels

Pollutant	Receptors Affected	AQS /AQO /EAL	Averaging Period	Value (μgm^{-3})
NO_2	Human	AQS	Annual mean	40
		AQS	1-hour mean, not to be exceeded more than 18 times a year (equivalent to 99.79th percentile)	200[3]
NO_x	Ecological	AQS	Annual mean	30
	Ecological	AQO	Daily mean	75
PM_0	Human	AQS	Annual mean	40
	Human	AQS	24-hour mean, not to be exceeded more than 7 times a year (equivalent of 98.08 Percentile	50
$PM_{2.5}$	Human	AQO	Annual mean	20
SO_2	Human	AQS	24-hour mean, not to be exceeded more than 3 times a year (equivalent of 99.18 Percentile)	125

Pollutant	Receptors Affected	AQS /AQO /EAL	Averaging Period	Value (μgm^{-3})
	Human	AQS	1-hour mean, not to be exceeded more than 24 times a year (equivalent of 99.73 Percentile)	350
	Human	EAL	15-minute mean, not to be exceeded more than 35 times a year (equivalent of 99.99 Percentile)	266
	Ecological	AQS	Annual mean	10[(a)]-20
NH_3	Human	EAL	Annual mean	180
	Human	EAL	1-hour mean	2,500
	Ecological	EAL	Annual mean	1[(a)]-3
Phenol	Human	EAL	1-hour mean	3,900
	Human	EAL	Annual mean	200
VOCs (Benzene)	Human	EAL	24-hour mean	30
	Human	AQO	Annual mean	5
HF	Human	EAL	Monthly mean	16
	Human	EAL	1-hour mean	160
	Ecological	AQO	24-hour mean	5
	Ecological	AQO	Weekly mean	0.5
HCl	Human	EAL	1-hour mean	750
Formaldehyde	Human	EAL	30-minute mean	100
	Human	EAL	Annual mean	5
Nitrogen deposition	Ecological	Critical load	Annual mean	Site-specific
Acid deposition	Ecological	Critical load	Annual mean	Site-specific

(a) Lower level applied when where lichens or bryophytes

Table 2.2 Air Quality Standards, Objectives and Environmental Assessment Levels - Metals

Pollutant	Receptors Affected	AQS /AQO /EAL	Averaging Period	Value (μgm^{-3})
Arsenic	Human	AQO	Annual	6 (ngm^{-3})

Pollutant	Receptors Affected	AQS /AQO /EAL	Averaging Period	Value (µgm^{-3})
Antimony	Human	EAL	Annual	5
	Human	EAL	1-hour	150
Cadmium	Human	AQO	Annual	5
Chromium III	Human	EAL	Annual	5
	Human	EAL	1-hour	150
Chromium VI	Human	EAL	Annual	0.2 (ngm^{-3})
Copper	Human	EAL	Annual	10
	Human	EAL	1-hour	200
Lead	Human	AQO	Annual	0.25
Manganese	Human	EAL	Annual	0.15
	Human	EAL	1-hour	1,500
Selenium	Human	EAL	Annual	1
	Human	EAL	1-hour	30
Nickel	Human	AQO	Annual	20 (ngm^{-3})
Vanadium	Human	EAL	24-hour	1

Critical Loads relevant to the assessment

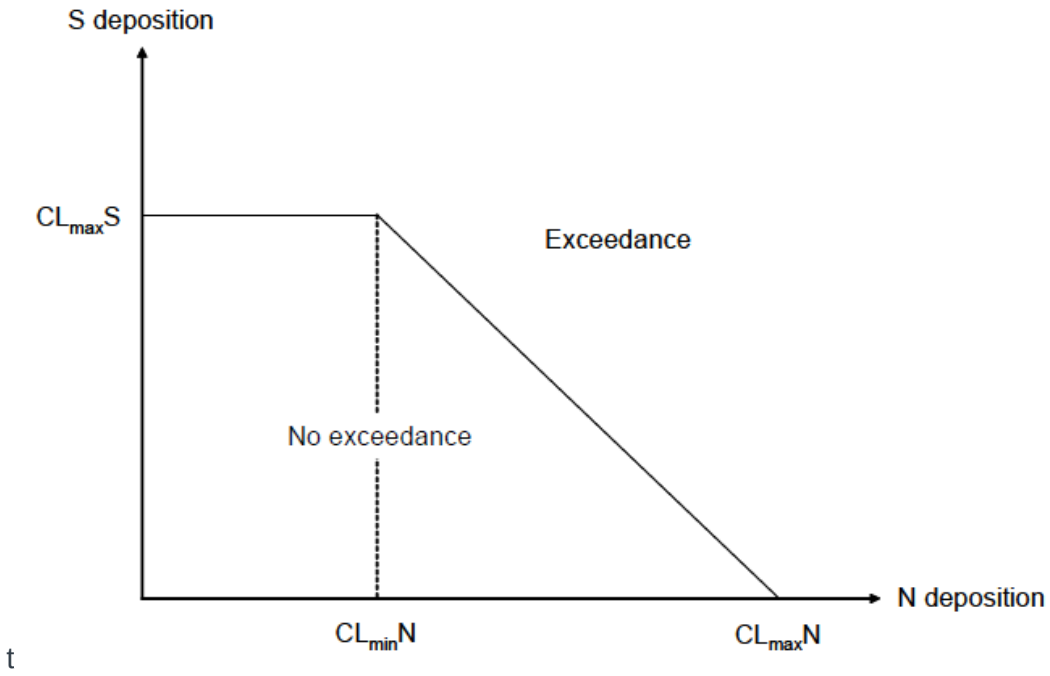
The Air Pollution Information Service (APIS) contains information on applicable critical loads for various habitats and species.

Eutrophication critical loads are given as a range and have units of kg N ha^{-1} y^{-1}. Generally, the lower end of the range should be used as a conservative assessment. The critical loads for acidification are more complicated, in that both the nitrogen and sulphur deposition fluxes must be considered at the same time. Therefore, a critical load function is specified for acidification, via the use of three critical load parameters:

- $CL_{max}S$ — the maximum critical load of sulphur, above which the deposition of sulphur alone would be considered to lead to an exceedance;
- $CL_{min}N$ — a measure of the ability of a system to "consume" deposited nitrogen (e.g. via immobilisation and uptake of the deposited nitrogen); and
- $CL_{max}N$ — the maximum critical load of acidifying nitrogen, above which the deposition of nitrogen alone would be considered to lead to an exceedance.

These three quantities define the critical load function shown in Figure 2.1.

Figure 2.1 Schematic Critical Load function for acidity



Source: Environment Agency (2011)

Table 2.3 presents the critical loads for the identified ecological receptors.

Table 2.3 Critical Loads

Site	Designation	Acid deposition Critical load function (Keq/ha/yr)			Nitrogen deposition Critical load (kgN/ha/yr)
		CLmaxS	CLminN	CLmaxN	
Mill Brow	LNR	1.435	0.357	1.792	10
Thatto Heath Meadows	LNR/ LWR	1.455	0.357	1.812	10

Public exposure

Guidance from the UK Government and Devolved Administrations makes clear that exceedances of the health-based objectives should be assessed at outdoor locations where members of the general public are regularly present over the averaging time of the objective. As in Section 2.2, this also excludes workplaces. Table 2.4 provides an indication of those locations that may or may not be relevant for each averaging period.

Table 2.4 Examples of where the Air Quality Objectives should apply for human receptors

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24- and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more. Any outdoor locations at which the public may be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

For gardens, such locations should represent parts of the garden where relevant public exposure is likely, for example where there is a seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

Significance Criteria

EA online guidance *'Air Emissions Risk Assessment'* gives criteria for screening out-source contributions in the context of environmental permit applications. This guidance suggests applicants first perform a screening assessment and, if the results of that do not meet the screening-out criteria, then perform a detailed modelling assessment.

This guidance also introduces the terms 'process contribution' (PC), meaning the concentration or deposition rate resulting from the development activities only, excluding other sources, and 'predicted environmental concentration' (PEC), meaning the total modelled concentration, equal to the PC plus the background contribution from all other sources. These terms are commonly used in air quality assessments, even where the term 'process' is not strictly accurate, and so are used in this assessment with 'process' referring to the Proposed Development. The term PEC is also used to describe total deposition rates.

For human receptors the guidance states there is no need for further assessment if the screening calculation finds that:

- Both the following are met:
  - the short-term PC is less than 10% of the short-term AQO/S; and
  - the long-term PC is less than 1% of the long-term AQO/S;
- Or:
  - the short term PC is less than 20% of the short term environmental standards minus twice the long term background concentration; and,
  - the long-term PEC is less than 70% of the long-term AQO/S.

For Special Protection Areas, Special Areas of Conservation, Ramsar sites and Sites of Special Scientific Interest, there is no need for further assessment if the screening calculation finds that:

- Both the following are met:
  - the short-term PC is less than 10% of the short-term AQO/S; and
  - the long-term PC is less than 1% of the long-term AQO/S;
- Or:
  - the long-term PEC is less than 70% of the long-term AQO/S.

For local nature sites (ancient woodland, local wildlife sites and national and local nature reserves), emissions are insignificant if:

- The short-term PC is less than 100% of the short-term AQO/S; and
- The long-term PC is less than 100% of the long-term AQO/S.

Following detailed dispersion modelling, no further action is required if:

- The proposed emissions comply with Best Available Technique (BAT) associated emission levels (AELs) or the equivalent requirements where there is no BAT AEL; and
- The resulting PECs will not exceed AQO/S.

The Institute of Air Quality Management (IAQM) guidance (2020) provides further suggestions on circumstances where there is definitely an insignificant effect on a site in relation to the Habitats Directive. This guidance notes that the EA criteria above are commonly used in air quality assessments, but notes that:

"In the IAQM's opinion, the 1% and 10% screening criteria should not be used rigidly and, not to a numerical precision greater than the expression of the criteria themselves. Whilst it is straightforward to generate model results for the PC to any level of precision required, the accuracy of the result is much less certain and it is unwise to place too much emphasis on whether the PC is 0.9% or 1.1%, for example. In practice, because the magnitude of impacts attributable to new sources is often around 1% of the criterion, a regulator may require the results to be presented at greater resolution, i.e. having one (or more) decimal places. The distinction here is between the presentation of the model results and the weight given to fine differences around the criterion itself in making a judgement.

"It is important to remember that a change of more than 1% does not necessarily indicate that a significant effect (or adverse effect on integrity) will occur; it simply means that the change in concentration or deposition rate cannot in itself be described as numerically inconsequential or imperceptible and therefore requires further consideration."

3. Assessment Methodology

3.1 Dispersion Model

The model used in this assessment is the latest version of the ADMS 5.2 atmospheric dispersion model developed and validated by Cambridge Environmental Research Consultants (CERC). The model was used to predict the ground level concentration of compounds emitted to atmosphere from the installation. The model has been used extensively throughout the UK for regulatory compliance purposes and is accepted as an appropriate air quality modelling tool by the National Resources Wales (NRW) and local authorities.

ADMS 5.2 parameterises stability and turbulence in the atmospheric boundary layer by the Monin-Obukhov length and the boundary layer depth. This approach allows the vertical structure of the boundary layer to be more accurately defined than by the stability classification methods of earlier dispersion models. In ADMS, the concentration distribution follows a symmetrical Gaussian profile in the vertical and crosswind directions in neutral and stable conditions. However, the vertical profile in convective conditions follows a skewed Gaussian distribution to take account of the inhomogeneous nature of the vertical velocity distribution in the Convective Boundary Layer.

A number of complex modules, including the effects of plume rise, complex terrain, coastlines, concentration fluctuations, radioactive decay and buildings effects, are also included in the model, as well as the facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes, and percentile concentrations, from either statistical meteorological data or hourly average data.

A range of input parameters is required including, among others, data describing the local area, meteorological measurements and emissions data. The data used in modelling the emissions are given in the following sections of this chapter.

3.2 Process Emissions

The principle inputs to the model with respect to the emissions to air has been derived from the Knauf Insulation Engineering Process Description Handbook (20220614). The following scenarios have been modelled in this assessment:

- Current scenario, which establishes pollutant concentrations in and around the facility at present;
- Future scenario, which establishes pollutant concentrations in and around the facility after the significant refurbishment project.

The pollutants assessed are:

- Oxides of nitrogen (NO_X as NO_2);
- Particulate matter (PM_{10} and $PM_{2.5}$);
- Carbon monoxide (CO);
- Sulphur dioxide (SO_2);
- Hydrogen chloride (HCl);
- Hydrogen fluoride (HF);
- Metals

- Volatile organic compounds (VOCs);
- Ammonia (NH_3);

Given that the speciation of VOCs is not known, it is assumed that VOCs are emitted as benzene and compared against the benzene Air Quality Standard in line with Environment Agency guidance. Similarly, it is assumed that all particles are emitted in the PM_{10} and $PM_{2.5}$ fractions for comparison against the PM_{10} and $PM_{2.5}$ Air Quality Standards.

Model input parameters are given in Table 3.1 and Table 3.2 for Scenario 1 (existing) and Scenario 2 (proposed), respectively. For NOx the half hour maximum derived emission rate was used to assess impacts on short-term concentrations (i.e hourly) and the daily average derived emission rate was used to assess long-term concentrations (i.e annual) to ensure realistic emissions are assessed, given that NO_x is a key pollutant. For PM the half hourly maximum was used to assess both long and short-term concentrations as PM is not a pollutant with widespread exceedances across the UK.

Table 3.1 Model input parameters – scenario 1

Parameter	A1	A2-north	A2-south	A3	A4
Stack characteristics					
Stack Height (m)	61.0	75.0	75.0	61.0	65.0
Stack Diameter (m)	1.1	1.8	1.8	2.5	4.0
Temperature (°C)	218	29.0	28.0	36.08	32.7
Velocity (m/s)	12.7	11.0	13.1	2.5	7.2
Volume Flow Rate (Am^3/s)	12.0	27.9	33.31	12.18	89.9
Volume Flow Rate (15%, 273K wet) (Nm^3/s)	7.0	25.1	30.1	10.7	80.6
Emission concentration (15%, 273K, wet) (mg/Nm^3)					
NOx (daily average)	300	-	-	-	-
NOx (half hour maximum)	400	-	-	-	-
PM (daily average)	10	-	-	-	-
PM (half hour maximum)	15	-	-	-	-
SO_2	150	-	-	-	-
HF	5	-	-	-	-
CO	100	-	-	-	-
HCl	10	-	-	-	-

Parameter	A1	A2-north	A2-south	A3	A4
As, Co, Ni, Cd, Se, CrVI and their compounds (total)	1	-	-	-	-
As, Co, Ni, Cd, Se, CrVI, Sb, Pb, CrIII, Cu, Mn, V, Sn and their compounds (total)	2	-	-	-	-
PM	-	30	30	30	30
Phenol	-	5	5	5	5
Formaldehyde	-	5	5	5	5
Ammonia	-	50	50	60	50
VOCs	-	25	25	30	25
		Emission rates (g/s)			
NOx (daily average)	1.97	-	-	-	-
NOx (half hour maximum)	2.63	-	-	-	-
PM (daily average)	0.07	-	-	-	-
PM (half hour maximum)	0.10	-	-	-	-
SO_2	0.99	-	-	-	-
HF	0.03	-	-	-	-
CO	0.66	-	-	-	-
HCl	0.07	-	-	-	-
As, Co, Ni, Cd, Se, Crvl and their compounds (total)	0.007	-	-	-	-
As, Co, Ni, Cd, Se, CrVI, Sb, Pb, CrIII, Cu, Mn, V, Sn and their compounds (total)	0.013	-	-	-	-
PM	-	0.75	0.90	0.32	2.42
Phenol	-	0.13	0.15	0.05	0.40
Formaldehyde	-	0.13	0.15	0.05	0.40
Ammonia	-	1.26	1.50	0.64	4.03
VOCs	-	0.63	0.75	0.32	2.01

Table 3.2 Model input parameters – scenario 2

Parameter	A1	A2-north	A2-south	A3	A4
Stack characteristics					
Stack Height (m)	61.0	75.0	75.0	61.0	65.0
Stack Diameter (m)	1.1	1.8	1.8	2.5	4.0
Temperature (°C)	240.0	29.0	28.0	36.1	39.0
Velocity (m/s)	17.1	11.0	13.1	2.5	12.3
Volume Flow Rate (Am^3/s)	16.2	27.9	33.3	12.2	154.2
Volume Flow Rate (15%, 273K wet) (Nm^3/s)	9.0	25.1	30.1	10.7	134.9
Emission concentration (15%, 273K, wet) (mg/Nm^3)					
NOx (daily average)	300	-	-	-	-
NOx (half hour maximum)	400	-	-	-	-
PM (daily average)	10	-	-	-	-
PM (half hour maximum)	15	-	-	-	-
SO_2	150	-	-	-	-
HF	5	-	-	-	-
CO	100	-	-	-	-
HCl	10	-	-	-	-
As, Co, Ni, Cd, Se, CrvI and their compounds (total)	1	-	-	-	-
As, Co, Ni, Cd, Se, CrVI, Sb, Pb, CrIII, Cu, Mn, V, Sn and their compounds (total)	2	-	-	-	-
PM	-	30	30	30	30
Phenol	-	5	5	5	5
Formaldehyde	-	5	5	5	5
Ammonia	-	50	50	60	50
VOCs	-	25	25	30	25

Parameter	A1	A2-north	A2-south	A3	A4
		Emission rates (g/s)			
NOx (daily average)	2.59	-	-	-	-
NOx (half hour maximum)	3.46	-	-	-	-
PM (daily average)	0.09	-	-	-	-
PM (half hour maximum)	0.13	-	-	-	-
SO_2	1.30	-	-	-	-
HF	0.04	-	-	-	-
CO	0.86	-	-	-	-
HCl	0.09	-	-	-	-
As, Co, Ni, Cd, Se, CrvI and their compounds (total)	0.01	-	-	-	-
As, Co, Ni, Cd, Se, CrVI, Sb, Pb, CrIII, Cu, Mn, V, Sn and their compounds (total)	0.02	-	-	-	-
PM	-	0.75	0.90	0.32	4.05
Phenol	-	0.13	0.15	0.05	0.67
Formaldehyde	-	0.13	0.15	0.05	0.67
Ammonia	-	1.26	1.50	0.64	6.74
VOCs	-	0.63	0.75	0.32	3.37

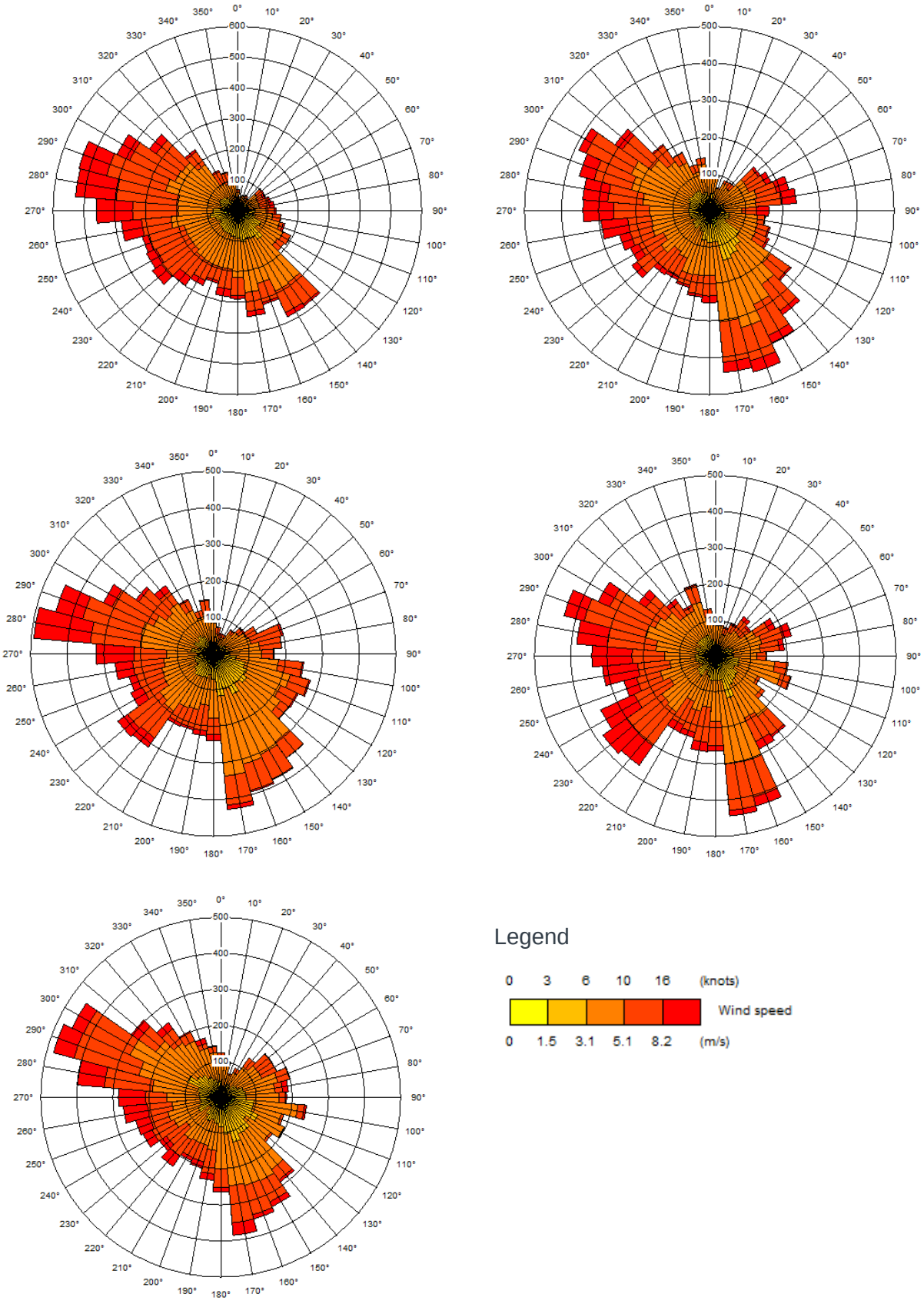
3.3 Meteorology

For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters are 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. The year of meteorological data that is used for a modelling assessment can also have a significant effect on ground level concentrations.

This assessment has used meteorological data recorded at the Liverpool meteorological station from 2017 to 2021. The meteorological station is located approximately 13.7km southwest, offering data in a suitable format for the model and representative of local meteorological conditions.

Figure 3.1 shows the wind roses for each year modelled, illustrating the frequency of monitored wind direction and wind speed.

Figure 3.1 Wind Rose: Liverpool meteorological station 2017 – 2021



Monin-Obukhov length

The minimum Monin-Obukhov length can be selected in ADMS for both the dispersion site and the meteorological site. This is a measure of the minimum stability of the atmosphere and can be adjusted to account for urban heat island effects which prevent the atmosphere in urban areas from ever becoming completely stable. The minimum Monin-Obukhov length has been set to 30 m for the dispersion site and 30 m for the meteorological site. The surroundings of the dispersion site are mainly industrial. A value of 30 m is recommended by CERC for mixed urban/industrial areas and is considered appropriate for the surroundings of the dispersion site. The surroundings of the meteorological site is mainly built up. A value of 30 m is recommended by CERC for cities/ large towns areas and is considered appropriate for the surroundings of the dispersion site.

3.4 Surface characteristics

The predominant surface characteristics and land use in a model domain have an important influence in determining turbulent fluxes and, hence, the stability of the boundary layer and atmospheric dispersion. Factors pertinent to this determination are detailed below.

Surface roughness

Roughness length, z_0, represents the aerodynamic effects of surface friction and is defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by meteorological pre-processors to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing.

The surface roughness length is related to the height of surface elements; typically, the surface roughness length is approximately 10% of the height of the main surface features. Thus, it follows that surface roughness is higher in urban and congested areas than in rural and open areas. Oke (1987) and CERC (2003) suggest typical roughness lengths for various land use categories (Table 3.3).

Table 3.3 Typical surface roughness lengths for various land use categories

Type of Surface	z_o (m)
Ice	0.00001
Smooth snow	0.00005
Smooth sea	0.0002
Lawn grass	0.01
Pasture	0.2
Isolated settlement (farms, trees, hedges)	0.4
Parkland, woodlands, villages, open suburbia	0.5-1.0
Forests/cities/industrialised areas	1.0-1.5
Heavily industrialised areas	1.5-2.0

Increasing surface roughness increases turbulent mixing in the lower boundary layer. With respect to elevated sources under neutral and stable conditions, increasing the roughness length can have complex and conflicting effects on ground level concentrations:

- The increased mixing can bring portions of an elevated plume down towards ground level, resulting in increased ground level concentrations close to the emission source; and
- The increased mixing increases entrainment of ambient air into the plume and dilutes plume concentrations, resulting in reduced ground level concentrations further downwind from an emission source.

The overall impact on ground level concentration is, therefore, strongly correlated with the distance of a receptor from the emission source.

Surface Energy Budget

One of the key factors governing the generation of convective turbulence is the magnitude of the surface sensible heat flux. This, in turn, is a factor of the incoming solar radiation. However, not all solar radiation arriving at the Earth's surface is available to be emitted back to atmosphere in the form of sensible heat. By adopting a surface energy budget approach, it can be identified that, for fixed values of incoming short and long wave solar radiation, the surface sensible heat flux is inversely proportional to the surface albedo and latent heat flux.

The surface albedo is a measure of the fraction of incoming short-wave solar radiation reflected by the Earth's surface. This parameter is dependent upon surface characteristics and varies throughout the year. Oke (1987) recommends average surface albedo values of 0.6 for snow covered ground and 0.23 for snow-free ground, respectively.

The latent heat flux is dependent upon the amount of moisture present at the surface. Areas where moisture availability is greater will experience a greater proportion of incoming solar radiation released back to atmosphere in the form of latent heat, leaving less available in the form of sensible heat and, thus, decreasing convective turbulence. The modified Priestly-Taylor parameter (α) can be used to represent the amount of moisture available for evaporation. Holstag and van Ulden (1983) suggest values of 0.45 and 1.0 for dry grassland and moist grassland respectively.

Selection of appropriate surface characteristic parameters for the site

A detailed analysis of the effects of surface characteristics on ground level concentrations by Auld et al. (2002) led them to conclude that, with respect to uncertainty in model predictions:

"…the energy budget calculations had relatively little impact on the overall uncertainty".

In this regard, it is not considered necessary to vary the surface energy budget parameters spatially or temporally, and annual averaged values have been adopted throughout the model domain for this assessment.

As snow covered ground is only likely to be present for a small fraction of the year, the surface albedo of 0.23m for snow-free ground advocated by Oke (1987) has been used whilst the model default α value of 1.0m has also been retained.

The area around the site is a mix of cities and woodlands. In view of this, a roughness length of 1 m was used.

Buildings

Any large object has an impact on atmospheric flow and air turbulence within the locality of the object. This can result in maximum ground level concentrations that are significantly different (generally higher) from those encountered in the absence of buildings. The building 'zone of influence' is generally regarded as extending a distance of 5L (where L is the lesser of the building height or width) from the foot of the building in the horizontal plane and three times the height of the building in the vertical plane. Table 3.4 details the building as they are included in the model.

Table 3.4 Modelled Buildings

ID		X (m)	Y (m)	Z (m)	Length (m)	Width (m)	Angle (°)
1	General Stores	350108	394301	8	15	66	186
2	Lines/engeen.	350121	394378	10	88	234	9
3	Veolia	350269	394213	10	65	104	137
4	Binder plant	350267	394340	10	13	13	11

Terrain

The concentrations of an emitted pollutant found in elevated, complex terrain differ from those found in simple level terrain. There have been numerous studies on the effects of topography on atmospheric flows. The UK ADMLC provides a summary of the main effects of terrain on atmospheric flow and dispersion of pollutants (Hill et al., 2005):

- *"Plume interactions with windward facing terrain features:*
  - *Plume interactions with terrain features whereby receptors on hills at a similar elevation to the plume experience elevated concentrations;*
  - *Direct impaction of the plume on hill slopes in stable conditions;*
  - *Flow over hills in neutral conditions can experience deceleration forces on the upwind slope, reducing the rate of dispersion and increasing concentrations; and*
  - *Recirculation regions on the upwind side of a hill can cause partial or complete entrainment of the plume, resulting in elevated ground level concentrations.*
- *Plume interactions with lee sides of terrain features:*
  - *Regions of recirculation behind steep terrain features can rapidly affect pollutants towards the ground culminating in elevated concentrations; and*
  - *As per the upwind case, releases into the lee of a hill in stable conditions can also be recirculated, resulting in increased ground level concentrations.*
- *Plume interactions within valleys:*
  - *Releases within steep valleys experience restricted lateral dispersion due to the valley sidewalls. During stable overnight conditions, inversion layers develop within the valley essentially trapping all emitted pollutants. Following sunrise and the erosion of the inversion, elevated ground level concentrations can result during fumigation events; and*

- *Convective circulations in complex terrain due to differential heating of the valley side walls can lead to the impingement of plumes due to crossflow onto the valley sidewalls and the subsidence of plume centrelines, both having the impact of increasing ground level concentrations."*

These effects are most pronounced when the terrain gradients exceed 1 in 10, i.e. a 100m change in elevation per 1km step in the horizontal plane. As the area surrounding the site is not flat, terrain was applied.

3.5 Modelled domain and receptors

Modelled domain

An 8 km × 8 km Cartesian grid centred on the site was modelled, with a receptor resolution of 80 m, to assess the impact of atmospheric emissions from the site on local air quality. This resolution is considered suitable for capturing the maximum process contribution from site emissions.

Human receptors

Discrete receptors considered were chosen based on locations where people may be located and judged in terms of the likely duration of their exposure to pollutants and proximity to the site, following the guidance given in Section 3 of this report. Details of the locations of human receptors are given in Table 2.5 and Figure 1.1.

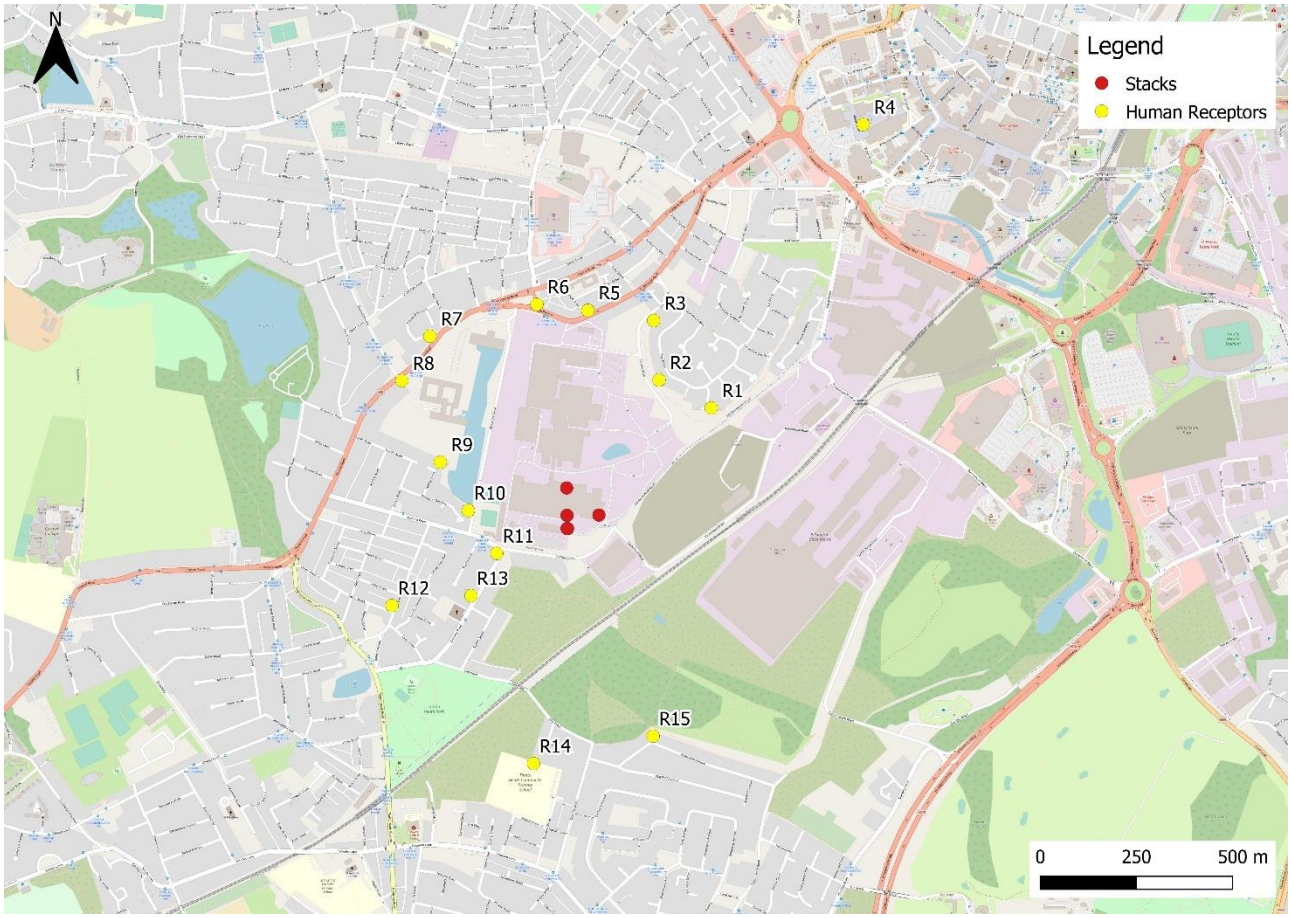
For the purposes of assessing air quality impacts, workplace locations have been excluded from the assessment in accordance with Schedule 1, Part 1, Paragraph 2 of the Air Quality Standards Regulations 2010. These Regulations are detailed in Section 3 of this report and do not differentiate between whether this is a workplace location under the control of the operator, or an off-site workplace location.

Table 3.5 Details of modelled human receptors

ID	Type	X (m)	Y (m)	Z (m)	Distance from Site (m)
R1	Residential	350528	394610	1.5	234.5
R2	Residential	350393	394684	1.5	243.1
R3	Residential	350381	394837	1.5	187.8
R4	Education	350930	395339	1.5	177.4
R5	Residential	350210	394866	1.5	218.1
R6	Residential/AQMA	350077	394883	1.5	429.8
R7	Residential/AQMA	349799	394803	1.5	388.8
R8	Residential	349725	394689	1.5	460.7
R9	Residential	349822	394477	1.5	510.1
R10	Residential	349894	394351	1.5	425.8

ID	Type	X (m)	Y (m)	Z (m)	Distance from Site (m)
R11	Residential	349967	394240	1.5	421.6
R12	Residential	349693	394108	1.5	445.1
R13	Church	349898	394131	1.5	498.8
R14	Education	350056	393695	1.5	487.2
R15	Residential	350368	393763	1.5	451.3

Figure 3.2 Location of Modelled Human Receptors



Ecological receptors

The Environment Agency's "Specified generators: dispersion modelling assessment" guidance (part of the "Risk assessments for specific activities: environmental permits") requires detailed dispersion modelling to be carried out based on local sensitive receptors. Regarding ecological receptors the following receptors need to be considered:

- Special protection areas (SPAs), Special areas of conservation (SACs) and Ramsar sites (protected wetlands) withing 5km of an installation; and
- Sites of special scientific interest (SSSIs), Local nature sites (ancient woods, local wildlife sites and national and local nature reserves) within 2 km of an installation.

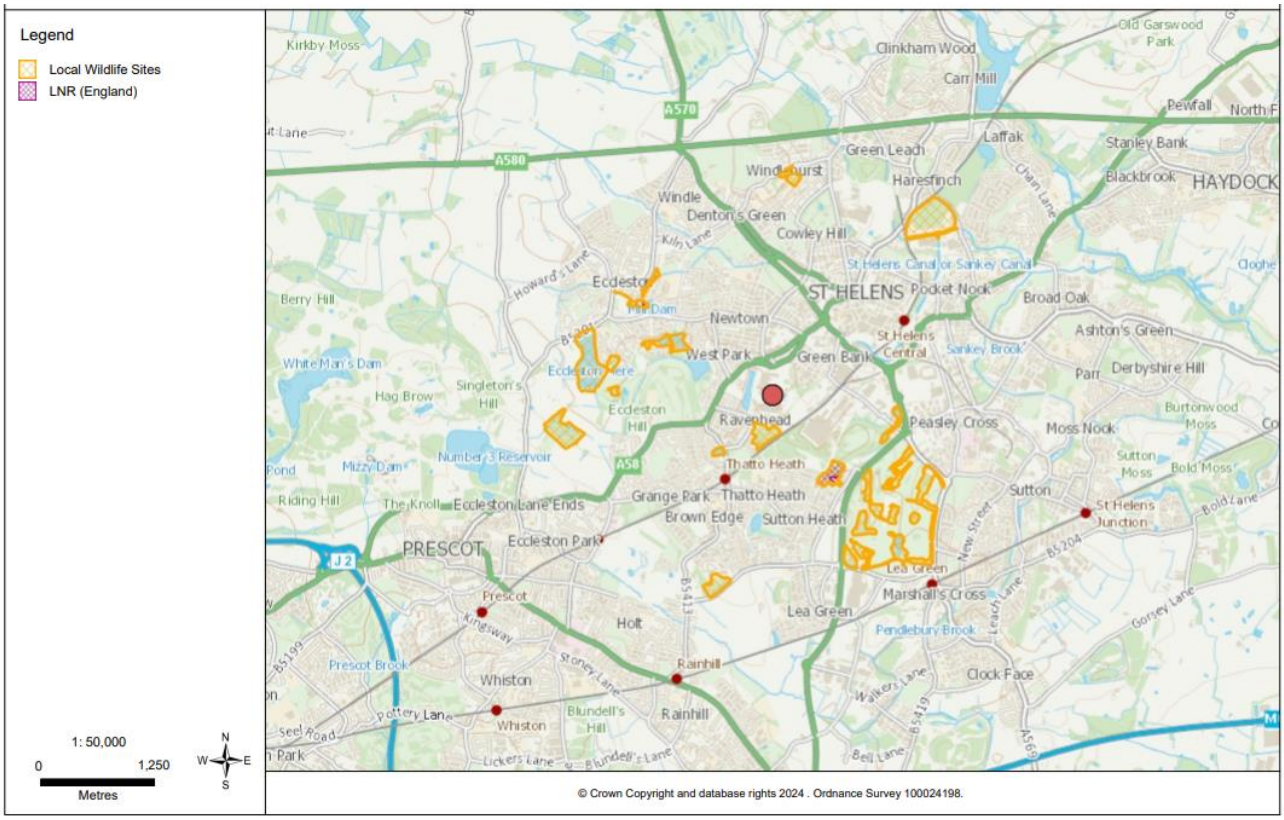
Following the above guidance, the following ecological receptors have been included in the assessment (Table 3.6 and Figure 3.3).

Table 3.6 Details of modelled ecological receptors

ID		Habitat Classification	Feature	Z (m)	Distance from Site (km)
E1	Mill Brow	LNR	Broadleaved, Mixed and Yew Woodland	0	1.6
E2	Thatto Heath Meadows	LNR/ LWR	Wood Pasture and Parkland	0	0.8
E3	Alexandra Colliery	LWR	Broadleaved, Mixed and Yew Woodland	0	0.1
E4	Thatto Heath Dam	LWR	Fen, Marsh and Swamp	0	0.6
E5	Leg O-Mutton Dam	LWR	Fen, Marsh and Swamp	0	1.2
E6	Eccleston Top Dam	LWR	Acid Grassland	0	1.3
E7	Ravenhead Ponds	LWR	Fen, Marsh and Swamp	0	1.4
E8	Sherdley Park	LWR	Acid Grassland	0	1.2
E9	Mill Wood, Eccleston	LWR	Broadleaved, Mixed and Yew Woodland	0	1.8
E10	Eccleston Golf Course, West Pond	LWR	Fen, Marsh and Swamp	0	1.6
E11	Old Joans Plantation	LWR	Broadleaved, Mixed and Yew Woodland	0	1.8
E12	Mill Brook	LWR	Coniferous Woodland	0	1.9
E13	Eccleston Mere	LWR	Fen, Marsh and Swamp	0	1.9
E14	Reeve Court woodland and grassland	LWR	Broadleaved, Mixed and Yew Woodland	0	2.0
E15	Sales Wood/ Gorse Plantation	LWR	Broadleaved, Mixed and Yew Woodland	0	2.0
E16	St Helens Canal, south of Haresfinch Burgy Bank	LWR	Fen, Marsh and Swamp	0	2.3

ID		Habitat Classification	Feature	Z (m)	Distance from Site (km)
E17	Haresfinch Burgy Bank	LWR	Acid Grassland	0	2.4
E18	Windlehurst Quarry	LWR	Acid Grassland	0	2.5

Figure 3.3 Location of modelled ecological receptors



3.6 Deposition

The predominant route by which emissions will affect land in the vicinity of a process is by deposition of atmospheric emissions. Ecological receptors can potentially be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

Deposition processes in the form of dry and wet deposition remove material from a plume and alter the plume concentration. Dry deposition occurs when particles are brought to the surface by gravitational settling and turbulence. They are then removed from the atmosphere by deposition on the land surface. Wet deposition occurs due to rainout scavenging (within clouds) and washout scavenging (below clouds) of the material in the plume. These processes lead to a variation with downwind distance of the plume strength and may alter the shape of the vertical concentration profile as dry deposition only occurs at the surface.

Environment Agency guidance AQTAG06 (Environment Agency, 2011) recommends deposition velocities for various pollutants dependent upon the habitat type (Table 3.7).

Table 3.7 Environment Agency recommended deposition velocities

Pollutant	Deposition Velocity (ms^{-1})	
	Grassland	Forest
NO_2	0.0015	0.003
SO_2	0.012	0.024
HCl	0.025	0.06
NH_3	0.02	0.03
HNO_3	0.04	0.04
SO42- (Sulphate aerosol)	0.01	0.01

Note Source: Environment Agency (2011)

In order to assess the impacts of deposition, habitat-specific critical loads and critical levels have been created. These are generally defined as (e.g. Nilsson and Grennfelt, 1988);

> *"...a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge."*

It is important to distinguish between a critical load and a critical level. The critical load relates to the quantity of a material deposited from air to the ground, whilst critical levels refer to the concentration of a material in air. The UK Air Pollution Information System (APIS) provides critical load data for ecological sites in the UK.

The critical loads used to assess the impact of compounds deposited to land which result in eutrophication and acidification are expressed in terms of kilograms of nitrogen deposited per hectare per year (kg N ha^{-1} y^{-1}) and kilo-equivalents deposited per hectare per year (keq ha^{-1} y^{-1}). The unit of 'equivalents' (eq) is used for the purposes of assessing acidification, rather than a unit of mass. The unit eq (1 keq ≡ 1,000 eq) refers to molar equivalent of potential acidity resulting from e.g. sulphur, oxidised and reduced nitrogen, as well as base cations. Essentially, it means 'moles of charge' and is a measure of how acidifying a particular chemical species can be.

To convert the predicted concentration in air of NO_2, SO_2, NH_3, or HNO_3, the following algorithm is used.

$$DR_i = C_i v_{d_i} f_i$$

Where:

DR_i = annual deposition of N or S (kg N ha^{-1} y^{-1} or kg S ha^{-1} y^{-1})

C_i = annual mean concentration of the *i*th chemical species (µg m^{-3})

v_{di} = deposition velocity of *i*th species (Table 3.8)

f_i = factor to convert from µg m^{-2} s^{-1} to kg ha^{-1} y^{-1} for the *i*th species

Table 3.8 provides the relevant conversion factors as extracted from AQTAG06.

Table 3.8 Environment Agency factors for converting modelled deposition rates

Pollutant	Conversion factor (µg m^{-2} s^{-1} to kg ha^{-1} y^{-1} for the *i*th species)	
	Of	f_i
NO_2	N	96.0
SO_2	S	157.7
HNO_3	N	70.1
NH_3	N	259.7

Note: Source: Environment Agency (2011)

In order to convert deposition of N to acid equivalents, the following relationships can be used:

- 1keq ha^{-1} y^{-1} = 14kg N ha^{-1} y^{-1}.

With respect to wet deposition, Environment Agency (2011) states:

"It is considered that wet deposition of SO_2, NO_2 and NH_3 is not significant within a short range."

Therefore, the assessment only considers dry deposition of nutrifying and acidifying N compounds (sulphur emissions from mains gas are negligible).

3.7 Special treatments

Other treatments

Specialised model treatments, for short-term (puff) releases, coastal models, fluctuations or photochemistry were not used in this assessment.

3.8 Sensitivity analysis and uncertainty

Sensitivity analysis

Wherever possible, this assessment has used worst-case scenarios, which will exaggerate the impact of the emissions on the surrounding area, including emissions, operational profile, ambient concentrations, meteorology and surface roughness. This assessment has considered five years of meteorological data, with data reported from the year(s) predicting the highest ground-level concentrations at the nearest sensitive receptor for comparison with the AQS/AQO/EAL.

Model uncertainty

Process emissions have been modelled under expected operation using the standard steady-state algorithms in ADMS to determine the impact on local human receptors. In order to model atmospheric dispersion using standard Gaussian methods, the following assumptions have to be made and limitations accepted:

- Conservation of mass - the entire mass of emitted pollutant remains in the atmosphere and no allowance is made for loss due to chemical reactions or deposition processes (although the standard Gaussian model can be modified to include such processes, as is the case with ADMS). Portions of the plume reaching the ground are assumed to be dispersed back away from the ground by turbulent eddies (eddy reflection);

- Steady-state emissions - emission rates are assumed to be constant and continuous over the time averaging period of interest; and
- Steady-state meteorology - no variations in wind speed, direction or turbulent profiles occur during transport from the source to the receptor. This assumption is reasonable within a few kilometres of a source but may not be valid for receptor distances in the order of tens of kilometres. For example, for a receptor 50km from a source and with a wind speed of 5m s−1 it will take nearly three hours for the plume to travel this distance during which time many different processes may change (e.g., the sun may rise or set and clouds may form or dissipate affecting the turbulent profiles). For this reason, Gaussian models are practically limited to predicting concentrations within ~20km of a source.

As a result of the above, and in combination with other factors, not least attempting to replicate stochastic processes (e.g. turbulence) by deterministic methods, dispersion modelling is inherently uncertain, but is nonetheless a useful tool in plume footprint visualisation and prediction of ground-level concentrations. The use of dispersion models has been widely used in the UK for regulatory and compliance purposes for a number of years and is an accepted approach for this type of assessment.

This assessment has incorporated a number of worst-case assumptions, as described above, which will result in an overestimation of the predicted ground-level concentrations from the process. As a result of these worst-case assumptions, the predicted results should be considered the upper limit of model uncertainty for a scenario where the actual site impact is determined. Therefore, the actual predicted ground level concentrations would be expected to be lower than those reported in this assessment and, in some cases, significantly lower.

4. Ambient air quality

4.1 Existing baseline conditions

Mapped background concentrations

Defra maintains a nationwide model (the Pollution Climate Mapping (PCM) model) of existing and future background air quality concentrations at a 1km grid square resolution. The data sets include annual average concentration estimates for NO_x, NO_2, PM_{10}, $PM_{2.5}$, CO, SO_2 and benzene. The PCM model is semi-empirical in nature: it uses data from the national atmospheric emissions inventory (NAEI) to model the concentrations of pollutants at the centroid of each 1km grid square but then calibrates these concentrations in relation to actual monitoring data.

Annual mean background data for NO_x, NO_2, PM_{10} and $PM_{2.5}$ for 2022 was obtained from the PCM model. Background concentrations of SO_2, benzene and CO were extracted from the 2001 Defra background map data as the PCM model does not consider these pollutants. Using the 2001 data is considered appropriate by Defra and in line with the LAQM guidance. Mapped atmospheric concentrations of NH_3 are available from the Centre for Ecology and Hydrology (CEH) throughout the UK on a 5km by 5km grid. A summary is presented in Table 4.1 showing the mapped annual mean background concentration expected at the site.

Table 4.1 Mapped annual mean background concentration (μgm^{-3})

Pollutant ID	Concentration (μgm^{-3})	Dataset
NO_x	25.5	Defra 2022 Dataset
NO_2	17.8	Defra 2022 Dataset
PM_{10}	11.8	Defra 2022 Dataset
$PM_{2.5}$	8.0	Defra 2022 Dataset
SO_2	4.2	Defra 2001 Dataset
VOCs (Benzene)	0.84	Defra 2001 Dataset
CO	0.4	Defra 2001 Dataset
NH_3	3.2	CEH 2018-2020 Average

Note: Backgrounds presented were doubled for the assessment of short term impacts.
Defra has not updated the mapped background datasets for carbon monoxide, sulphur dioxide and benzene since those produced for a base year of 2001. Defra provides factors for adjusting these pollutants to later years. The factors were published in 2003 and result in reduced concentrations in later years. As a conservative measure the 2001 mapped background concentrations have been presented. However, due to a decline in local industry and shipping, it is anticipated that concentrations of pollutants in the area, in particular sulphur dioxide, have decreased substantially since 2001.

Air Quality Management Areas

The Site lies within the administrative area St Helens Council. There are currently two Air Quality Management Areas (AQMAs) declared by St Helens Council. The closest AQMA to the Site is AQMA No.3 (Borough Road), located approximately 0.3km north of the Site. Figure 4.1 shows

AQMA No.3 and AQMA No.4 are located within 1.5km of the Site. Table 4.2 shows the AQMAs within 5km of the Site.

Table 4.2 Air Quality Management Areas

AQMA	Description	Date Declared
M6 AQMA No.1	An area encompassing the M6 for its entire length within the borough.	30/04/2009
Newton High Street AQMA No.2	High Street Newton le Willow (A49) between the junction of Ashton Road and Church Street.	30/04/2009
Borough Road AQMA No.3	Borough Rd St Helens between the junctions of Westfield Street and Prescott Road including 5-9 Alexandra Drive and 1-17 Prescott Road.	30/11/2011
Reflection Court AQMA No.4	Reflection Court, Linkway West, St Helens.	30/11/2011

Figure 4.1 Location of Air Quality Management Areas

Local monitoring data

Continuous monitoring data

St Helens Council operates four continuous monitors within its jurisdiction. There are two continuous monitors located within 1.5km of the Site. Table 4.3 shows the location of the automatic monitoring sites, the classification type and the distance from the Site. The nearest automatic monitor to the site is located at St Helens Borough Road,0.6km north of the site (see Figure 4.2)

Table 4.3 Automatic monitoring sites operated by St Helens Council

Site ID	Site Name	Classification	X (m)	Y (m)	Inlet Height (Z) (m)	Distance to Road (m)	Distance to Site (m)
LW	St Helens Linkway	Roadside	350815	395260	2.4	5.35	1.0
BR	St Helens Borough Road	Roadside	350403	394961	1.5	2.5	0.6

Figure 4.2 Location of continuous monitors in the vicinity of the Site

Table 4.4 shows the monitored concentrations of NO_2 from automatic monitoring sites. The data was obtained from the most recently available Annual Status Report, published by St Helens Council.

Table 4.4 Summary of automatic NO_2 monitoring data: Annual Mean (μgm^{-3})

Site ID	2016	2017	2018	2019	2020
LW	38	34	33	33	25
BR	39	29	30	29	26

The data in Table 4.4 shows that annual mean NO_2 concentrations are below the 40 μgm^{-3} AQO between 2016 and 2020. Even though the general trend in NO_2 levels was decreasing before the Covid 19 pandemic, 2020 data should be treated with caution. In 2020, traffic flows significantly reduced due to the public having to work from home where possible. The 2020 BR concentrations were used to assess impacts on receptors R5-R8.

Passive monitoring data

St Helens Council operates a network of passive diffusion tubes to monitor annual mean NO_2. As off 2020, there are 32 passive monitoring locations in the Borough. Five monitoring locations are situated within 1.5km of the Site (Figure 4.3). Table 4.5 shows the location of the passive monitoring sites, the classification type and the distance from the Site.

Table 4.5 Passive diffusion tube monitoring sites operated by St Helens Council

Site ID	Site Name	Classification	X (m)	Y (m)	Inlet Height (Z) (m)	Distance to Road (m)	Distance to Site (km)
3	Taylor park	Urban Background	349485	394766	2.4	N/A	0.6
18, 22	Linkway Monitor	Roadside	350815	395265	2.4	5.3	1.0
19, 24	55 Borough Road	Roadside	350438	395005	2.3	2.6	0.6
28	206 Borough Road	Roadside	350156	394848	1.9	6.4	0.4
29	25 Prescot Road	Roadside	350456	395135	2.4	1.9	0.7

Figure 4.3 Location of passive monitors in the vicinity of the Site

Table 4.6 shows the monitored concentrations of NO_2 from passive monitoring sites. The data was obtained from the most recently available Annual Status Report, published by St Helens Council.

Table 4.6 Summary of passive NO_2 monitoring data: annual mean (μgm^{-3})

Site ID	2016	2017	2018	2019	2020
3	14.9	13.5	13.2	14.3	11.2
18, 22	33.5	33.9	30.4	30.7	25.4
19, 24	**46.8**	**42.9**	**48.1**	**44.3**	**42.7**
28	25.8	25.9	25.7	25.2	22.1
29	26.5	25	25.5	25.6	21.4

Table 4.6 shows that annual mean NO_2 concentrations are below the 40 μgm^{-3} AQO between 2016 and 2020 for four of the monitoring sites located within 1.5km of the Site. Site 19, 24 is located in the designated AQMA No.3. Even though the general trend in NO_2 levels was decreasing before the Covid 19 pandemic, 2020 data should be treated with caution. In 2020, traffic flows significantly reduced due to the public having to work from home where possible. No exceedances were found to be above the 60 μgm^{-3} indicating that there are no exceedances of the 1 hour mean objective.

National monitoring data

Hydrogen Chloride (HCl)

Hydrogen chloride is measured on behalf of Defra as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. This consolidates the previous Acid Deposition Monitoring Network (ADMN), and National Ammonia Monitoring Network (NAMN). There are no monitoring locations within 10km of the Facility. The UK ceased monitoring of hydrogen chloride at the end of 2015. In lieu of any local monitoring, the HCl measured at Harwell Monitoring site for 2015 has been used (0.06 μgm^{-3}).

Hydrogen Flouride (HF)

Concentrations of hydrogen fluoride are not measured locally or nationally since this pollutant is not generally of concern in terms of local air quality. However, the EPAQS report 'Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects' contains some estimates of baseline levels, reporting that measured concentrations have been in the range of 0.036 μgm^{-3} to 2.35 μgm^{-3}.

In lieu of any local monitoring, or any other significant local sources, the maximum measured hydrogen fluoride concentration (2.35 μgm^{-3}) was used as the baseline concentration for the assessment as a conservative estimate.

Ammonia (NH_3)

Ammonia is measured as part of the UKEAP project. There are no UKEAP monitoring locations within 10km of the Facility. In lieu of any representative monitoring data, the maximum background concentrations within the modelling domain presented in Table 4.1 has been used as the baseline concentration for the assessment for human health.

Volatile Organic Compounds (VOCs)

Benzene concentrations are measured as part of the automatic and non-automatic hydrocarbon networks. There are no monitoring locations within 10km of the Facility. In lieu of any representative monitoring data, the maximum background concentrations within the modelling domain presented in Table 4.1 has been used as the baseline concentration for the assessment for human health.

Metals

Metals are monitored as part of the Heavy Metals Network. There are no monitoring locations within 10km of the Site. Sheffied Tinsley is the closest monitoring site to the Site. A summary of data used is presented in Table 4.7.

Table 4.7 Metals national monitoring data obtained from Sheffield Tinsley

Substance	Max Concentration (ng/m^3)	Year
Arsenic (As)	4.5	2021
Antimony (Sb)	1.3	2013
Cadmium (Cd)	1.31	2021

Substance	Max Concentration (ng/m^3)	Year
Chromium (Cr)	172.0	2021
Copper (Cu)	42.2	2021
Lead (Pb)	46.3	2021
Manganese (Mn)	132.3	2021
Nickel (Ni)	62.0	2021
Selenium	4.12	2021
Vanadium	2.761	2021

Baseline ambient concentrations and deposition levels

The annual mean background concentrations for the receptors considered in this assessment have used the maximum value presented in Table 4.1. The annual average process contribution is added to the annual average background concentration to give a total concentration at each receptor location. This total concentration can then be compared against the relevant AQS/O and the likelihood of an exceedance determined.

It is not technically rigorous to add predicted short-term or percentile concentrations to ambient background concentrations, since peak contributions from different sources would not necessarily coincide at the same time or at the same location. Without hourly ambient background monitoring data available, it is difficult to make an assessment against the achievement or short-term assessment criteria. For the current assessment, conservative short term ambient levels have been derived by applying a factor of two to the annual mean background data as per the recommendation in the Environmental Agency guidance[1].

In regard to baseline ambient concentrations and deposition levels, over the identified ecological receptors, data were extracted from the Air Pollution Information Service (APIS) website and the Defra background maps. The pollutants of concern were NOx, SO_2 and their contribution to nitrogen and acid deposition. The pollutants of concern were NOx, SO_2 and their contribution to nitrogen and acid deposition. The data applied is presented in Table 4.8.

Table 4.8 Background deposition data for ecological receptors

Site	Designation	Nitrogen Deposition (kgN/ha/yr)	Acidification load (keg/ha/yr)	
			N	S
Mill Brow	LNR	45.92	3.28	0.32
Thatto Heath Meadows	LNR/ LWR	50.68	3.62	0.28
Alexandra Colliery	LWR	32.66	2.33	0.3
Thatto Heath Dam	LWR	20.39	1.62	0.25

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

Site	Designation	Nitrogen Deposition (kgN/ha/yr)	Acidification load (keg/ha/yr)	
			N	S
Leg O'Mutton Dam	LWR	19.98	1.43	0.26
Eccleston Top Dam	LWR	19.98	1.43	0.26
Ravenhead Ponds	LWR	20.28	1.45	0.25
Sherdley Park	LWR	20.46	1.46	0.24
Mill Wood, Eccelston	LWR	32.08	2.29	0.31
Eccleston Golf Course, West Pond	LWR	20.14	1.44	0.26
Old Joans Plantation	LWR	32.46	2.32	0.31
Mill Brook	LWR	32.08	2.29	0.31
Eccleston Mere	LWR	20.14	1.44	0.26
Reeve Court Woodland and grassland	LWR	33.3	2.38	0.29
Sales Wood/Gorse Plantation	LWR	32.46	2.32	0.31
St Helens Canal, South of Burgy Bank	LWR	19.93	1.42	0.26
Haresfinch Burgy Bank	LWR	19.93	1.42	0.26
Windlehurst Quarry	LWR	19.85	1.42	0.26

5. Assessment of impact

This section sets out the results of the dispersion modelling and compares predicted ground level concentrations against the assessment criteria detailed in Section 3. The predicted concentrations resulting from the process (i.e. the process contribution (PC)) are presented along with background concentrations and the percentage contribution that the predicted environmental concentrations (PEC), would make towards the relevant standard, objective or guideline value.

5.1 Meteorological data sensitivity analysis

As described in Section 3.3, results were calculated separately for five different years of meteorological data (‘met year’). For each of the specific receptors and for each pollutant measure, the met year giving the highest concentration was determined, and the corresponding concentration is the one presented here. In other words, each of the individual results are the worst case for that measure. For plotting the concentration isopleths, a single met year was chosen, namely the year producing the highest mean concentration at any point in the model domain. This means that some results in the tables of specific receptors will not accord exactly with the contour bandings on the figure (they will be higher in the tables).

5.2 Human Receptors

Table 5.1 presents a summary of the maximum predicted PC at any human receptor for all pollutants modelled. Table 5.2 presents a summary of the maximum predicted PC of metals.

For the majority of pollutants, the maximum PC is predicted to be less than 5% for long-term averages and less than 10% for short-term averages (Where the PEC is less than 70% of the AQAL), therefore the change in concentration as a result of the Proposed Development is considered to be Negligible.

Table 5.1 Impact to air quality at human receptors (Maximum PC)

Pollutant	Averaging Period	AQAL (μgm^{-3})	Receptor at which max PC change occurs	Background	Existing Conc (μgm^{-3})	Proposed Conc (μgm^{-3})	Max PC (μgm^{-3})	Max PC change as a % of AQAL	Max PEC (μgm^{-3})	Max PEC as a % of AQAL
NO_2	Annual	40	R6	26.00	3.05×10^{-4}	4.01×10^{-4}	9.59×10^{-5}	<0.01%	26.00	65.00%
	1-hour mean, no more than 18 exceedances a year (equivalent of 99.79 percentile)	200	R2	17.77	4.27	5.61	1.35	0.67%	56.28	28.14%
PM_{10}	Annual	40	R6	11.78	0.86	1.18	0.32	0.80%	12.96	32.40%
	24-hour mean, no more than 35 exceedances per year (90.41 percentile)	50	R7	11.78	3.14	4.34	1.20	2.40%	27.90	55.80%
$PM_{2.5}$	Annual	20	R6	7.98	0.86	1.18	0.32	1.60%	17.14	85.69%
SO_2	1-hour mean, not to be exceeded more than 24 times per year (equivalent to 99.73 percentile)	350	R2	4.15	4.43	5.82	1.39	0.40%	14.12	4.03%
	24-hour mean not to be exceeded more than 3 times per year (equivalent to 99.18 percentile)	125	R1	4.15	1.11	1.46	0.35	0.35%	10.13	8.10%
	15-minute mean, not to be exceeded more than 35 times a year	266	R10	4.15	5.07	6.65	1.59	0.60%	10.80	4.06%

Pollutant	Averaging Period	AQAL (μgm^{-3})	Receptor at which max PC change occurs	Background	Existing Conc (μgm^{-3})	Proposed Conc (μgm^{-3})	Max PC (μgm^{-3})	Max PC change as a % of AQAL	Max PEC (μgm^{-3})	Max PEC as a % of AQAL
	(equivalent to 99.9 percentile)									
HF	1-hour	160	R5	2.60	2.38×10^{-4}	3.18×10^{-4}	0.00	<0.01%	5.20	3.25%
	Monthly	16	R14	2.60	5.52×10^{-7}	1.75	1.75	10.94%	4.35	27.19%
CO	8-hour	10000	R1	0.40	2.87	3.74	0.87	0.01%	4.54	0.05%
	1-hour	30000	R5	0.40	5.24	6.83	1.59	0.01%	7.63	0.03%
HCL	1-hour	750	R5	0.06	0.56	0.72	0.16	0.02%	0.84	0.11%
Phenol	Annual	200	R6	0.00	0.14	0.19	0.05	0.10%	0.19	0.10%
	1-hour	3900	R6	0.00	6.93	9.24	2.30	0.24%	9.24	0.24%
HCHO	Annual	5	R6	0.00	1.40×10^{-4}	1.91E-04	5.20×10^{-5}	<0.01%	0.00	0.00%
	30-minute	100	R6	0.00	0.01	0.01	2.61×10^{-3}	0.01%	0.01	0.01%
NH_3	Annual	180	R6	3.10	1.45	1.96	0.52	0.29%	8.16	4.53%
	1-hour	2500	R6	3.10	70.97	94.10	23.13	0.93%	100.30	4.01%
VOCs	Annual	5	R6	0.90	0.72	0.98	0.26	19.60%	2.78	55.60%
	24-hour	30	R2	2.20	5.70	7.77	2.15	25.91%	12.17	40.58%

Table 5.2 Impact to air quality at human receptors – Metals (Maximum PC)

Pollutant	Averaging Period	AQAL (μgm^{-3})	Receptor at which maximum PC change occurs	Existing PC [(a)]	Proposed PC [(a)]	PC Change	% PC of AQAL	PEC	% PEC of AQAL
Arsenic	Annual	0.006	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	0.48%	4.57×10^{-3}	76.20%
Antimony	Annual	5	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	1.36×10^{-3}	0.03%
	1-hour	150	R5	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	4.69×10^{-3}	<0.01%
Cadmium	Annual	5	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	1.37×10^{-3}	0.03%
Chromium III	Annual	5	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	0.17	3.44%
	1-hour	150	R5	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	0.35	0.23%
Chromium VI[(b)]	Annual	0.00025	R6	4.04×10^{-7}	8.08×10^{-7}	4.04×10^{-7}	0.16%	0.17	68800.32%
Copper	Annual	10	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	0.04	0.42%
	1-hour	200	R5	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	0.09	0.04%
Lead	Annual	0.25	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	0.01%	0.05	18.55%
Manganese	Annual	0.15	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	0.02%	0.13	88.23%
	1-hour	1,500	R5	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	0.27	0.02%
Selenium	Annual	1	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	4.18×10^{-3}	0.42%
	1-hour	30	R5	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	0.01	0.03%
Nickel	Annual	0.02	R6	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	0.15%	0.06	310.25%

Pollutant	Averaging Period	AQAL (µgm^{-3})	Receptor at which maximum PC change occurs	Existing PC [(a)]	Proposed PC [(a)]	PC Change	% PC of AQAL	PEC	% PEC of AQAL
Vanadium	24-hour	1	R5	0.03	0.05	0.03	2.51%	0.05	5.29%

Note: (a) Emission concentrations were adjusted accordingly assuming the worst case emission factor of 0.013 (b) Further assessment of the Chromium VI EVL was undertaken by considering to the EU Best Available Techniques(BREF) reference document for manufacturing of glass[2]. Table 3.18 in this document states the emission of total Chromium expressed as emissions factors is 0.000044 kg/melted tonnes with secondary dust abatement. Calculations based on plant mass balance and using the typical material input of 359 tonnes per day, results in an emission rate of 0.000183 g/s was applied to this assessment for Chromium VI, considering that metal emissions were modelled collectively as 1g/s and adjusted during post processing.

[2] Joint Research Centre, Institute for Prospective Technological Studies, Sissa, A., Delgado Sancho, L., Roudier, S., et al. (2013) Best available techniques (BAT) reference document for the manufacture of glass : industrial emissions Directive 2010/75/EU: integrated pollution prevention and control. Publications Office. https://data.europa.eu/doi/10.2791/70161

5.3 Ecological effects

Critical levels

Annual mean nitrogen oxide (NOx)

Predicted concentrations of annual mean NOx are given in Table 5.3. These concentrations assume the installation operates 8,760 hours a year.

Table 5.3 Critical levels assessment of annual mean NOx impacts

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critical Level
Mill Brow (LNR)	30	1.92×10^{-4}	2.53×10^{-4}	6.05×10^{-5}	<0.01%
Thatto Heath Meadows (LNR/ LWR)	30	1.00×10^{-4}	1.32×10^{-4}	3.15×10^{-5}	<0.01%
Alexandra Colliery (LWR)	30	2.05×10^{-5}	2.70×10^{-5}	6.46×10^{-6}	<0.01%
Thatto Heath Dam (LWR)	30	1.72×10^{-4}	2.27×10^{-4}	5.43×10^{-5}	<0.01%
Leg O'Mutton Dam (LWR)	30	1.49×10^{-4}	1.96×10^{-4}	4.69×10^{-5}	<0.01%
Eccleston Top Dam (LWR)	30	1.34×10^{-4}	1.77×10^{-4}	4.23×10^{-5}	<0.01%
Ravenhead Ponds (LWR)	30	2.23×10^{-4}	2.93×10^{-4}	7.03×10^{-5}	<0.01%
Sherdley Park (LWR)	30	1.66×10^{-4}	2.18×10^{-4}	5.22×10^{-5}	<0.01%
Mill Wood, Eccelston (LWR)	30	1.10×10^{-4}	1.44×10^{-4}	3.45×10^{-5}	<0.01%
Eccleston Golf Course, West Pond (LWR)	30	9.84×10^{-5}	1.29×10^{-4}	3.10×10^{-5}	<0.01%
Old Joans Plantation (LWR)	30	1.02×10^{-4}	1.34×10^{-4}	3.22×10^{-5}	<0.01%
Mill Brook (LWR)	30	1.05×10^{-4}	1.38×10^{-4}	3.31×10^{-5}	<0.01%
Eccleston Mere (LWR)	30	9.33×10^{-5}	1.23×10^{-4}	2.94×10^{-5}	<0.01%

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critical Level
Reeve Court Woodland and grassland (LWR)	30	2.92×10^{-5}	3.84×10^{-5}	9.20×10^{-6}	<0.01%
Sales Wood/Gorse Plantation (LWR)	30	7.14×10^{-5}	9.39×10^{-5}	2.25×10^{-5}	<0.01%
St Helens Canal, South of Burgy Bank (LWR)	30	7.73×10^{-5}	1.02×10^{-4}	2.43×10^{-5}	<0.01%
Haresfinch Burgy Bank (LWR)	30	7.52×10^{-5}	9.88×10^{-5}	2.37×10^{-5}	<0.01%
Windlehurst Quarry (LWR)	30	6.98×10^{-5}	9.18×10^{-5}	2.20×10^{-5}	<0.01%

PC is below 100% of the AQS, and therefore impacts are insignificant.

Daily mean nitrogen oxide (NOx)

Predicted concentrations of daily mean NOx are given in Table 5.4, assuming the facility operates 24 hours per day.

Table 5.4 Critical levels assessment of daily mean NOx impacts

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critical Level
Mill Brow (LNR)	200	1.93×10^{-3}	2.54×10^{-3}	6.07×10^{-4}	<0.01%
Thatto Heath Meadows (LNR/ LWR)	200	2.50×10^{-3}	3.28×10^{-3}	7.86×10^{-4}	<0.01%
Alexandra Colliery (LWR)	200	1.72×10^{-3}	2.26×10^{-3}	5.42×10^{-4}	<0.01%
Thatto Heath Dam (LWR)	200	2.81×10^{-3}	3.70×10^{-3}	8.85×10^{-4}	<0.01%
Leg O'Mutton Dam (LWR)	200	1.92×10^{-3}	2.53×10^{-3}	6.05×10^{-4}	<0.01%
Eccleston Top Dam (LWR)	200	1.48×10^{-3}	1.95×10^{-3}	4.66×10^{-4}	<0.01%

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critical Level
Ravenhead Ponds (LWR)	200	1.30×10^{-3}	1.71×10^{-3}	4.10×10^{-4}	<0.01%
Sherdley Park (LWR)	200	1.73×10^{-3}	2.28×10^{-3}	5.45×10^{-4}	<0.01%
Mill Wood, Eccelston (LWR)	200	1.26×10^{-3}	1.66×10^{-3}	3.98×10^{-4}	<0.01%
Eccleston Golf Course, West Pond (LWR)	200	1.27×10^{-3}	1.67×10^{-3}	3.99×10^{-4}	<0.01%
Old Joans Plantation (LWR)	200	1.19×10^{-3}	1.56×10^{-3}	3.73×10^{-4}	<0.01%
Mill Brook (LWR)	200	1.19×10^{-3}	1.56×10^{-3}	3.74×10^{-4}	<0.01%
Eccleston Mere (LWR)	200	1.15×10^{-3}	1.51×10^{-3}	3.61×10^{-4}	<0.01%
Reeve Court Woodland and grassland (LWR)	200	7.02×10^{-4}	9.23×10^{-4}	2.21×10^{-4}	<0.01%
Sales Wood/Gorse Plantation (LWR)	200	7.54×10^{-4}	9.92×10^{-4}	2.37×10^{-4}	<0.01%
St Helens Canal, South of Burgy Bank (LWR)	200	5.55×10^{-4}	7.30×10^{-4}	1.75×10^{-4}	<0.01%
Haresfinch Burgy Bank (LWR)	200	5.46×10^{-4}	7.18×10^{-4}	1.72×10^{-4}	<0.01%
Windlehurst Quarry (LWR)	200	5.84×10^{-4}	7.68×10^{-4}	1.84×10^{-4}	<0.01%

Table 5.4 indicates that the daily mean NOx PC for the ecological receptors is less than 100% of the critical level for the local designations and less than 1% of the critical level and therefore insignificant.

Annual mean sulphur dioxide (SO_2)

Table 5.5 presents the assessment of predicted SO_2 concentrations against established critical levels for the ecological receptors considered in this study.

Table 5.5 Critical levels assessment of annual mean SO_2

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Mill Brow (LNR)	20	0.10	0.13	0.03	0.15%
Thatto Heath Meadows (LNR/ LWR)	20	0.05	0.07	0.02	0.08%
Alexandra Colliery (LWR)	20	0.10	0.13	0.03	0.15%
Thatto Heath Dam (LWR)	20	0.05	0.07	0.02	0.08%
Leg O'Mutton Dam (LWR)	20	0.01	0.01	0.00	0.02%
Eccleston Top Dam (LWR)	20	0.09	0.11	0.03	0.14%
Ravenhead Ponds (LWR)	20	0.07	0.10	0.02	0.12%
Sherdley Park (LWR)	20	0.07	0.09	0.02	0.11%
Mill Wood, Eccelston (LWR)	20	0.11	0.15	0.04	0.18%
Eccleston Golf Course, West Pond (LWR)	20	0.08	0.11	0.03	0.13%
Old Joans Plantation (LWR)	20	0.06	0.07	0.02	0.09%
Mill Brook (LWR)	20	0.05	0.06	0.02	0.08%
Eccleston Mere (LWR)	20	0.05	0.07	0.02	0.08%
Reeve Court Woodland and grassland (LWR)	20	0.05	0.07	0.02	0.08%
Sales Wood/Gorse Plantation (LWR)	20	0.05	0.06	0.01	0.07%
St Helens Canal, South of Burgy Bank (LWR)	20	0.01	0.02	0.00	0.02%

Receptor	Critical Level (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Haresfinch Burgy Bank (LWR)	20	0.04	0.05	0.01	0.06%
Windlehurst Quarry (LWR)	20	0.04	0.05	0.01	0.06%

Table 5.5 indicates that the annual mean SO_2 PC for the ecological receptors is less than 100% of the critical level for the local designations and less than 1% of the critical level and therefore insignificant.

Annual mean ammonia (NH_3)

Table 5.6 presents the assessment of predicted NH_3 concentrations against established critical levels for the ecological receptors considered in this study. These concentrations assume the facility operate 8,760 hours a year.

Table 5.6 Critical levels assessment of annual mean NH_3

Receptor	Critical Level (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Mill Brow (LNR)	3	0.73	0.97	0.24	0.13 %
Thatto Heath Meadows (LNR/ LWR)	3	0.41	0.54	0.14	0.08 %
Alexandra Colliery (LWR)	3	0.74	0.98	0.24	0.13%
Thatto Heath Dam (LWR)	3	0.40	0.53	0.13	0.07%
Leg O'Mutton Dam (LWR)	3	0.06	0.09	0.03	0.02%
Eccleston Top Dam (LWR)	3	0.55	0.73	0.18	0.10%
Ravenhead Ponds (LWR)	3	0.62	0.83	0.21	0.12%
Sherdley Park (LWR)	3	0.55	0.74	0.19	0.10%
Mill Wood, Eccelston (LWR)	3	0.80	1.09	0.29	0.16%

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Eccleston Golf Course, West Pond (LWR)	3	0.62	0.82	0.20	0.11%
Old Joans Plantation (LWR)	3	0.45	0.60	0.15	0.08%
Mill Brook (LWR)	3	0.39	0.52	0.13	0.07%
Eccleston Mere (LWR)	3	0.41	0.55	0.14	0.08%
Reeve Court Woodland and grassland (LWR)	3	0.43	0.57	0.14	0.08%
Sales Wood/Gorse Plantation (LWR)	3	0.37	0.49	0.12	0.07%
St Helens Canal, South of Burgy Bank (LWR)	3	0.11	0.14	0.04	0.02%
Haresfinch Burgy Bank (LWR)	3	0.28	0.37	0.09	0.05%
Windlehurst Quarry (LWR)	3	0.30	0.41	0.11	0.06%

Table 5.6 indicates that the annual mean NH_3 PC the ecological receptors is less than 100% of the critical level for the local designations and less than 1% of the critical level and therefore insignificant.

Daily mean hydrogen flouride (HF)

Table 5.7 Critical levels assessment of daily mean HF

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Mill Brow (LNR)	5	3.88×10^{-5}	5.17×10^{-5}	1.29×10^{-5}	<0.01%
Thatto Heath Meadows (LNR/ LWR)	5	1.80×10^{-5}	2.40×10^{-5}	6.01×10^{-6}	<0.01%

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Alexandra Colliery (LWR)	5	2.62×10^{-5}	3.50×10^{-5}	8.74×10^{-6}	<0.01%
Thatto Heath Dam (LWR)	5	4.28×10^{-5}	5.71×10^{-5}	1.43×10^{-5}	<0.01%
Leg O'Mutton Dam (LWR)	5	2.93×10^{-5}	3.91×10^{-5}	9.76×10^{-6}	<0.01%
Eccleston Top Dam (LWR)	5	2.25×10^{-5}	3.01×10^{-5}	7.51×10^{-6}	<0.01%
Ravenhead Ponds (LWR)	5	1.98×10^{-5}	2.65×10^{-5}	6.62×10^{-6}	<0.01%
Sherdley Park (LWR)	5	2.64×10^{-5}	3.52×10^{-5}	8.79×10^{-6}	<0.01%
Mill Wood, Eccelston (LWR)	5	1.92×10^{-5}	2.57×10^{-5}	6.41×10^{-6}	<0.01%
Eccleston Golf Course, West Pond (LWR)	5	1.93×10^{-5}	2.58×10^{-5}	6.44×10^{-6}	<0.01%
Old Joans Plantation (LWR)	5	1.80×10^{-5}	2.41×10^{-5}	6.02×10^{-6}	<0.01%
Mill Brook (LWR)	5	1.81×10^{-5}	2.41×10^{-5}	6.03×10^{-6}	<0.01%
Eccleston Mere (LWR)	5	1.75×10^{-5}	2.33×10^{-5}	5.83×10^{-6}	<0.01%
Reeve Court Woodland and grassland (LWR)	5	1.07×10^{-5}	1.43×10^{-5}	3.56×10^{-6}	<0.01%
Sales Wood/Gorse Plantation (LWR)	5	1.15×10^{-5}	1.53×10^{-5}	3.83×10^{-6}	<0.01%
St Helens Canal, South of Burgy Bank (LWR)	5	8.46×10^{-6}	1.13×10^{-5}	2.82×10^{-6}	<0.01%
Haresfinch Burgy Bank (LWR)	5	8.32×10^{-6}	1.11×10^{-5}	2.77×10^{-6}	<0.01%
Windlehurst Quarry (LWR)	5	8.89×10^{-6}	1.19×10^{-5}	2.96×10^{-6}	<0.01%

Table 5.7 indicates that the daily mean HF PC the ecological receptors is less than 100% of the critical level for the local designations and less than 1% of the critical level and therefore insignificant.

Weekly mean hydrogen flouride (HF)

Table 5.8 Critical levels assessment of weekly mean HF

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Mill Brow (LNR)	0.5	1.05×10^{-2}	1.40×10^{-2}	3.51×10^{-3}	0.70%
Thatto Heath Meadows (LNR/ LWR)	0.5	9.41×10^{-3}	1.25×10^{-2}	3.14×10^{-3}	0.63%
Alexandra Colliery (LWR)	0.5	3.21×10^{-3}	4.28×10^{-3}	1.07×10^{-3}	0.21%
Thatto Heath Dam (LWR)	0.5	2.47×10^{-2}	3.29×10^{-2}	8.22×10^{-3}	1.64%
Leg O'Mutton Dam (LWR)	0.5	1.34×10^{-2}	1.78×10^{-2}	4.46×10^{-3}	0.89%
Eccleston Top Dam (LWR)	0.5	1.12×10^{-2}	1.50×10^{-2}	3.75×10^{-3}	0.75%
Ravenhead Ponds (LWR)	0.5	7.64×10^{-3}	1.02×10^{-2}	2.55×10^{-3}	0.51%
Sherdley Park (LWR)	0.5	8.61×10^{-3}	1.15×10^{-2}	2.87×10^{-3}	0.57%
Mill Wood, Eccelston (LWR)	0.5	1.03×10^{-2}	1.37×10^{-2}	3.42×10^{-3}	0.68%
Eccleston Golf Course, West Pond (LWR)	0.5	7.29×10^{-3}	9.72×10^{-3}	2.43×10^{-3}	0.49%
Old Joans Plantation (LWR)	0.5	8.03×10^{-3}	1.07×10^{-2}	2.68×10^{-3}	0.54%
Mill Brook (LWR)	0.5	9.83×10^{-3}	1.31×10^{-2}	3.28×10^{-3}	0.66%
Eccleston Mere (LWR)	0.5	7.08×10^{-3}	9.44×10^{-3}	2.36×10^{-3}	0.47%
Reeve Court Woodland and grassland (LWR)	0.5	3.74×10^{-3}	4.99×10^{-3}	1.25×10^{-3}	0.25%

Receptor	Critical Level (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC	PC Change	% PC of Critcal Level
Sales Wood/Gorse Plantation (LWR)	0.5	6.80×10^{-3}	9.06×10^{-3}	2.27×10^{-3}	0.45%
St Helens Canal, South of Burgy Bank (LWR)	0.5	3.62×10^{-3}	4.83×10^{-3}	1.21×10^{-3}	0.24%
Haresfinch Burgy Bank (LWR)	0.5	3.52×10^{-3}	4.70×10^{-3}	1.17×10^{-3}	0.23%
Windlehurst Quarry (LWR)	0.5	3.94×10^{-3}	5.25×10^{-3}	1.31×10^{-3}	0.26%

Table 5.8 indicates that the weekly mean HF PC the ecological receptors is less than 100% of the critical level for the local designations and less than 1% of the critical level and therefore insignificant.

Critical loads

Nitrogen deposition

Predicted nitrogen deposition is given in Table 5.9. These tables assume the installation operated for up to 8,670 hours a year.

Table 5.9 Nitrogen deposition impacts

Receptor	Critical load (kgN/ha/yr)	Existing PC Total (kgN/ha/yr)	Proposed PC Total (kgN/ha/yr)	Change in PC (kgN/ha/yr)	% PC of Critical Load
Mill Brow (LNR)	10	5.71	7.56	1.85	18.55%
Thatto Heath Meadows (LNR/ LWR)	10	3.17	4.24	1.07	10.71%
Alexandra Colliery (LWR)	10	0.48	0.72	0.23	2.33%
Thatto Heath Dam (LWR)	5	4.30	5.68	1.37	27.48%
Leg O'Mutton Dam (LWR)	5	4.83	6.47	1.64	32.79%
Eccleston Top Dam (LWR)	6	4.30	5.77	1.47	24.50%

Receptor	Critical load (kgN/ha/yr)	Existing PC Total (kgN/ha/yr)	Proposed PC Total (kgN/ha/yr)	Change in PC (kgN/ha/yr)	% PC of Critical Load
Ravenhead Ponds (LWR)	5	6.20	8.47	2.28	45.51%
Sherdley Park (LWR)	6	4.84	6.41	1.57	26.16%
Mill Wood, Eccelston (LWR)	10	3.48	4.65	1.18	11.75%
Eccleston Golf Course, West Pond (LWR)	5	3.07	4.09	1.02	20.34%
Old Joans Plantation (LWR)	10	3.18	4.26	1.08	10.83%
Mill Brook (LWR)	3	3.32	4.45	1.12	37.46%
Eccleston Mere (LWR)	5	2.88	3.86	0.97	19.46%
Reeve Court Woodland and grassland (LWR)	10	0.84	1.12	0.28	2.79%
Sales Wood/Gorse Plantation (LWR)	10	2.20	2.92	0.72	7.24%
St Helens Canal, South of Burgy Bank (LWR)	5	2.33	3.17	0.84	16.82%
Haresfinch Burgy Bank (LWR)	6	2.27	3.09	0.82	13.67%
Windlehurst Quarry (LWR)	6	2.10	2.83	0.73	12.19%

The nitrogen deposition PC at the local designated sites is below 100% of the relevant critical load and therefore impacts are insignificant.

Acid deposition

Table 5.10 and Table 5.11 presents the assessment of predicted acid deposition using the critical load function on the ecological receptors considered in this study. This table assumes the installation operates for 8,670 hours a year.

Table 5.10 Output of APIS critical load function tool (sulphur)

Receptor	Existing PC[(a)]	Proposed PC	Change PC	Background	PEC
Mill Brow (LNR)	0.0264	0.035	0.0082	0.32	0.35
Thatto Heath Meadows (LNR/ LWR)	0.0137	0.018	0.0043	0.28	0.30
Alexandra Colliery (LWR)	0.0028	0.004	0.0009	0.28	0.28
Eccleston Top Dam (LWR)	0.0185	0.024	0.0057	0.28	0.30
Sherdley Park (LWR)	0.0228	0.030	0.0070	0.28	0.31
Mill Wood, Eccleston (LWR)	0.0150	0.020	0.0047	0.28	0.30
Old Joans Plantation (LWR)	0.0140	0.018	0.0043	0.28	0.30
Mill Brook (LWR)	0.0144	0.019	0.0045	0.28	0.30
Reeve Court woodland and grassland (LWR)	0.0040	0.005	0.0012	0.28	0.29
Sales Wood/ Gorse Plantation (LWR)	0.0098	0.013	0.0030	0.28	0.29
Haresfinch Burgy Bank (LWR)	0.0103	0.014	0.0032	0.28	0.29
Windlehurst Quarry (LWR)	0.0096	0.013	0.0030	0.28	0.29

Table 5.11 Output of APIS critical load function tool (nitrogen)

Receptor	Existing PC[(a)]	Proposed PC	Change PC	Background	PEC
Mill Brow (LNR)	0.4081	0.541	0.1325	3.28	3.82
Thatto Heath Meadows (LNR/ LWR)	0.2265	0.303	0.0765	3.62	3.92

Receptor	Existing PC[(a)]	Proposed PC	Change PC	Background	PEC
Alexandra Colliery (LWR)	0.0345	0.051	0.0167	3.62	3.67
Eccleston Top Dam (LWR)	0.3071	0.412	0.1050	3.62	4.03
Sherdley Park (LWR)	0.3459	0.458	0.1121	3.62	4.08
Mill Wood, Eccleston (LWR)	0.2484	0.332	0.0839	3.62	3.95
Old Joans Plantation (LWR)	0.2270	0.304	0.0774	3.62	3.92
Mill Brook (LWR)	0.2374	0.318	0.0803	3.62	3.94
Reeve Court woodland and grassland (LWR)	0.0601	0.080	0.0199	3.62	3.70
Sales Wood/ Gorse Plantation (LWR)	0.1568	0.209	0.0517	3.62	3.83
Haresfinch Burgy Bank (LWR)	0.1624	0.221	0.0586	3.62	3.84
Windlehurst Quarry (LWR)	0.1497	0.202	0.0522	3.62	3.82

The results in Table 5.10 and Table 5.11 indicate that for the local designated sites, the PC is less than 100% of the relevant critical loads and impacts can be screened out as insignificant.

6. Conclusion

This assessment has used detailed dispersion modelling to undertake an impact assessment of emissions to air to determine the variance between the current and anticipated inventory for releases to air at the St Helens Site associated with the modifications of stacks.

The impact assessment demonstrated that exceedances of any AQS/AQO/EAL are unlikely at the local receptors identified to protect human health. With regards to ecological receptors, the assessment demonstrated that there are no exceedance of the ambient pollution concentration and deposition levels. Therefore, the impact of Site emissions on human and ecological receptors is insignificant.

Appendix A Model Checklist

Item	✓/×	Reason for Omission
Location map	✓	
Site plan	✓	
List of pollutants modelled and relevant air quality guidelines	✓	
Details of modelled scenarios	✓	
Details of relevant ambient concentrations used	✓	
Model description and justification	✓	
Special model treatments used	✓	
Table of emission parameters used	✓	
Details of modelled domain and receptors	✓	
Details of meteorological data used, including origin, and justification	✓	
Details of terrain treatment	✓	
Details of buildings treatment	✓	
Details of modelling wet/dry deposition	✓	
Sensitivity analysis	✓	
Assessment of impacts	✓	
Model input files	✓	

Appendix B Full Results

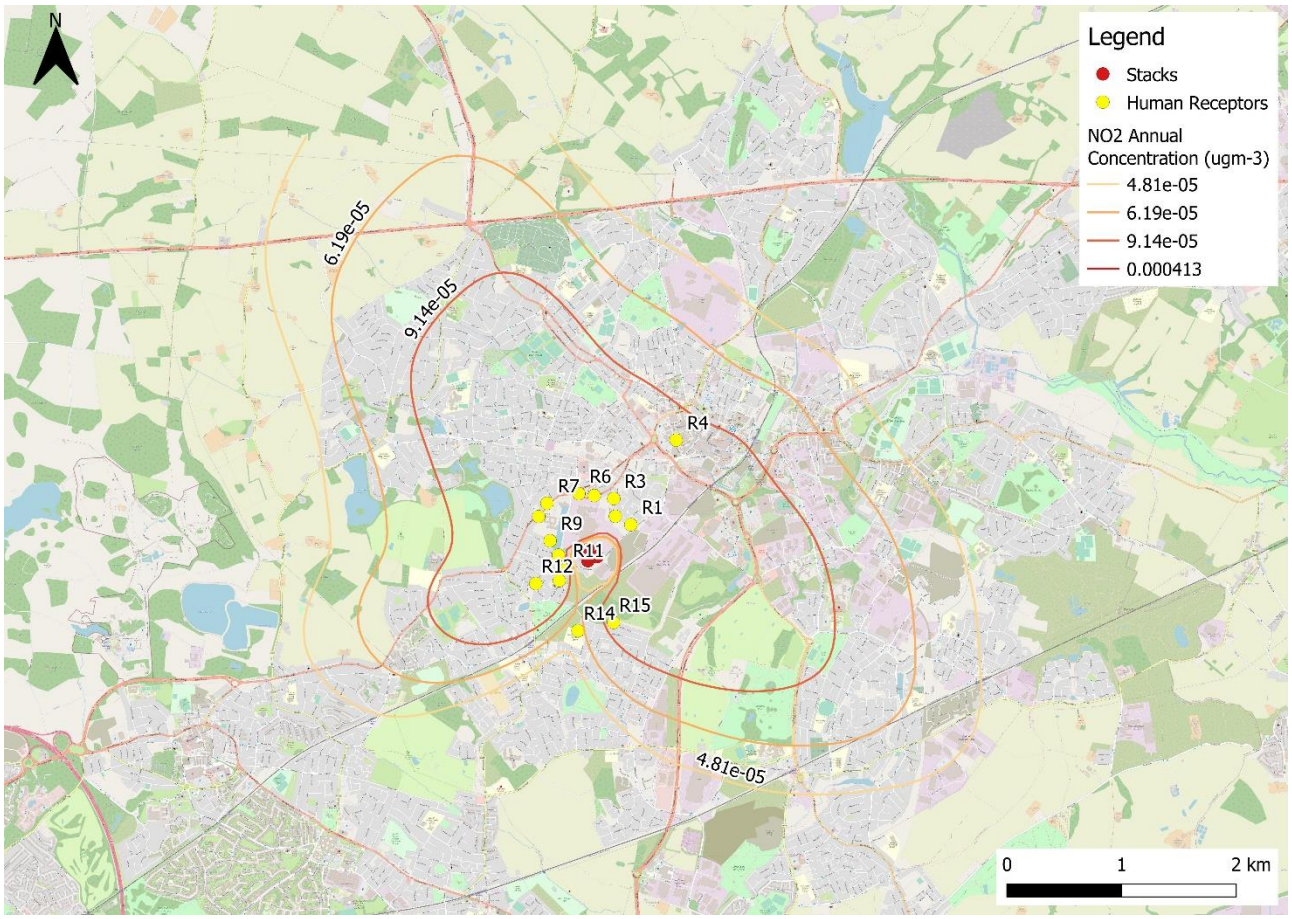
Nitrogen Dioxide (NO_2)

Predicted concentrations of annual mean NO_2 are given in are given in Table 6.1. The contour plot for annual mean NO_2 contours is shown in Figure 6.1. As the PCs are less than 100 % of the AQS impacts can been screened out as insignificant.

Table 6.1 Annual Mean NO_2 Impacts

Receptor	Background	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQS	40 μgm^{-3}						
R1	17.77	2.36E-04	3.10E-04	7.42×10^{-5}	<0.01%	17.77	44.43%
R2	17.77	1.76×10^{-4}	2.32×10^{-4}	5.54×10^{-5}	<0.01%	17.77	44.43%
R3	17.77	1.94×10^{-4}	2.56×10^{-4}	6.12E x 10^{-5}	<0.01%	17.77	44.43%
R4	17.77	1.18×10^{-4}	1.55×10^{-4}	3.70×10^{-5}	<0.01%	17.77	44.43%
R5	26.00	2.40×10^{-4}	3.16×10^{-4}	7.56×10^{-5}	<0.01%	26.00	44.43%
R6	26.00	3.05×10^{-4}	4.01×10^{-4}	9.59×10^{-5}	<0.01%	26.00	44.43%
R7	26.00	2.48×10^{-4}	3.26×10^{-4}	7.81×10^{-5}	<0.01%	26.00	44.43%
R8	26.00	1.95×10^{-4}	2.56×10^{-4}	6.13×10^{-5}	<0.01%	26.00	44.43%
R9	17.77	1.78×10^{-4}	2.35×10^{-4}	5.62×10^{-5}	<0.01%	17.77	44.43%
R10	17.77	1.13×10^{-4}	1.49×10^{-4}	3.57×10^{-5}	<0.01%	17.77	44.43%
R11	17.77	8.05×10^{-4}	1.06×10^{-4}	2.53×10^{-5}	<0.01%	17.77	44.43%
R12	17.77	1.53×10^{-4}	2.02×10^{-4}	4.82×10^{-5}	<0.01%	17.77	44.43%
R13	17.77	1.20×10^{-4}	1.58×10^{-4}	3.78×10^{-5}	<0.01%	17.77	44.43%
R14	17.77	5.05×10^{-5}	6.64×10^{-5}	1.59×10^{-5}	<0.01%	17.77	44.43%
R15	17.77	8.96×10^{-5}	1.18×10^{-4}	2.82×10^{-5}	<0.01%	17.77	44.43%

Figure 6.1 Contour Plot PC NO_2 Annual Mean



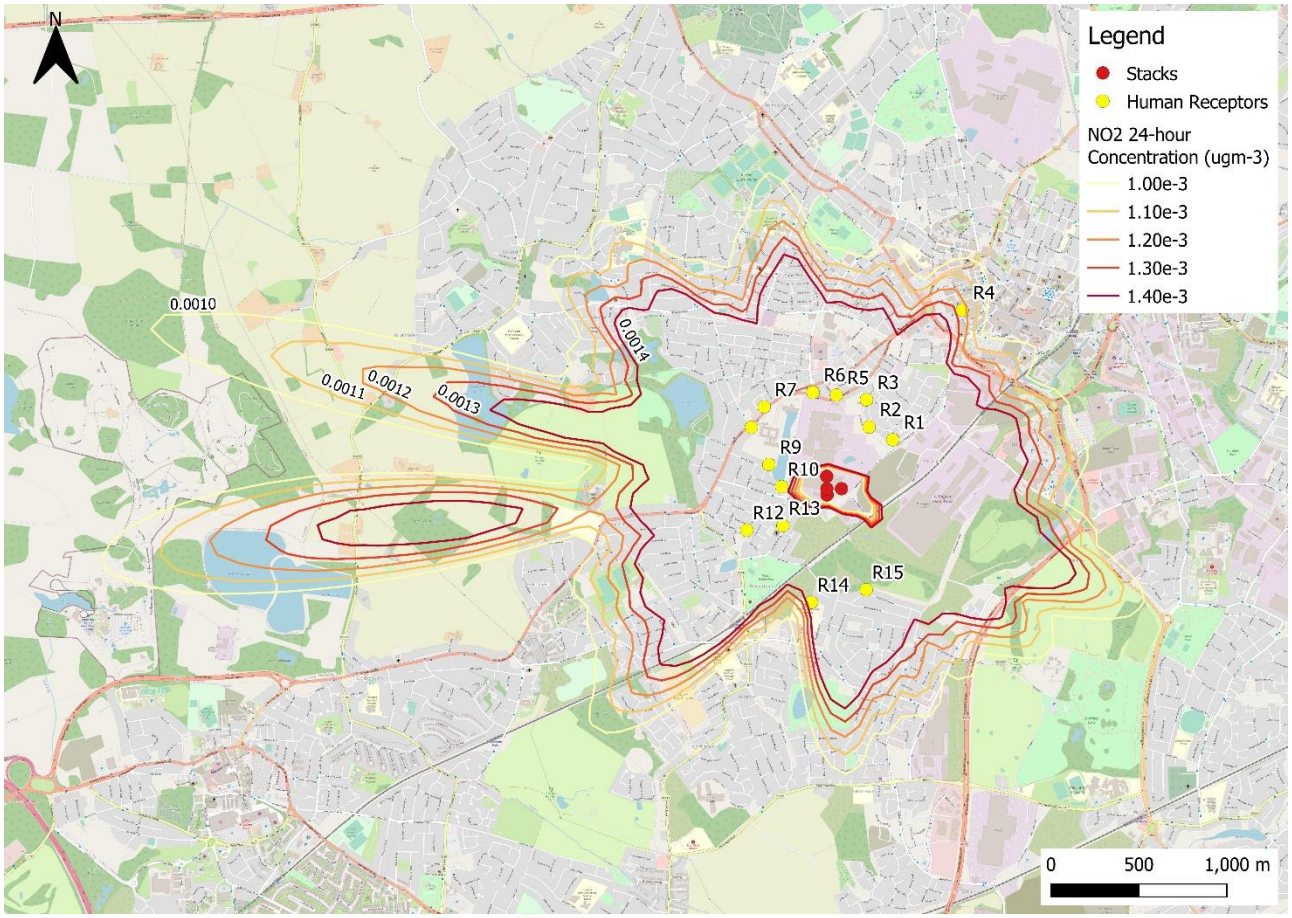
Predicted concentrations of 99.79th percentile 1-hour mean NO_2 are given in are given in Table 6.2. The contour plot for 99.79th percentile 1-hour mean NO_2 is shown in Figure 6.2. The PC does not exceed the AQS at all modelled receptors.

Table 6.2 99.79 Percentile 1-hour mean NO_2 impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQS	200 μgm^{-3}						
R1	17.77	3.79	4.98	1.20	0.60%	40.52	20.26%
R2	17.77	4.27	5.61	1.35	0.67%	41.15	20.58%
R3	17.77	3.34	4.39	1.05	0.53%	39.94	19.97%
R4	17.77	1.40	1.85	0.44	0.22%	37.39	18.69%
R5	26.00	3.25	4.28	1.03	0.51%	56.28	28.14%
R6	26.00	3.10	4.08	0.98	0.49%	56.08	28.04%
R7	26.00	2.87	3.78	0.91	0.45%	55.78	27.89%

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R8	26.00	2.91	3.83	0.92	0.46%	55.83	27.91%
R9	17.77	3.90	5.13	1.23	0.62%	40.68	20.34%
R10	17.77	4.00	5.26	1.26	0.63%	40.80	20.40%
R11	17.77	3.18	4.18	1.00	0.50%	39.72	19.86%
R12	17.77	2.77	3.65	0.87	0.44%	39.19	19.59%
R13	17.77	3.32	4.36	1.05	0.52%	39.90	19.95%
R14	17.77	2.23	2.93	0.70	0.35%	38.48	19.24%
R15	17.77	2.70	3.55	0.85	0.43%	39.09	19.55%

Figure 6.2 Contour Plot PC NO_2 99.79 Percentile 1-hour Mean



Since the installation will operate for fewer hours than modelled, the likelihood that it will be running during those hours of the year that produce the highest concentrations is very low. As there are not exceedances of the PEC impacts from NO_2 emission on human receptors are considered not significant.

Particulate matter (PM_{10} and $PM_{2.5}$)

Predicted concentrations of annual mean PM_{10}, daily mean PM_{10} and annual mean $PM_{2.5}$ are given in are given in Table 4.3 to Table 4.5.

Table 6.3 Annual Mean PM_{10} Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQS	40 μgm^{-3}						
R1	11.78	0.76	1.05	0.29	0.72%	12.83	32.07%
R2	11.78	0.65	0.89	0.25	0.62%	12.67	31.68%
R3	11.78	0.61	0.85	0.24	0.59%	12.63	31.57%
R4	11.78	0.39	0.54	0.15	0.37%	12.32	30.80%
R5	11.78	0.66	0.89	0.24	0.59%	12.67	31.68%
R6	11.78	0.86	1.18	0.32	0.80%	12.96	32.40%
R7	11.78	0.86	1.17	0.30	0.76%	12.94	32.36%
R8	11.78	0.66	0.89	0.22	0.56%	12.66	31.66%
R9	11.78	0.46	0.60	0.14	0.35%	12.38	30.94%
R10	11.78	0.23	0.29	0.06	0.14%	12.06	30.16%
R11	11.78	0.10	0.14	0.04	0.10%	11.92	29.80%
R12	11.78	0.43	0.58	0.15	0.38%	12.35	30.89%
R13	11.78	0.22	0.29	0.08	0.19%	12.07	30.18%
R14	11.78	0.18	0.24	0.06	0.16%	12.02	30.05%
R15	11.78	0.31	0.42	0.11	0.27%	12.20	30.49%

Table 6.4 99.4 Percentile 24-hour Mean PM_{10} Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQS	50 μgm^{-3}						
R1	11.78	2.49	3.38	0.89	1.79%	26.94	53.9%
R2	11.78	2.31	3.18	0.87	1.74%	26.73	53.5%
R3	11.78	2.11	2.92	0.81	1.62%	26.48	53.0%

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
R4	11.78	1.22	1.67	0.45	0.89%	25.23	50.5%
R5	11.78	2.24	3.04	0.80	1.61%	26.60	53.2%
R6	11.78	2.80	3.88	1.07	2.15%	27.43	54.9%
R7	11.78	3.14	4.34	1.20	2.40%	27.90	55.8%
R8	11.78	2.71	3.54	0.83	1.67%	27.10	54.2%
R9	11.78	1.82	2.40	0.58	1.16%	25.96	51.9%
R10	11.78	0.91	1.25	0.34	0.69%	24.81	49.6%
R11	11.78	0.36	0.54	0.18	0.35%	24.10	48.2%
R12	11.78	1.75	2.28	0.53	1.06%	25.83	51.7%
R13	11.78	0.83	1.15	0.32	0.65%	24.70	49.4%
R14	11.78	0.68	0.92	0.24	0.48%	24.47	48.9%
R15	11.78	1.31	1.74	0.43	0.85%	25.30	50.6%

Table 6.5 Annual Mean $PM_{2.5}$ Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
AQO	20 µgm^{-3}						
R1	7.98	0.76	1.05	0.29	1.45%	17.00	85.02%
R2	7.98	0.65	0.89	0.25	1.24%	16.85	84.24%
R3	7.98	0.61	0.85	0.24	1.19%	16.81	84.03%
R4	7.98	0.39	0.54	0.15	0.74%	16.50	82.49%
R5	7.98	0.66	0.89	0.24	1.18%	16.85	84.24%
R6	7.98	0.86	1.18	0.32	1.60%	17.14	85.69%
R7	7.98	0.86	1.17	0.30	1.52%	17.12	85.61%
R8	7.98	0.66	0.89	0.22	1.12%	16.84	84.21%
R9	7.98	0.46	0.60	0.14	0.70%	16.56	82.78%
R10	7.98	0.23	0.29	0.06	0.29%	16.24	81.21%
R11	7.98	0.10	0.14	0.04	0.20%	16.10	80.49%

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
R12	7.98	0.43	0.58	0.15	0.75%	16.53	82.66%
R13	7.98	0.22	0.29	0.08	0.38%	16.25	81.24%
R14	7.98	0.18	0.24	0.06	0.31%	16.20	80.99%
R15	7.98	0.31	0.42	0.11	0.54%	16.37	81.87%

Predicted concentrations of the annual mean PM_{10} and $PM_{2.5}$ are below the AQS. As a result, impacts are considered insignificant. There are no predicted exceedances of the daily mean PM_{10}.

Sulphur Dioxide (SO_2)

Table 6.6 99.4 Percentile 24-hour Mean SO_2 Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
AQS	125 µgm^{-3}						
R1	4.15	1.11	1.46	0.35	<0.01%	9.76	7.81%
R2	4.15	1.11	1.46	0.35	<0.01%	9.76	7.81%
R3	4.15	1.06	1.39	0.33	<0.01%	9.69	7.75%
R4	4.15	0.56	0.74	0.18	<0.01%	9.04	7.23%
R5	4.15	1.07	1.41	0.34	<0.01%	9.71	7.77%
R6	4.15	1.34	1.76	0.42	<0.01%	10.06	8.05%
R7	4.15	1.39	1.83	0.44	<0.01%	10.13	8.10%
R8	4.15	1.30	1.71	0.41	<0.01%	10.01	8.01%
R9	4.15	1.21	1.58	0.38	<0.01%	9.88	7.91%
R10	4.15	0.99	1.30	0.31	<0.01%	9.60	7.68%
R11	4.15	0.69	0.91	0.22	<0.01%	9.21	7.37%
R12	4.15	1.26	1.66	0.40	<0.01%	9.96	7.97%
R13	4.15	1.08	1.42	0.34	<0.01%	9.72	7.78%
R14	4.15	0.73	0.96	0.23	<0.01%	9.26	7.41%
R15	4.15	1.04	1.36	0.33	<0.01%	9.66	7.73%

Table 6.7 Hourly Mean SO_2 Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQS	350 μgm^{-3}						
R1	4.15	3.98	5.22	124.50%	<0.01%	13.52	3.86%
R2	4.15	4.43	5.82	138.82%	<0.01%	14.12	4.03%
R3	4.15	3.50	4.59	109.50%	<0.01%	12.89	3.68%
R4	4.15	1.46	1.92	45.81%	<0.01%	10.22	2.92%
R5	4.15	3.44	4.51	107.63%	<0.01%	12.81	3.66%
R6	4.15	3.23	4.24	101.04%	<0.01%	12.54	3.58%
R7	4.15	2.98	3.91	93.21%	<0.01%	12.21	3.49%
R8	4.15	3.02	3.97	94.66%	<0.01%	12.27	3.51%
R9	4.15	4.11	5.40	128.78%	<0.01%	13.70	3.91%
R10	4.15	3.98	5.23	124.63%	<0.01%	13.53	3.86%
R11	4.15	2.91	3.81	90.97%	<0.01%	12.11	3.46%
R12	4.15	2.94	3.86	92.04%	<0.01%	12.16	3.47%
R13	4.15	3.25	4.27	101.82%	<0.01%	12.57	3.59%
R14	4.15	2.32	3.04	72.60%	<0.01%	11.34	3.24%
R15	4.15	2.84	3.73	88.90%	<0.01%	12.03	3.44%

Table 6.8 15-minute Mean SO_2 Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	266 μgm^{-3}						
R1	4.15	4.64	6.09	1.45	0.55%	10.24	3.85%
R2	4.15	5.03	6.61	1.58	0.59%	10.76	4.04%
R3	4.15	4.16	5.46	1.30	0.49%	9.61	3.61%
R4	4.15	1.91	2.51	0.60	0.23%	6.66	2.50%
R5	4.15	4.15	5.45	1.30	0.49%	9.60	3.61%
R6	4.15	3.93	5.16	1.23	0.46%	9.31	3.50%

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
R7	4.15	3.62	4.75	1.13	0.43%	8.90	3.35%
R8	4.15	3.69	4.85	1.16	0.43%	9.00	3.38%
R9	4.15	4.66	6.12	1.46	0.55%	10.27	3.86%
R10	4.15	5.07	6.65	1.59	0.60%	10.80	4.06%
R11	4.15	4.71	6.18	1.47	0.55%	10.33	3.88%
R12	4.15	3.62	4.76	1.13	0.43%	8.91	3.35%
R13	4.15	4.23	5.56	1.33	0.50%	9.71	3.65%
R14	4.15	2.94	3.86	0.92	0.35%	8.01	3.01%
R15	4.15	3.38	4.44	1.06	0.40%	8.59	3.23%

Hydrogen Fluoride

Table 6.9 1-hourly Mean HF Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
EAL	160						
R1	2.60	1.54×10^{-4}	2.05×10^{-4}	5.12×10^{-5}	<0.01%	5.20	3.25%
R2	2.60	1.60×10^{-4}	2.14×10^{-4}	5.34×10^{-5}	<0.01%	5.20	3.25%
R3	2.60	2.36×10^{-4}	3.15×10^{-4}	7.88×10^{-5}	<0.01%	5.20	3.25%
R4	2.60	1.44×10^{-4}	1.92×10^{-4}	4.81×10^{-5}	<0.01%	5.20	3.25%
R5	2.60	2.38×10^{-4}	3.18×10^{-4}	7.95×10^{-5}	<0.01%	5.20	3.25%
R6	2.60	2.26×10^{-4}	3.01×10^{-4}	7.53×10^{-5}	<0.01%	5.20	3.25%
R7	2.60	1.38×10^{-4}	1.84×10^{-4}	4.59×10^{-5}	<0.01%	5.20	3.25%
R8	2.60	1.77×10^{-4}	2.36×10^{-4}	5.90×10^{-5}	<0.01%	5.20	3.25%
R9	2.60	2.06×10^{-4}	2.75×10^{-4}	6.88×10^{-5}	<0.01%	5.20	3.25%
R10	2.60	1.73×10^{-4}	2.30×10^{-4}	5.76×10^{-5}	<0.01%	5.20	3.25%
R11	2.60	1.94×10^{-4}	2.58×10^{-4}	6.46×10^{-5}	<0.01%	5.20	3.25%
R12	2.60	1.67×10^{-4}	2.23×10^{-4}	5.57×10^{-5}	<0.01%	5.20	3.25%
R13	2.60	2.25×10^{-4}	2.99×10^{-4}	7.49×10^{-5}	<0.01%	5.20	3.25%

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R14	2.60	1.51×10^{-4}	2.01×10^{-4}	5.02×10^{-5}	<0.01%	5.20	3.25%
R15	2.60	1.16×10^{-4}	1.55×10^{-4}	3.87×10^{-5}	<0.01%	5.20	3.25%

Table 6.10 Monthly Mean HF Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	16 μgm^{-3}						
R1	2.60	4.27×10^{-7}	1.67	1.67	10.42%	4.27	26.67%
R2	2.60	3.19×10^{-7}	1.42	1.42	8.85%	4.02	25.10%
R3	2.60	3.52×10^{-7}	1.42	1.42	8.85%	4.02	25.10%
R4	2.60	2.13×10^{-7}	1.67	1.67	10.42%	4.27	26.67%
R5	2.60	4.36×10^{-7}	1.50	1.50	9.38%	4.10	25.63%
R6	2.60	5.52×10^{-7}	1.50	1.50	9.38%	4.10	25.63%
R7	2.60	4.50×10^{-7}	1.50	1.50	9.38%	4.10	25.63%
R8	2.60	3.53×10^{-7}	1.58	1.58	9.90%	4.18	26.15%
R9	2.60	3.23×10^{-7}	1.58	1.58	9.90%	4.18	26.15%
R10	2.60	2.06×10^{-7}	1.75	1.75	10.94%	4.35	27.19%
R11	2.60	1.46×10^{-7}	1.50	1.50	9.38%	4.10	25.63%
R12	2.60	2.78×10^{-7}	1.50	1.50	9.38%	4.10	25.63%
R13	2.60	2.18×10^{-7}	1.50	1.50	9.38%	4.10	25.63%
R14	2.60	9.15×10^{-8}	1.75	1.75	10.94%	4.35	27.19%
R15	2.60	1.62×10^{-5}	1.75	1.75	10.94%	4.35	27.19%

Carbon Monoxide

Table 6.11 8-hourly rolling Mean CO Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQO	10,000 μgm^{-3}						
R1	0.40	2.87	3.74	0.87	0.01%	4.54	0.05%

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
R2	0.40	2.80	3.65	0.85	0.01%	4.45	0.04%
R3	0.40	1.95	2.54	0.59	0.01%	3.34	0.03%
R4	0.40	0.99	1.29	0.30	0.00%	2.09	0.02%
R5	0.40	2.46	3.21	0.75	0.01%	4.01	0.04%
R6	0.40	2.10	2.74	0.64	0.01%	3.54	0.04%
R7	0.40	1.72	2.25	0.52	0.01%	3.05	0.03%
R8	0.40	2.00	2.60	0.61	0.01%	3.40	0.03%
R9	0.40	2.62	3.42	0.79	0.01%	4.22	0.04%
R10	0.40	2.31	3.01	0.70	0.01%	3.81	0.04%
R11	0.40	2.27	2.95	0.69	0.01%	3.75	0.04%
R12	0.40	1.78	2.32	0.54	0.01%	3.12	0.03%
R13	0.40	2.16	2.81	0.65	0.01%	3.61	0.04%
R14	0.40	1.45	1.89	0.44	0.00%	2.69	0.03%
R15	0.40	1.82	2.37	0.55	0.01%	3.17	0.03%

Table 6.12 1-hourly Mean CO Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
AQO	30,000 µgm^{-3}						
R1	0.40	3.38	4.40	1.02	<0.01%	5.20	<0.01%
R2	0.40	3.52	4.59	1.07	<0.01%	5.39	<0.01%
R3	0.40	5.20	6.77	1.58	<0.01%	7.57	<0.01%
R4	0.40	3.17	4.13	0.96	<0.01%	4.93	<0.01%
R5	0.40	5.24	6.83	1.59	<0.01%	7.63	<0.01%
R6	0.40	4.97	6.48	1.51	<0.01%	7.28	<0.01%
R7	0.40	3.03	3.95	0.92	<0.01%	4.75	<0.01%
R8	0.40	3.90	5.08	1.18	<0.01%	5.88	<0.01%
R9	0.40	4.54	5.91	1.38	<0.01%	6.71	<0.01%

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
R10	0.40	3.80	4.95	1.15	<0.01%	5.75	<0.01%
R11	0.40	4.27	5.56	1.29	<0.01%	6.36	<0.01%
R12	0.40	3.68	4.79	1.11	<0.01%	5.59	<0.01%
R13	0.40	4.94	6.44	1.50	<0.01%	7.24	<0.01%
R14	0.40	3.31	4.32	1.00	<0.01%	5.12	<0.01%
R15	0.40	2.56	3.33	0.77	<0.01%	4.13	<0.01%

Hydrogen Chloride

Table 6.13 1-hourly mean HCl Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
EAL	750 µgm^{-3}						
R1	0.06	0.36	0.46	0.10	0.01%	0.58	0.08%
R2	0.06	0.37	0.48	0.11	0.01%	0.60	0.08%
R3	0.06	0.55	0.71	0.16	0.02%	0.83	0.11%
R4	0.06	0.34	0.43	0.10	0.01%	0.55	0.07%
R5	0.06	0.56	0.72	0.16	0.02%	0.84	0.11%
R6	0.06	0.53	0.68	0.15	0.02%	0.80	0.11%
R7	0.06	0.32	0.41	0.09	0.01%	0.53	0.07%
R8	0.06	0.41	0.53	0.12	0.02%	0.65	0.09%
R9	0.06	0.48	0.62	0.14	0.02%	0.74	0.10%
R10	0.06	0.40	0.52	0.12	0.02%	0.64	0.09%
R11	0.06	0.45	0.58	0.13	0.02%	0.70	0.09%
R12	0.06	0.39	0.50	0.11	0.01%	0.62	0.08%
R13	0.06	0.52	0.67	0.15	0.02%	0.79	0.11%
R14	0.06	0.35	0.45	0.10	0.01%	0.57	0.08%
R15	0.06	0.27	0.35	0.08	0.01%	0.47	0.06%

Phenol

Table 6.14 Annual Mean Phenol Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
EAL	200 µgm^{-3}						
R1	0.00	0.12	0.17	0.05	0.08%	0.17	0.08%
R2	0.00	0.10	0.14	0.04	0.07%	0.14	0.07%
R3	0.00	0.10	0.14	0.04	0.07%	0.14	0.07%
R4	0.00	0.06	0.09	0.02	0.04%	0.09	0.04%
R5	0.00	0.11	0.14	0.04	0.07%	0.14	0.07%
R6	0.00	0.14	0.19	0.05	0.10%	0.19	0.10%
R7	0.00	0.14	0.19	0.05	0.09%	0.19	0.09%
R8	0.00	0.11	0.14	0.04	0.07%	0.14	0.07%
R9	0.00	0.07	0.10	0.02	0.05%	0.10	0.05%
R10	0.00	0.04	0.05	0.01	0.02%	0.05	0.02%
R11	0.00	0.02	0.02	0.01	0.01%	0.02	0.01%
R12	0.00	0.07	0.09	0.02	0.05%	0.09	0.05%
R13	0.00	0.03	0.05	0.01	0.02%	0.05	0.02%
R14	0.00	0.03	0.04	0.01	0.02%	0.04	0.02%
R15	0.00	0.05	0.07	0.02	0.03%	0.07	0.03%

Table 6.15 1-hourly Mean Phenol Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
EAL	3,900 µgm^{-3}						
R1	0.00	4.01	5.75	1.74	<0.01%	5.75	<0.01%
R2	0.00	4.34	5.38	1.04	<0.01%	5.38	<0.01%
R3	0.00	3.97	5.04	1.06	<0.01%	5.04	<0.01%
R4	0.00	3.34	4.47	1.13	<0.01%	4.47	<0.01%
R5	0.00	6.53	8.54	2.02	<0.01%	8.54	<0.01%

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R6	0.00	6.93	9.24	2.30	<0.01%	9.24	<0.01%
R7	0.00	4.40	5.41	1.01	<0.01%	5.41	<0.01%
R8	0.00	4.87	6.65	1.78	<0.01%	6.65	<0.01%
R9	0.00	4.75	5.98	1.23	<0.01%	5.98	<0.01%
R10	0.00	5.15	6.76	1.61	<0.01%	6.76	<0.01%
R11	0.00	5.51	7.32	1.82	<0.01%	7.32	<0.01%
R12	0.00	5.82	7.85	2.03	<0.01%	7.85	<0.01%
R13	0.00	4.88	6.35	1.47	<0.01%	6.35	<0.01%
R14	0.00	3.82	5.05	1.23	<0.01%	5.05	<0.01%
R15	0.00	4.56	5.81	1.25	<0.01%	5.81	<0.01%

Formaldehyde

Table 6.16 Annual Mean Formaldehyde Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	5 μgm^{-3}						
R1	0.00	1.23×10^{-4}	1.70×10^{-4}	4.72×10^{-5}	<0.01%	1.70×10^{-4}	<0.01%
R2	0.00	1.05×10^{-4}	1.45×10^{-4}	4.03×10^{-5}	<0.01%	1.45×10^{-4}	<0.01%
R3	0.00	9.93×10^{-5}	1.38×10^{-4}	3.87×10^{-5}	<0.01%	1.38×10^{-4}	<0.01%
R4	0.00	6.38×10^{-5}	8.81×10^{-5}	2.43×10^{-5}	<0.01%	8.81×10^{-5}	<0.01%
R5	0.00	1.06×10^{-4}	1.44×10^{-4}	3.82×10^{-5}	<0.01%	1.44×10^{-4}	<0.01%
R6	0.00	1.39×10^{-4}	1.91×10^{-4}	5.20×10^{-5}	<0.01%	1.91×10^{-4}	<0.01%
R7	0.00	1.40×10^{-4}	1.89×10^{-4}	4.94×10^{-5}	<0.01%	1.89×10^{-4}	<0.01%
R8	0.00	1.07×10^{-4}	1.44×10^{-4}	3.63×10^{-5}	<0.01%	1.44×10^{-4}	<0.01%
R9	0.00	7.38×10^{-5}	9.63×10^{-5}	2.25×10^{-5}	<0.01%	9.63×10^{-5}	<0.01%
R10	0.00	3.63×10^{-5}	4.55×10^{-5}	9.17×10^{-6}	<0.01%	4.55×10^{-5}	<0.01%
R11	0.00	1.60×10^{-5}	2.22×10^{-5}	6.21×10^{-6}	<0.01%	2.22×10^{-5}	<0.01%
R12	0.00	6.87×10^{-5}	9.31×10^{-5}	2.44×10^{-5}	<0.01%	9.31×10^{-5}	<0.01%

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R13	0.00	3.41×10^{-5}	4.64×10^{-5}	1.23×10^{-5}	<0.01%	4.64×10^{-5}	<0.01%
R14	0.00	2.91×10^{-5}	3.92×10^{-5}	1.01×10^{-5}	<0.01%	3.92×10^{-5}	<0.01%
R15	0.00	5.03×10^{-5}	6.78×10^{-5}	1.75×10^{-5}	<0.01%	6.78×10^{-5}	<0.01%

Table 6.17 30-minute Mean Formaldehyde Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	100 μgm^{-3}						
R1	0.00	4.10×10^{-3}	5.83×10^{-3}	1.72×10^{-3}	0.01%	5.83×10^{-3}	0.01%
R2	0.00	4.89×10^{-3}	5.80×10^{-3}	9.02×10^{-4}	0.01%	5.80×10^{-3}	0.01%
R3	0.00	3.93×10^{-3}	4.93×10^{-3}	1.00×10^{-3}	<0.01%	4.93×10^{-3}	<0.01%
R4	0.00	3.97×10^{-3}	5.30×10^{-3}	1.33×10^{-3}	0.01%	5.30×10^{-3}	0.01%
R5	0.00	7.46×10^{-3}	9.74×10^{-3}	2.27×10^{-3}	0.01%	9.74×10^{-3}	0.01%
R6	0.00	7.87×10^{-3}	1.05×10^{-2}	2.61×10^{-3}	0.01%	1.05×10^{-2}	0.01%
R7	0.00	4.97×10^{-3}	6.08×10^{-3}	1.11×10^{-3}	0.01%	6.08×10^{-3}	0.01%
R8	0.00	5.23×10^{-3}	7.26×10^{-3}	2.03×10^{-3}	0.01%	7.26×10^{-3}	0.01%
R9	0.00	5.23×10^{-3}	6.19×10^{-3}	9.55×10^{-4}	0.01%	6.19×10^{-3}	0.01%
R10	0.00	5.27×10^{-3}	6.91×10^{-3}	1.64×10^{-3}	0.01%	6.91×10^{-3}	0.01%
R11	0.00	5.63×10^{-3}	7.50×10^{-3}	1.87×10^{-3}	0.01%	7.50×10^{-3}	0.01%
R12	0.00	6.42×10^{-3}	8.75×10^{-3}	2.33×10^{-3}	0.01%	8.75×10^{-3}	0.01%
R13	0.00	5.33×10^{-3}	6.86×10^{-3}	1.54×10^{-3}	0.01%	6.86×10^{-3}	0.01%
R14	0.00	4.36×10^{-3}	5.75×10^{-3}	1.39×10^{-3}	0.01%	5.75×10^{-3}	0.01%
R15	0.00	4.63×10^{-3}	5.86×10^{-3}	1.23×10^{-3}	0.01%	5.86×10^{-3}	0.01%

Ammonia (NH3)

Table 6.18 Annual Mean NH3 Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	180 μgm^{-3}						

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
R1	3.10	1.27	1.75	0.47	0.26%	7.95	4.41%
R2	3.10	1.09	1.49	0.40	0.22%	7.69	4.27%
R3	3.10	1.03	1.42	0.39	0.22%	7.62	4.23%
R4	3.10	0.65	0.90	0.24	0.14%	7.10	3.94%
R5	3.10	1.10	1.48	0.38	0.21%	7.68	4.27%
R6	3.10	1.44	1.96	0.52	0.29%	8.16	4.53%
R7	3.10	1.45	1.94	0.50	0.28%	8.14	4.52%
R8	3.10	1.11	1.48	0.36	0.20%	7.68	4.27%
R9	3.10	0.77	1.00	0.23	0.13%	7.20	4.00%
R10	3.10	0.39	0.48	0.09	0.05%	6.68	3.71%
R11	3.10	0.17	0.23	0.06	0.03%	6.43	3.57%
R12	3.10	0.71	0.96	0.24	0.14%	7.16	3.98%
R13	3.10	0.36	0.48	0.12	0.07%	6.68	3.71%
R14	3.10	0.30	0.40	0.10	0.06%	6.60	3.67%
R15	3.10	0.52	0.70	0.18	0.10%	6.90	3.83%

Table 6.19 1-hourly Mean NH3 Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
EAL	2,500 µgm^{-3}						
R1	3.10	40.86	58.4	17.5	0.70%	64.6	2.58%
R2	3.10	45.15	54.7	9.5	0.38%	60.9	2.43%
R3	3.10	40.63	51.3	10.7	0.43%	57.5	2.30%
R4	3.10	34.10	45.4	11.3	0.45%	51.6	2.06%
R5	3.10	66.89	87.1	20.2	0.81%	93.3	3.73%
R6	3.10	70.97	94.1	23.1	0.93%	100.3	4.01%
R7	3.10	45.47	55.6	10.2	0.41%	61.8	2.47%
R8	3.10	49.95	67.8	17.9	0.72%	74.0	2.96%

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
R9	3.10	48.99	60.9	11.9	0.48%	67.1	2.69%
R10	3.10	53.00	69.2	16.2	0.65%	75.4	3.02%
R11	3.10	56.89	75.1	18.2	0.73%	81.3	3.25%
R12	3.10	59.86	80.2	20.4	0.81%	86.4	3.46%
R13	3.10	50.16	64.9	14.8	0.59%	71.1	2.84%
R14	3.10	39.12	51.4	12.3	0.49%	57.6	2.31%
R15	3.10	46.49	59.1	12.6	0.50%	65.3	2.61%

Volatile Organic Compounds (VOCs) (as Benzene)

Table 6.20 Annual Mean VOCs Impacts

Receptor	Background (µgm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
AQO	5 µgm^{-3}						
R1	0.90	0.64	0.87	0.24	17.47%	2.67	53.47%
R2	0.90	0.54	0.75	0.20	14.93%	2.55	50.93%
R3	0.90	0.51	0.71	0.20	14.15%	2.51	50.15%
R4	0.90	0.33	0.45	0.12	8.98%	2.25	44.98%
R5	0.90	0.55	0.74	0.19	14.79%	2.54	50.79%
R6	0.90	0.72	0.98	0.26	19.60%	2.78	55.60%
R7	0.90	0.72	0.97	0.25	19.41%	2.77	55.41%
R8	0.90	0.56	0.74	0.18	14.77%	2.54	50.77%
R9	0.90	0.39	0.50	0.11	10.00%	2.30	46.00%
R10	0.90	0.19	0.24	0.05	4.78%	2.04	40.78%
R11	0.90	0.09	0.12	0.03	2.33%	1.92	38.33%
R12	0.90	0.36	0.48	0.12	9.58%	2.28	45.58%
R13	0.90	0.18	0.24	0.06	4.84%	2.04	40.84%
R14	0.90	0.15	0.20	0.05	4.03%	2.00	40.03%
R15	0.90	0.26	0.35	0.09	6.98%	2.15	42.98%

Table 6.21 24-hourly Mean VOCs Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	30 μgm^{-3}						
R1	1.80	5.13	6.94	1.81	23.14%	10.54	35.14%
R2	1.80	5.58	7.73	2.15	25.75%	11.33	37.75%
R3	1.80	4.40	6.11	1.71	20.36%	9.71	32.36%
R4	1.80	2.35	3.18	0.83	10.61%	6.78	22.61%
R5	1.80	5.18	7.09	1.91	23.63%	10.69	35.63%
R6	1.80	5.70	7.77	2.07	25.91%	11.37	37.91%
R7	1.80	5.58	7.71	2.13	25.70%	11.31	37.70%
R8	1.80	4.99	6.70	1.70	22.33%	10.30	34.33%
R9	1.80	5.45	7.40	1.95	24.68%	11.00	36.68%
R10	1.80	3.79	4.68	0.89	15.60%	8.28	27.60%
R11	1.80	2.67	3.66	0.99	12.20%	7.26	24.20%
R12	1.80	5.67	7.49	1.82	24.98%	11.09	36.98%
R13	1.80	3.35	4.34	1.00	14.48%	7.94	26.48%
R14	1.80	4.38	5.98	1.60	19.93%	9.58	31.93%
R15	1.80	5.60	7.68	2.08	25.60%	11.28	37.60%

Arsenic

Table 6.22 Annual Mean Arsenic Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQO	6 ngm^{-3}						
R1	4.51	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	0.37%	4.56×10^{-3}	75.98%
R2	4.51	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	0.28%	4.55×10^{-3}	75.79%
R3	4.51	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	0.31%	4.55×10^{-3}	75.85%
R4	4.51	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	0.19%	4.54×10^{-3}	75.61%
R5	4.51	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	0.38%	4.56×10^{-3}	76.00%

R6	4.51	2.90 x 10^{-5}	5.81 x 10^{-5}	2.90 x 10^{-5}	0.48%	4.57 x 10^{-3}	76.20%
R7	4.51	2.37 x 10^{-5}	4.73 x 10^{-5}	2.37 x 10^{-5}	0.39%	4.56 x 10^{-3}	76.02%
R8	4.51	1.86 x 10^{-5}	3.71 x 10^{-5}	1.86 x 10^{-5}	0.31%	4.55 x 10^{-3}	75.85%
R9	4.51	1.70 x 10^{-5}	3.40 x 10^{-5}	1.70 x 10^{-5}	0.28%	4.55 x 10^{-3}	75.80%
R10	4.51	1.08 x 10^{-5}	2.16 x 10^{-5}	1.08 x 10^{-5}	0.18%	4.54 x 10^{-3}	75.59%
R11	4.51	7.68 x 10^{-6}	1.54 x 10^{-5}	7.68 x 10^{-6}	0.13%	4.53 x 10^{-3}	75.49%
R12	4.51	1.46 x 10^{-5}	2.92 x 10^{-5}	1.46 x 10^{-5}	0.24%	4.54 x 10^{-3}	75.72%
R13	4.51	1.14 x 10^{-5}	2.29 x 10^{-5}	1.14 x 10^{-5}	0.19%	4.54 x 10^{-3}	75.61%
R14	4.51	4.81 x 10^{-6}	9.62 x 10^{-6}	4.81 x 10^{-6}	0.08%	4.52 x 10^{-3}	75.39%
R15	4.51	8.54 x 10^{-6}	1.71 x 10^{-5}	8.54 x 10^{-6}	0.14%	4.53 x 10^{-3}	75.52%

Antimony

Table 6.23 Annual Mean Antimony Impacts

Receptor	Background (ngm^{-3})	Existing PC (µgm^{-3})	Proposed PC (µgm^{-3})	PC Change	PC (% of AQS)	PEC (µgm^{-3})	PEC (% of AQS)
EAL	5 µgm^{-3}						
R1	1.30	2.25 x 10^{-5}	4.49 x 10^{-5}	2.25 x 10^{-5}	<0.01%	1.30	0.03%
R2	1.30	1.68 x 10^{-5}	3.36 x 10^{-5}	1.68 x 10^{-5}	<0.01%	1.30	0.03%
R3	1.30	1.85 x 10^{-5}	3.71 x 10^{-5}	1.85 x 10^{-5}	<0.01%	1.30	0.03%
R4	1.30	1.12 x 10^{-5}	2.24 x 10^{-5}	1.12 x 10^{-5}	<0.01%	1.30	0.03%
R5	1.30	2.29 x 10^{-5}	4.58 x 10^{-5}	2.29 x 10^{-5}	<0.01%	1.30	0.03%
R6	1.30	2.90 x 10^{-5}	5.81 x 10^{-5}	2.90 x 10^{-5}	<0.01%	1.30	0.03%
R7	1.30	2.37 x 10^{-5}	4.73 x 10^{-5}	2.37 x 10^{-5}	<0.01%	1.30	0.03%
R8	1.30	1.86 x 10^{-5}	3.71 x 10^{-5}	1.86 x 10^{-5}	<0.01%	1.30	0.03%
R9	1.30	1.70 x 10^{-5}	3.40 x 10^{-5}	1.70 x 10^{-5}	<0.01%	1.30	0.03%
R10	1.30	1.08 x 10^{-5}	2.16 x 10^{-5}	1.08 x 10^{-5}	<0.01%	1.30	0.03%
R11	1.30	7.68 x 10^{-6}	1.54 x 10^{-5}	7.68 x 10^{-6}	<0.01%	1.30	0.03%
R12	1.30	1.46 x 10^{-5}	2.92 x 10^{-5}	1.46 x 10^{-5}	<0.01%	1.30	0.03%
R13	1.30	1.14 x 10^{-5}	2.29 x 10^{-5}	1.14 x 10^{-5}	<0.01%	1.30	0.03%
R14	1.30	4.81 x 10^{-6}	9.62 x 10^{-6}	4.81 x 10^{-6}	<0.01%	1.30	0.03%

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R15	1.30	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	<0.01%	1.30	0.03%

Table 6.24 Hourly Antimony Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	150 μgm^{-3}						
R1	1.30	6.73×10^{-4}	1.35×10^{-3}	6.73×10^{-4}	<0.01%	3.95×10^{-3}	1.73%
R2	1.30	7.02×10^{-4}	1.40×10^{-3}	7.02×10^{-4}	<0.01%	4.00×10^{-3}	1.73%
R3	1.30	1.04×10^{-3}	2.07×10^{-3}	1.04×10^{-3}	<0.01%	4.67×10^{-3}	1.73%
R4	1.30	6.32×10^{-4}	1.26×10^{-3}	6.32×10^{-4}	<0.01%	3.86×10^{-3}	1.73%
R5	1.30	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	4.69×10^{-3}	1.73%
R6	1.30	9.90×10^{-4}	1.98×10^{-3}	9.90×10^{-4}	<0.01%	4.58×10^{-3}	1.73%
R7	1.30	6.03×10^{-4}	1.21×10^{-3}	6.03×10^{-4}	<0.01%	3.81×10^{-3}	1.73%
R8	1.30	7.76×10^{-4}	1.55×10^{-3}	7.76×10^{-4}	<0.01%	4.15×10^{-3}	1.73%
R9	1.30	9.04×10^{-4}	1.81×10^{-3}	9.04×10^{-4}	<0.01%	4.41×10^{-3}	1.73%
R10	1.30	7.57×10^{-4}	1.51×10^{-3}	7.57×10^{-4}	<0.01%	4.11×10^{-3}	1.73%
R11	1.30	8.49×10^{-4}	1.70×10^{-3}	8.49×10^{-4}	<0.01%	4.30×10^{-3}	1.73%
R12	1.30	7.32×10^{-4}	1.46×10^{-3}	7.32×10^{-4}	<0.01%	4.06×10^{-3}	1.73%
R13	1.30	9.84×10^{-4}	1.97×10^{-3}	9.84×10^{-4}	<0.01%	4.57×10^{-3}	1.73%
R14	1.30	6.60×10^{-4}	1.32×10^{-3}	6.60×10^{-4}	<0.01%	3.92×10^{-3}	1.73%
R15	1.30	5.09×10^{-4}	1.02×10^{-3}	5.09×10^{-4}	<0.01%	3.62×10^{-3}	1.73%

Cadmium

Table 6.25 Annual Cadmium Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQO	5 μgm^{-3}						
R1	1.31	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	<0.01%	1.36×10^{-3}	0.03%
R2	1.31	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	<0.01%	1.35×10^{-3}	0.03%
R3	1.31	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	<0.01%	1.35×10^{-3}	0.03%
R4	1.31	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	<0.01%	1.34×10^{-3}	0.03%
R5	1.31	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	<0.01%	1.36×10^{-3}	0.03%
R6	1.31	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	1.37×10^{-3}	0.03%
R7	1.31	2.37×10^{-5}	4.73×10^{-5}	2.37×10^{-5}	<0.01%	1.36×10^{-3}	0.03%
R8	1.31	1.86×10^{-5}	3.71×10^{-5}	1.86×10^{-5}	<0.01%	1.35×10^{-3}	0.03%
R9	1.31	1.70×10^{-5}	3.40×10^{-5}	1.70×10^{-5}	<0.01%	1.35×10^{-3}	0.03%
R10	1.31	1.08×10^{-5}	2.16×10^{-5}	1.08×10^{-5}	<0.01%	1.34×10^{-3}	0.03%
R11	1.31	7.68×10^{-6}	1.54×10^{-5}	7.68×10^{-6}	<0.01%	1.33×10^{-3}	0.03%
R12	1.31	1.46×10^{-5}	2.92×10^{-5}	1.46×10^{-5}	<0.01%	1.34×10^{-3}	0.03%
R13	1.31	1.14×10^{-5}	2.29×10^{-5}	1.14×10^{-5}	<0.01%	1.34×10^{-3}	0.03%
R14	1.31	4.81×10^{-6}	9.62×10^{-6}	4.81×10^{-6}	<0.01%	1.32×10^{-3}	0.03%
R15	1.31	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	<0.01%	1.33×10^{-3}	0.03%

Chromium III

Table 6.26 Annual Chromium III Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	5 μgm^{-3}						
R1	172.00	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	<0.01%	0.17	3.44%
R2	172.00	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	<0.01%	0.17	3.44%
R3	172.00	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	<0.01%	0.17	3.44%
R4	172.00	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	<0.01%	0.17	3.44%
R5	172.00	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	<0.01%	0.17	3.44%
R6	172.00	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	0.17	3.44%
R7	172.00	2.37×10^{-5}	4.73×10^{-5}	2.37×10^{-5}	<0.01%	0.17	3.44%
R8	172.00	1.86×10^{-5}	3.71×10^{-5}	1.86×10^{-5}	<0.01%	0.17	3.44%
R9	172.00	1.70×10^{-5}	3.40×10^{-5}	1.70×10^{-5}	<0.01%	0.17	3.44%
R10	172.00	1.08×10^{-5}	2.16×10^{-5}	1.08×10^{-5}	<0.01%	0.17	3.44%
R11	172.00	7.68×10^{-6}	1.54×10^{-5}	7.68×10^{-6}	<0.01%	0.17	3.44%
R12	172.00	1.46×10^{-5}	2.92×10^{-5}	1.46×10^{-5}	<0.01%	0.17	3.44%
R13	172.00	1.14×10^{-5}	2.29×10^{-5}	1.14×10^{-5}	<0.01%	0.17	3.44%
R14	172.00	4.81×10^{-6}	9.62×10^{-6}	4.81×10^{-6}	<0.01%	0.17	3.44%
R15	172.00	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	<0.01%	0.17	3.44%

Table 6.27 Hourly Chromium III Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	150 μgm^{-3}						
R1	172.00	6.73×10^{-4}	1.35×10^{-3}	6.73×10^{-4}	<0.01%	0.35	0.23%
R2	172.00	7.02×10^{-4}	$1.40E \times 10^{-3}$	7.02×10^{-4}	<0.01%	0.35	0.23%
R3	172.00	1.04×10^{-3}	2.07×10^{-3}	1.04E-03	<0.01%	0.35	0.23%
R4	172.00	6.32×10^{-4}	1.26×10^{-3}	6.32×10^{-4}	<0.01%	0.35	0.23%
R5	172.00	1.04×10^{-4}	2.09×10^{-3}	1.04E-03	<0.01%	0.35	0.23%
R6	172.00	9.90×10^{-4}	1.98×10^{-3}	9.90×10^{-4}	<0.01%	0.35	0.23%
R7	172.00	6.03×10^{-4}	1.21×10^{-3}	6.03×10^{-4}	<0.01%	0.35	0.23%
R8	172.00	7.76×10^{-4}	1.55×10^{-3}	7.76×10^{-4}	<0.01%	0.35	0.23%
R9	172.00	9.04×10^{-4}	1.81×10^{-3}	9.04×10^{-4}	<0.01%	0.35	0.23%
R10	172.00	7.57×10^{-4}	1.51×10^{-3}	7.57×10^{-4}	<0.01%	0.35	0.23%
R11	172.00	8.49×10^{-4}	1.70×10^{-3}	8.49×10^{-4}	<0.01%	0.35	0.23%
R12	172.00	7.32×10^{-4}	1.46×10^{-3}	7.32×10^{-4}	<0.01%	0.35	0.23%
R13	172.00	9.84×10^{-4}	1.97×10^{-3}	9.84×10^{-4}	<0.01%	0.35	0.23%
R14	172.00	6.60×10^{-4}	1.32×10^{-3}	6.60×10^{-4}	<0.01%	0.35	0.23%
R15	172.00	5.09×10^{-4}	1.02 x 10-3	5.09×10^{-4}	<0.01%	0.35	0.23%

Chromium VI

Table 6.28 Annual Chromium III Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	0.2 ngm^{-3}						
R1	172.00	3.12×10^{-7}	6.25×10^{-7}	3.12×10^{-7}	0.12%	0.17	68800%
R2	172.00	2.34×10^{-7}	4.67×10^{-7}	2.34×10^{-7}	0.09%	0.17	68800%
R3	172.00	2.58×10^{-7}	5.15×10^{-7}	2.58×10^{-7}	0.10%	0.17	68800%
R4	172.00	1.56×10^{-7}	3.12×10^{-7}	1.56×10^{-7}	0.06%	0.17	68800%
R5	172.00	3.19×10^{-7}	6.37×10^{-7}	3.19×10^{-7}	0.13%	0.17	68800%
R6	172.00	4.04×10^{-7}	8.08×10^{-7}	4.04×10^{-7}	0.16%	0.17	68800%
R7	172.00	3.29×10^{-7}	6.58×10^{-7}	3.29×10^{-7}	0.13%	0.17	68800%
R8	172.00	2.58×10^{-7}	5.16×10^{-7}	2.58×10^{-7}	0.10%	0.17	68800%
R9	172.00	2.37×10^{-7}	4.73×10^{-7}	2.37×10^{-7}	0.09%	0.17	68800%
R10	172.00	1.50×10^{-7}	3.01×10^{-7}	1.50×10^{-7}	0.06%	0.17	68800%
R11	172.00	1.07×10^{-7}	2.14×10^{-7}	1.07×10^{-7}	0.04%	0.17	68800%
R12	172.00	2.03×10^{-7}	4.06×10^{-7}	2.03×10^{-7}	0.08%	0.17	68800%
R13	172.00	1.59×10^{-7}	3.18×10^{-7}	1.59×10^{-7}	0.06%	0.17	68800%
R14	172.00	6.69×10^{-8}	1.34×10^{-7}	6.69×10^{-7}	0.03%	0.17	68800%
R15	172.00	1.19×10^{-7}	2.38×10^{-7}	1.19×10^{-7}	0.05%	0.17	68800%

Copper

Table 6.29 Annual Copper Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	10 μgm^{-3}						
R1	42.21	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	<0.01%	0.04	0.42%
R2	42.21	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	<0.01%	0.04	0.42%
R3	42.21	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	<0.01%	0.04	0.42%
R4	42.21	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	<0.01%	0.04	0.42%

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R5	42.21	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	<0.01%	0.04	0.42%
R6	42.21	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	0.04	0.42%
R7	42.21	2.37×10^{-5}	4.73×10^{-5}	2.37×10^{-5}	<0.01%	0.04	0.42%
R8	42.21	1.86×10^{-5}	3.71×10^{-5}	1.86×10^{-5}	<0.01%	0.04	0.42%
R9	42.21	1.70×10^{-5}	3.40×10^{-5}	1.70×10^{-5}	<0.01%	0.04	0.42%
R10	42.21	1.08×10^{-5}	2.16×10^{-5}	1.08×10^{-5}	<0.01%	0.04	0.42%
R11	42.21	7.68×10^{-6}	1.54×10^{-5}	7.68×10^{-6}	<0.01%	0.04	0.42%
R12	42.21	1.46×10^{-5}	2.92×10^{-5}	1.46×10^{-5}	<0.01%	0.04	0.42%
R13	42.21	1.14×10^{-5}	2.29×10^{-5}	1.14×10^{-5}	<0.01%	0.04	0.42%
R14	42.21	4.81×10^{-6}	9.62×10^{-6}	4.81×10^{-6}	<0.01%	0.04	0.42%
R15	42.21	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	<0.01%	0.04	0.42%

Table 6.30 Hourly Copper Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	200 μgm^{-3}						
R1	42.21	6.73×10^{-4}	1.35×10^{-3}	6.73×10^{-4}	<0.01%	0.09	0.04%
R2	42.21	7.02×10^{-4}	1.40×10^{-3}	7.02×10^{-4}	<0.01%	0.09	0.04%
R3	42.21	1.04×10^{-4}	2.07×10^{-3}	1.04×10^{-3}	<0.01%	0.09	0.04%
R4	42.21	6.32×10^{-4}	1.26×10^{-3}	6.32×10^{-4}	<0.01%	0.09	0.04%
R5	42.21	1.04×10^{-4}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	0.09	0.04%
R6	42.21	9.90×10^{-4}	1.98×10^{-3}	9.90×10^{-4}	<0.01%	0.09	0.04%
R7	42.21	6.03×10^{-4}	1.21×10^{-3}	6.03×10^{-4}	<0.01%	0.09	0.04%
R8	42.21	7.76×10^{-4}	1.55×10^{-3}	7.76×10^{-4}	<0.01%	0.09	0.04%
R9	42.21	9.04×10^{-4}	1.81×10^{-3}	9.04×10^{-4}	<0.01%	0.09	0.04%
R10	42.21	7.57×10^{-4}	1.51×10^{-3}	7.57×10^{-4}	<0.01%	0.09	0.04%
R11	42.21	8.49×10^{-4}	1.70×10^{-3}	8.49×10^{-4}	<0.01%	0.09	0.04%
R12	42.21	7.32×10^{-4}	1.46×10^{-3}	7.32×10^{-4}	<0.01%	0.09	0.04%
R13	42.21	9.84×10^{-4}	1.97×10^{-3}	9.84×10^{-4}	<0.01%	0.09	0.04%

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R14	42.21	6.60×10^{-4}	1.32×10^{-3}	6.60×10^{-4}	<0.01%	0.09	0.04%
R15	42.21	5.09×10^{-4}	1.02×10^{-3}	5.09×10^{-4}	<0.01%	0.09	0.04%

Lead

Table 6.31 Annual Lead Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQO	0.25 μgm^{-3}						
R1	46.32	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	0.01%	0.05	19%
R2	46.32	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	0.01%	0.05	19%
R3	46.32	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	0.01%	0.05	18.54%
R4	46.32	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	<0.01%	0.05	18.54%
R5	46.32	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	0.01%	0.05	18.55%
R6	46.32	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	0.01%	0.05	18.55%
R7	46.32	2.37×10^{-5}	4.73×10^{-5}	2.37×10^{-5}	0.01%	0.05	18.55%
R8	46.32	1.86×10^{-5}	3.71×10^{-5}	1.86×10^{-5}	0.01%	0.05	18.54%
R9	46.32	1.70×10^{-5}	3.40×10^{-5}	1.70×10^{-5}	0.01%	0.05	18.54%
R10	46.32	1.08×10^{-5}	2.16×10^{-5}	1.08×10^{-5}	<0.01%	0.05	18.54%
R11	46.32	7.68×10^{-6}	1.54×10^{-5}	7.68×10^{-6}	<0.01%	0.05	18.53%
R12	46.32	1.46×10^{-5}	2.92×10^{-5}	1.46×10^{-5}	0.01%	0.05	18.54%
R13	46.32	1.14×10^{-5}	2.29×10^{-5}	1.14×10^{-5}	<0.01%	0.05	18.54%
R14	46.32	4.81×10^{-6}	9.62×10^{-6}	4.81×10^{-6}	<0.01%	0.05	18.53%
R15	46.32	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	<0.01%	0.05	18.53%

Manganese

Table 6.32 Annual Manganese Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	0.15 μgm^{-3}						

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R1	132.29	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	0.01%	0.13	88.22%
R2	132.29	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	0.01%	0.13	88.22%
R3	132.29	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	0.01%	0.13	88.22%
R4	132.29	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	0.01%	0.13	88.21%
R5	132.29	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	0.02%	0.13	88.22%
R6	132.29	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	0.02%	0.13	88.23%
R7	132.29	2.37×10^{-5}	4.73×10^{-5}	2.37×10^{-5}	0.02%	0.13	88.23%
R8	132.29	1.86×10^{-5}	3.71×10^{-5}	1.86×10^{-5}	0.01%	0.13	88.22%
R9	132.29	1.70×10^{-5}	3.40×10^{-5}	1.70×10^{-5}	0.01%	0.13	88.22%
R10	132.29	1.08×10^{-5}	2.16×10^{-5}	1.08×10^{-5}	0.01%	0.13	88.21%
R11	132.29	7.68×10^{-6}	1.54×10^{-5}	7.68×10^{-6}	0.01%	0.13	88.20%
R12	132.29	1.46×10^{-5}	2.92×10^{-5}	1.46×10^{-5}	0.01%	0.13	88.21%
R13	132.29	1.14×10^{-5}	2.29×10^{-5}	1.14×10^{-5}	0.01%	0.13	88.21%
R14	132.29	4.81×10^{-6}	9.62×10^{-6}	4.81×10^{-6}	<0.01%	0.13	88.20%
R15	132.29	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	0.01%	0.13	88.21%

Table 6.33 Hourly Manganese Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	1,500 μgm^{-3}						
R1	132.29	6.73×10^{-4}	1.35×10^{-3}	6.73×10^{-4}	<0.01%	0.27	0.02%
R2	132.29	7.02×10^{-4}	1.40×10^{-3}	7.02×10^{-4}	<0.01%	0.27	0.02%
R3	132.29	1.04×10^{-3}	2.07×10^{-3}	1.04×10^{-3}	<0.01%	0.27	0.02%
R4	132.29	6.32×10^{-4}	1.26×10^{-3}	6.32×10^{-4}	<0.01%	0.27	0.02%
R5	132.29	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-3}	<0.01%	0.27	0.02%
R6	132.29	9.90×10^{-4}	1.98×10^{-3}	9.90×10^{-4}	<0.01%	0.27	0.02%
R7	132.29	6.03×10^{-4}	1.21×10^{-3}	6.03×10^{-4}	<0.01%	0.27	0.02%
R8	132.29	7.76×10^{-4}	1.55×10^{-3}	7.76×10^{-4}	<0.01%	0.27	0.02%

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R9	132.29	9.04×10^{-4}	1.81×10^{-3}	9.04×10^{-4}	<0.01%	0.27	0.02%
R10	132.29	7.57×10^{-4}	1.51×10^{-3}	7.57×10^{-4}	<0.01%	0.27	0.02%
R11	132.29	8.49×10^{-4}	1.70×10^{-3}	8.49×10^{-4}	<0.01%	0.27	0.02%
R12	132.29	7.32×10^{-4}	1.46×10^{-3}	7.32×10^{-4}	<0.01%	0.27	0.02%
R13	132.29	9.84×10^{-4}	1.97×10^{-3}	9.84×10^{-4}	<0.01%	0.27	0.02%
R14	132.29	6.60×10^{-4}	1.32×10^{-3}	6.60×10^{-4}	<0.01%	0.27	0.02%
R15	132.29	5.09×10^{-4}	1.02×10^{-3}	5.09×10^{-4}	<0.01%	0.27	0.02%

Selenium

Table 6.34 Annual Selenium Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	1 μgm^{-3}						
R1	4.12	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	<0.01%	4.16×10^{-3}	0.42%
R2	4.12	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	<0.01%	4.15×10^{-3}	0.42%
R3	4.12	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	<0.01%	4.16×10^{-3}	0.42%
R4	4.12	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	<0.01%	4.14×10^{-3}	0.41%
R5	4.12	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	<0.01%	4.17×10^{-3}	0.42%
R6	4.12	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	<0.01%	4.18×10^{-3}	0.42%
R7	4.12	2.37×10^{-5}	4.73×10^{-5}	2.37×10^{-5}	<0.01%	4.17×10^{-3}	0.42%
R8	4.12	1.86×10^{-5}	3.71×10^{-5}	1.86×10^{-5}	<0.01%	4.16×10^{-3}	0.42%
R9	4.12	1.70×10^{-5}	3.40×10^{-5}	1.70×10^{-5}	<0.01%	4.15×10^{-3}	0.42%
R10	4.12	1.08×10^{-5}	2.16×10^{-5}	1.08×10^{-5}	<0.01%	4.14×10^{-3}	0.41%
R11	4.12	7.68×10^{-6}	1.54×10^{-5}	7.68×10^{-6}	<0.01%	4.14×10^{-3}	0.41%
R12	4.12	1.46×10^{-5}	2.92×10^{-5}	1.46×10^{-5}	<0.01%	4.15×10^{-3}	0.41%
R13	4.12	1.14×10^{-5}	2.29×10^{-5}	1.14×10^{-5}	<0.01%	4.14×10^{-3}	0.41%
R14	4.12	4.81×10^{-6}	9.62×10^{-6}	4.81×10^{-6}	<0.01%	4.13×10^{-3}	0.41%
R15	4.12	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	<0.01%	4.14×10^{-3}	0.41%

Table 6.35 Hourly Selenium Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	30 μgm^{-3}						
R1	4.12	6.73×10^{-4}	1.35×10^{-3}	6.73×10^{-4}	<0.01%	9.59×10^{-3}	0.03%
R2	4.12	7.02×10^{-4}	1.40×10^{-3}	7.02×10^{-4}	<0.01%	9.64×10^{-3}	0.03%
R3	4.12	1.04×10^{-3}	2.07×10^{-3}	1.04×10^{-3}	<0.01%	1.03×10^{-2}	0.03%
R4	4.12	6.32×10^{-4}	1.26×10^{-3}	6.32×10^{-4}	<0.01%	9.50×10^{-3}	0.03%
R5	4.12	1.04×10^{-3}	2.09×10^{-3}	1.04×10^{-4}	<0.01%	1.03×10^{-2}	0.03%
R6	4.12	9.90×10^{-4}	1.98×10^{-3}	9.90×10^{-4}	<0.01%	1.02×10^{-2}	0.03%
R7	4.12	6.03×10^{-4}	1.21×10^{-3}	6.03×10^{-4}	<0.01%	9.45×10^{-3}	0.03%
R8	4.12	7.76×10^{-4}	1.55×10^{-3}	7.76×10^{-4}	<0.01%	9.79×10^{-3}	0.03%
R9	4.12	9.04×10^{-4}	1.81×10^{-3}	9.04×10^{-4}	<0.01%	1.00×10^{-2}	0.03%
R10	4.12	7.57×10^{-4}	1.51×10^{-3}	7.57×10^{-4}	<0.01%	9.75×10^{-3}	0.03%
R11	4.12	8.49×10^{-4}	1.70×10^{-3}	8.49×10^{-4}	<0.01%	9.94×10^{-3}	0.03%
R12	4.12	7.32×10^{-4}	1.46×10^{-3}	7.32×10^{-4}	<0.01%	9.70×10^{-3}	0.03%
R13	4.12	9.84×10^{-4}	1.97×10^{-3}	9.84×10^{-4}	<0.01%	1.02×10^{-2}	0.03%
R14	4.12	6.60×10^{-4}	1.32×10^{-3}	6.60×10^{-4}	<0.01%	9.56×10^{-3}	0.03%
R15	4.12	5.09×10^{-4}	1.02×10^{-3}	5.09×10^{-4}	<0.01%	9.26×10^{-3}	0.03%

Nickel

Table 6.36 Annual Nickel Impacts

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
AQO	20 ngm^{-3}						
R1	61.99	2.25×10^{-5}	4.49×10^{-5}	2.25×10^{-5}	0.11%	6.20×10^{-2}	310%
R2	61.99	1.68×10^{-5}	3.36×10^{-5}	1.68×10^{-5}	0.08%	6.20×10^{-2}	310%
R3	61.99	1.85×10^{-5}	3.71×10^{-5}	1.85×10^{-5}	0.09%	6.20×10^{-2}	310%
R4	61.99	1.12×10^{-5}	2.24×10^{-5}	1.12×10^{-5}	0.06%	6.20×10^{-2}	310%
R5	61.99	2.29×10^{-5}	4.58×10^{-5}	2.29×10^{-5}	0.11%	6.20×10^{-2}	310%

Receptor	Background (ngm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R6	61.99	2.90×10^{-5}	5.81×10^{-5}	2.90×10^{-5}	0.15%	6.20×10^{-2}	310%
R7	61.99	2.37×10^{-5}	4.73×10^{-5}	2.37×10^{-5}	0.12%	6.20×10^{-2}	310%
R8	61.99	1.86×10^{-5}	3.71×10^{-5}	1.86×10^{-5}	0.09%	6.20×10^{-2}	310%
R9	61.99	1.70×10^{-5}	3.40×10^{-5}	1.70×10^{-5}	0.09%	6.20×10^{-2}	310%
R10	61.99	1.08×10^{-5}	2.16×10^{-5}	1.08×10^{-5}	0.05%	6.20×10^{-2}	310%
R11	61.99	7.68×10^{-6}	1.54×10^{-5}	7.68×10^{-6}	0.04%	6.20×10^{-2}	310%
R12	61.99	1.46×10^{-5}	2.92×10^{-5}	1.46×10^{-5}	0.07%	6.20×10^{-2}	310%
R13	61.99	1.14×10^{-5}	2.29×10^{-5}	1.14×10^{-5}	0.06%	6.20×10^{-2}	310%
R14	61.99	4.81×10^{-6}	9.62×10^{-6}	4.81×10^{-6}	0.02%	6.20×10^{-2}	310%
R15	61.99	8.54×10^{-6}	1.71×10^{-5}	8.54×10^{-6}	0.04%	6.20×10^{-2}	310%

Vanadium

Table 6.37 24-hourly Vanadium Impacts

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
EAL	1 μgm^{-3}						
R1	2.76	0.02	0.03	0.02	1.61%	0.04	3.51%
R2	2.76	0.02	0.03	0.02	1.68%	0.04	3.64%
R3	2.76	0.02	0.05	0.02	2.48%	0.05	5.25%
R4	2.76	0.02	0.03	0.02	1.52%	0.03	3.31%
R5	2.76	0.03	0.05	0.03	2.51%	0.05	5.29%
R6	2.76	0.02	0.05	0.02	2.38%	0.05	5.03%
R7	2.76	0.01	0.03	0.01	1.45%	0.03	3.17%
R8	2.76	0.02	0.04	0.02	1.86%	0.04	4.00%
R9	2.76	0.02	0.04	0.02	2.17%	0.05	4.61%
R10	2.76	0.02	0.04	0.02	1.82%	0.04	3.91%
R11	2.76	0.02	0.04	0.02	2.04%	0.04	4.35%
R12	2.76	0.02	0.04	0.02	1.76%	0.04	3.79%

Receptor	Background (μgm^{-3})	Existing PC (μgm^{-3})	Proposed PC (μgm^{-3})	PC Change	PC (% of AQS)	PEC (μgm^{-3})	PEC (% of AQS)
R13	2.76	0.02	0.05	0.02	2.36%	0.05	5.00%
R14	2.76	0.02	0.03	0.02	1.58%	0.03	3.44%
R15	2.76	0.01	0.02	0.01	1.22%	0.03	2.72%

Appendix C Sensitivity testing

The model sensitivity testing for this scheme includes the models for Scenario 2 (proposed facility).

Surface Roughness

Table C.1 presents a comparison of the main assessment results (with a surface roughness at 1 m) for the annual mean NO_2 against model runs with the surface roughness set at 1.5 m. The results indicate that there are no significant changes in predicted concentrations with varying the surface roughness.

Table C.1 Annual Mean NO_2 – Surface Roughness

Receptor	Surface Roughness at 1 m		Surface Roughness at 1.5	
	PC (μgm^{-3})	% PC of AQS	PC (μgm^{-3})	% PC of AQS
R1	2.55×10^{-4}	<0.01%	2.85×10^{-4}	<0.01%
R2	1.94×10^{-4}	<0.01%	2.50×10^{-4}	<0.01%
R3	2.14×10^{-4}	<0.01%	2.60×10^{-4}	<0.01%
R4	1.30×10^{-4}	<0.01%	1.18×10^{-4}	<0.01%
R5	2.76×10^{-4}	<0.01%	3.40×10^{-4}	<0.01%
R6	3.42×10^{-4}	<0.01%	4.28×10^{-4}	<0.01%
R7	3.08×10^{-4}	<0.01%	3.60×10^{-4}	<0.01%
R8	2.56×10^{-4}	<0.01%	2.83×10^{-4}	<0.01%
R9	2.35×10^{-4}	<0.01%	2.10×10^{-4}	<0.01%
R10	1.41×10^{-4}	<0.01%	1.60×10^{-4}	<0.01%
R11	6.38×10^{-5}	<0.01%	1.42×10^{-4}	<0.01%
R12	1.42×10^{-4}	<0.01%	2.22×10^{-4}	<0.01%
R13	8.82×10^{-5}	<0.01%	1.95×10^{-4}	<0.01%
R14	5.21×10^{-5}	<0.01%	6.29×10^{-5}	<0.01%
R15	1.04×10^{-4}	<0.01%	1.17×10^{-4}	<0.01%

Buildings

Table C.2 presents a comparison of the main assessment results (with buildings included) for the annual mean NO_2 against model runs with no buildings. The results indicate that there are no significant changes in predicted concentrations with varying absence of buildings in the model.

Table C.2 Annual Mean NO_2 – Buildings

Receptor	With Buildings		Without Buildings	
	PC (μgm^{-3})	% PC of AQS	PC (μgm^{-3})	% PC of AQS
R1	2.55×10^{-4}	<0.01%	2.38×10^{-4}	<0.01%
R2	1.94×10^{-4}	<0.01%	2.11×10^{-4}	<0.01%
R3	2.14×10^{-4}	<0.01%	2.35×10^{-4}	<0.01%
R4	1.30×10^{-4}	<0.01%	1.15×10^{-4}	<0.01%
R5	2.76×10^{-4}	<0.01%	3.16×10^{-4}	<0.01%
R6	3.42×10^{-4}	<0.01%	4.01×10^{-4}	<0.01%
R7	3.08×10^{-4}	<0.01%	3.26×10^{-4}	<0.01%
R8	2.56×10^{-4}	<0.01%	2.49×10^{-4}	<0.01%
R9	2.35×10^{-4}	<0.01%	1.75×10^{-4}	<0.01%
R10	1.41×10^{-4}	<0.01%	1.27×10^{-4}	<0.01%
R11	6.38×10^{-5}	<0.01%	1.06×10^{-4}	<0.01%
R12	1.42×10^{-4}	<0.01%	2.02×10^{-4}	<0.01%
R13	8.82×10^{-5}	<0.01%	1.58×10^{-4}	<0.01%
R14	5.21×10^{-5}	<0.01%	5.64×10^{-5}	<0.01%
R15	1.04×10^{-4}	<0.01%	1.06×10^{-4}	<0.01%

Terrain

Table C.2 presents a comparison of the main assessment results (with terrain included) for the annual mean NO_2 against model runs with no terrain. The results indicate that there are no significant changes in predicted concentrations with the absence of terrain data in the model.

Table C.3 Annual Mean NO_2 – Terrain

Receptor	With Buildings		Without Buildings	
	PC (μgm^{-3})	% PC of AQS	PC (μgm^{-3})	% PC of AQS
R1	2.55×10^{-4}	<0.01%	2.37×10^{-4}	<0.01%
R2	1.94×10^{-4}	<0.01%	2.06×10^{-4}	<0.01%
R3	2.14×10^{-4}	<0.01%	2.34×10^{-4}	<0.01%
R4	1.30×10^{-4}	<0.01%	1.19×10^{-4}	<0.01%
R5	2.76×10^{-4}	<0.01%	3.26×10^{-4}	<0.01%

Receptor	With Buildings		Without Buildings	
	PC (μgm^{-3})	% PC of AQS	PC (μgm^{-3})	% PC of AQS
R6	3.42×10^{-4}	<0.01%	4.11×10^{-4}	<0.01%
R7	3.08×10^{-4}	<0.01%	3.25×10^{-4}	<0.01%
R8	2.56×10^{-4}	<0.01%	2.49×10^{-4}	<0.01%
R9	2.35×10^{-4}	<0.01%	1.82×10^{-4}	<0.01%
R10	1.41×10^{-4}	<0.01%	1.37×10^{-4}	<0.01%
R11	6.38×10^{-5}	<0.01%	1.14×10^{-4}	<0.01%
R12	1.42×10^{-4}	<0.01%	2.06×10^{-4}	<0.01%
R13	8.82×10^{-5}	<0.01%	1.67×10^{-4}	<0.01%
R14	5.21×10^{-5}	<0.01%	6.04×10^{-5}	<0.01%
R15	1.04×10^{-4}	<0.01%	1.11×10^{-4}	<0.01%

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