FICHTNER

Consulting Engineers Limited





Severn Road Resource Recovery Centre – Energy from Waste Facility



Viridor Avonmouth Waste Services Limited

Dispersion Modelling Assessment

ENGINEERING CONSULTING

Document approval

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Management Summary

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged by Viridor Avonmouth Waste Services Limited to undertake a Dispersion Modelling Assessment to support the application for a variation to the Environmental Permit (EP) for the Severn Road Resource Recovery Centre – Energy from Waste Facility (the Facility). The proposed change to the EP is to increase the processing capacity of the Facility from 427,050 tonnes per annum to 538,000 tonnes per annum of waste (61.4 tonnes per hour), representative of operation at 126% of thermal capacity.

This assessment has considered the following scenarios:

- the "Operational Facility" – the model has been set up with data from the operational plant and this has been used to evaluate the impact of the Facility as it is currently operated; and
- the "Proposed Facility" – operational data factored to represent operation at 126% of the thermal capacity.

Dispersion Modelling of Emissions

The ADMS dispersion model is routinely used for air quality assessments to the satisfaction of the Environment Agency (EA). The model uses weather data from the local area to predict the spread and movement of the exhaust gases from the stack for each hour over a five-year period. The model takes account of wind speed, wind direction, temperature, humidity and the amount of cloud cover, as all of these factors influence the dispersion of emissions. The model also takes account of the effects of buildings and terrain on the movement of air. To set up the model, it has been assumed that the Facility operates for the whole year and continuously releases emissions at the emission limits set in the existing EP. The model has been used to predict concentration of pollutants on a long-term and short-term basis across a grid of points. In addition, concentrations have been predicted at the identified sensitive receptors.

Approach and Assessment of Impact on Air Quality – Protection of Human Health

The air quality impact on human health has been assessed using a standard approach based on guidance provided by the EA. Using this approach, in relation to the AQALs set for the protection of human health the following can be concluded from the assessment.

1. Emissions from the operation of the Proposed Facility will not cause a breach of any AQAL.
2. There is predicted to be a slight increase in most the impacts, but a slight reduction in the peak 1-hour impacts as a result of the proposed EP variation.
3. For all pollutants the change in impact as a result of the EP variation can be screened out as 'insignificant'.
4. For all pollutants the overall impact of the Proposed Facility can either be screened out as 'insignificant' or is 'not significant' when the total concentration is taken into consideration.

Approach and Assessment of Impact on Air Quality – Protection of Ecosystems

The impact of air quality on ecology has been assessed using a standard approach based on guidance provided by the EA. Using this approach, in relation to the Critical Level and Critical Loads set for the protection of ecology the following can be concluded from the assessment.

1. At all identified European and UK designated ecological receptors, the change in impact can be screened out as 'insignificant' as it is less than 1% of the long-term Critical Levels and Critical Loads and less than 10% of the short-term Critical Levels.
2. The impact of the Proposed Facility cannot be screened out as 'insignificant' at the Severn Estuary and River Wye designated sites. However, as the change in impact from the Operational Facility is extremely small and would be imperceptible, it is considered that there would be no significant effects on the integrity of these designated sites as a result of the proposed EP variation.
3. As a screening assessment it has been assumes that a local nature site is present at the overall point of maximum impact. The change in impact and the overall impact of the Proposed Facility at the point of maximum impact are both less than 100% of the Critical Levels and Loads and can be screened out as 'insignificant'.

Summary and Conclusions

In summary, the assessment has shown that the change in air quality impact associated with the proposed EP variation is marginal and emissions would not have a significant impact on local air quality, the general population or the local community. As such there should be no air quality constraint in granting a variation to the existing EP for the increased throughput as proposed.

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1 Introduction

1.1 Background

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged by Viridor Avonmouth Waste Services Limited to undertake a Dispersion Modelling Assessment to support the application for a variation to the Environmental Permit (EP) for the Severn Road Resource Recovery Centre – Energy from Waste Facility (the Facility). The proposed change to the EP is to increase the processing capacity of the Facility from 427,050 tonnes per annum to 538,000 tonnes per annum of waste (61.4 tonnes per hour), representative of operation at 126% of thermal capacity.

This assessment has considered the following scenarios:

- the "Operational Facility" – the model has been set up with data from the operational plant, and this has been used to evaluate the impact of the Facility as it is currently operated; and
- the "Proposed Facility" – operational data factored to represent operation at 126% of the design load.

The existing EP (Ref: EPR/GP3834HY) includes emission limits for emissions to air based on the Industrial Emissions Directive (IED) (Directive 2010/75/EU) and the Waste Incineration BREF[1]. When considering the impact on human health, the predicted atmospheric concentrations from operation at these emission limits have been compared to the Air Quality Assessment Levels (AQALs) for the protection of human health. For dioxins the AQAL is a Tolerable Daily Intake (TDI) which considered the combination of the intake from inhalation and ingestion. As such it is not possible to demonstrate compliance with the assessment level with just reference to the air concentration. As such, a separate Dioxin Pathway Intake Assessment has been undertaken to assess the pathway intake of these pollutants and impacts compared to the TDI and is provided with the application pack, refer to Appendix C.

When considering the impact on ecosystems, the predicted atmospheric concentrations have been compared to the Critical Levels for the protection of ecosystems. It is noted that deposition of emissions over a prolonged period can have nutrification and acidification impacts; therefore, an assessment of the long-term deposition of pollutants has been undertaken and the results compared to the habitat specific Critical Loads.

1.2 Structure of the report

This report has the following structure.

- National and international air quality legislation and guidance are considered in section 2.
- The background levels of ambient air quality are described in section 3.
- The residential properties and ecological receptors which are sensitive to changes in air quality associated with the Facility and identified in section 5.
- The inputs used for the dispersion model are contained in section 6.
- Details of the sensitivity analysis carried out is presented in section 7.
- The assessment methodology and results of the assessment of the impact of emissions on human health is presented in section 8.

[1] Best Available Techniques (BAT) Reference Document for Waste Incineration - 2019

- The assessment methodology and results of the assessment of the impact of emissions at ecological sites is presented in section 9.
- The conclusions of the assessment are set out in section 10.
- The Appendices include illustrative figures and detailed results tables.

2 Legislation Framework and Policy

2.1 Air quality assessment levels

In the UK, Ambient Air Directive (AAD) Limit Values, Targets, and air quality standards and objectives for major pollutants are described in The Air Quality Strategy (AQS). In addition, the Environment Agency include Environmental Assessment Levels (EALs) for other pollutants in the environmental management guidance 'Air Emissions Risk Assessment for your Environmental Permit'[2] ("Air Emissions Guidance"), which are also considered. The long-term and short-term EALs from these documents have been used when the AQS does not contain relevant objectives. Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within the Air Emissions Guidance and the Air Pollution Information System (APIS).

AAD Target and Limit Values, AQS Objectives, and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups. For the remainder of this report these are collectively referred to as AQALs. Table 1 to Table 3 summarise the air quality objectives and guidelines used in this assessment.

Table 1: Air Quality Assessment Levels (AQALs)

Pollutant	Limit value (µg/m³)	Averaging period	Frequency of exceedances	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)	AAD Limit Value
	40	Annual	-	AAD Limit Value
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)	AQS Objective
	350	1 hour	24 times per year (99.73rd percentile)	AAD Limit Value
	125	24 hours	3 times per year (99.18th percentile)	AAD Limit Value
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41st percentile)	AAD Limit Value
	40	Annual	-	AAD Limit Value
Particulate matter ($PM_{2.5}$)	10	Annual	-	Environmental Targets (fine particulate matter) (England) Regulations 2023 – to be achieved by 2040.
Carbon monoxide	10,000	8 hours, running	-	AAD Limit Value
	30,000	1 hour		Air Emissions Guidance
Hydrogen chloride	750	1 hour	-	Air Emissions Guidance

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

Pollutant	Limit value (µg/m³)	Averaging period	Frequency of exceedances	Source
Hydrogen fluoride	160	1 hour	-	Air Emissions Guidance
	16	Annual	-	Air Emissions Guidance
Ammonia	2,500	1 hour	-	Air Emissions Guidance
	180	Annual	-	Air Emissions Guidance
Lead	0.25	Annual	-	AQS Objective
Benzene	5.00	Annual	-	AQS Objective
	30	24 hour	-	Air Emissions Guidance
PCBs	6	1-hour	-	Air Emissions Guidance
	0.2	Annual	-	Air Emissions Guidance
PAHs	0.00025	Annual	-	AQS Objective

Table 2: Environmental Assessment Levels (EALs) for Metals

Pollutant	AQAL (ng/m³)	Averaging Period	Source
Arsenic (As)	-	1 hour	-
	6	Annual	Air Emissions Guidance
Antimony (Sb)	150,000	1 hour	Air Emissions Guidance
	5,000	Annual	Air Emissions Guidance
Cadmium (Cd)	30	24 hours	Air Emissions Guidance
	5	Annual	AAD Target Value
Chromium (III) (Cr)	2,000	24 hours	Air Emissions Guidance
	-	Annual	-
Chromium (VI) (Cr (VI))	-	1 hour	-
	0.25	Annual	Air Emissions Guidance
Cobalt (Co)	-	1 hour	-
	-	Annual	-
Copper (Cu)	50	24 hours	Air Emissions Guidance
	-	Annual	-
Lead (Pb)	-	1 hour	-
	250	Annual	AQS Target
Manganese (Mn)	1,500,000	1 hour	Air Emissions Guidance
	150	Annual	Air Emissions Guidance
Mercury (Hg)	600	1 hour	Air Emissions Guidance
	60	24 hours	Air Emissions Guidance
	-	Annual	-
Nickel (Ni)	700	1 hour	Air Emissions Guidance

Pollutant	AQAL (ng/m³)	Averaging Period	Source
	20	Annual	AAD Limit
Vanadium (V)	1,000	24 hours	Air Emissions Guidance
	-	Annual	-

Table 3: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration (µg/m³)	Measured as	Source
Nitrogen oxides (as nitrogen dioxide)	75 / 200*	Daily mean	Air Emissions Guidance
	30	Annual mean	AQS Objective
Sulphur dioxide	10	Annual mean, for the protection of lichens and bryophytes	Air Emissions Guidance
	20	Annual mean for all higher plants	AQS Objective
Hydrogen fluoride	5	Daily mean	Air Emissions Guidance
	0.5	Weekly mean	Air Emissions Guidance
Ammonia	1	Annual mean, for the protection of lichens and bryophytes	Air Emissions Guidance
	3	Annual mean For all higher plants	Air Emissions Guidance
Note: **The higher Critical Level of 200 µg/m³ is only for detailed assessments where ozone is below the AOT40 critical level and sulphur dioxide is below the lower Critical Level of 10 µg/m³* The *AOT40 for ozone is 3,000 ppb.h (6,000 µg/m³.h) calculated from accumulated hourly ozone concentrations – AOT40 means the sum of the difference between each hourly daytime (08:00 to 20:00 Central European Time, CET) ozone concentration greater than 80 µg/m³ (40 ppb) and 80 µg/m³, for the period between 1 May and 31 July.*			

In addition to the Critical Levels set out in Table 3, APIS provides habitat specific Critical Loads for nitrogen and acid deposition. Full details of the habitat specific Critical Loads can be found in Appendix B.

2.2 Areas of relevant exposure

The AQALs apply only at areas of exposure relevant to the assessment level. The following table extracted from Local Authority Air Quality Technical Guidance (LAQM.TG22) explains where the AQALs apply.

Table 4: Guidance on Where AQALs Apply

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

Source: Box 1.1 LAQM.TG22

2.3 Industrial pollution regulation

Atmospheric emissions from industrial processes are controlled in England through the Environmental Permitting Regulations (2016) (and subsequent amendments). The Facility currently has an EP to operate. The EP includes conditions to ensure that the environmental impact of the operations is minimised. This includes conditions to prevent fugitive emissions of dust and odour beyond the boundary of the permitted activity, and limits on emissions to air.

The Industrial Emissions Directive (IED) (Directive 2010/75/EU) was adopted on 7 January 2013, and is the key European Directive which covers almost all regulation of industrial processes in the European Union (EU). Within the IED, the requirements of the relevant sector BREF become binding as BAT guidance, as follows.

- Article 15, paragraph 2, of the IED requires that Emission Limit Values (ELVs) are based on best available techniques, referred to as BAT.
- Article 13 of the IED, requires that 'the Commission' develops BAT guidance documents (referred to as BREFs).
- Article 21, paragraph 3, of the IED, requires that when updated BAT conclusions are published, the Competent Authority (in England this is the EA) has up to four years to revise permits for facilities covered by that activity to comply with the requirements of the sector specific BREF.

The EA has published guidance[3] which explains that 'BAT' means the available techniques which are the best for preventing or minimising emissions and impacts on the environment where 'techniques' include both the technology used and the way the installation is designed, built, maintained, operated and decommissioned.

The Waste Incineration BREF was published by the European Integrated Pollution Prevention and Control (IPPC) Bureau in December 2019. The existing EP has previously been varied to implement the requirements of the Waste Incineration BREF.

2.4 Local air quality management

In accordance with Section 82 of the Environment Act (1995) (Part IV), local authorities are required to periodically review and assess air quality within their area of jurisdiction, under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves assessing present and likely future ambient pollutant concentrations against AQALs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, then the local authority is required to declare an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant levels in pursuit of the relevant AQALs.

[3] Guidance - Best available techniques: environmental permits, https://www.gov.uk/guidance/best-available-techniques-environmental-permits

3 Assessment Criteria

3.1 Human health

The Air Emissions Guidance states that to screen out 'insignificant' process contributions (PCs):

- *the long-term PC must be less than 1% of the long-term environmental standard; and*
- *the short-term PC must be less than 10% of the short-term environmental standard.*

As part of this assessment, predicted PCs have been compared to the AQALs detailed in section 2.1.

If the above criteria are achieved, it can be concluded that emissions would not lead to significant environmental impacts and the PCs can be screened out from further assessment.

The long-term 1% PC threshold is based on the judgement that:

- it is unlikely that an emission at this level will make a significant contribution to air quality; and
- the threshold provides a substantial safety margin to protect health and the environment.

The short-term 10% PC threshold is based on the judgement that:

- spatial and temporal conditions mean that short-term PCs are transient and limited in comparison with long-term PCs; and
- the threshold provides a substantial safety margin to protect health and the environment.

For the purpose of this assessment, if the impact can be screened out as 'insignificant' at the point of maximum impact, further assessment is not required. However, if the PC cannot be screened out, assessment will be undertaken for the following:

- the predicted environmental concentration (PEC, defined as the PC plus the background concentration) at the point of maximum impact; and
- the PC and PEC at areas of public exposure.

If the long-term PEC is below 70% of the AQAL, or the short-term PC is less than 20% of the headroom[4], it can be concluded that there is little risk of the PEC exceeding the AQAL, and the impact can be considered 'not significant'.

For the assessment of group 3 metals, guidance taken from the EA document 'Guidance on assessing group 3 metals stack emissions from incinerators – V.4 June 2016' ('EA metals guidance') has been used. The EA metals guidance states that where the PC for any metal exceeds 1% of the long term or 10% of the short-term environmental standard (in this case the AQAL), this is considered to have potential for significant pollution. Where the PC exceeds these criteria, the PEC should be compared to the AQAL. The PEC can be screened out if is less than the AQAL. Where the impact is within these parameters it can be concluded that there is no significant risk of exceeding the AQAL.

3.2 Ecology

The Air Emissions Guidance states that to screen out impacts as 'insignificant' at European and UK statutory designated sites:

- the long-term PC must be less than 1% of the long-term environmental standard (i.e. the Critical Level or Load); and

[4] Calculated as the AQAL minus twice the long-term background concentration.

- the short-term PC must be less than 10% of the short-term environmental standard.

If the above criteria are met, no further assessment is required. If the long-term PC exceeds 1% of the long-term environmental standard, the PEC must be calculated and compared to the standard. If the resulting PEC is less than 70% of the long-term environmental standard, the Air Emissions Guidance states that the emissions are 'insignificant' and further assessment is not required. In accordance with the guidance, calculation of the PEC for short-term standards is not required.

In addition, the Air Emissions Guidance states that to screen out impacts as 'insignificant' at local nature sites[5]:

- the long-term PC must be less than 100% of the long-term environmental standard; and
- the short-term PC must be less than 100% of the short-term environmental standard.

Therefore, in accordance with the guidance, calculation of the PEC for local nature sites is not required.

[5] Ancient woodlands, local wildlife sites and national and local nature reserves.

4 Baseline Air Quality

The Facility is located in Avonmouth, a predominantly industrial area within the administrative area of Bristol City Council (BCC) approximately 10 km northwest of Bristol city centre. The boundary with South Gloucestershire District Council (SGDC) lies immediately to the east of the Facility. The location of the Facility is shown on Figure 1 of Appendix A.

4.1 Air quality review and assessment

Under Section 82 of the Environment Act (1995) (Part IV), local authorities are required to undertake an ongoing exercise to review air quality within their area of jurisdiction.

The closest AQMA to the Facility is the Bristol AQMA, declared by BCC due to concern over concentrations of nitrogen dioxide and particulate matter. The Bristol AQMA lies approximately 7 km southeast of the Facility at the closest point. Due to the distance from the Facility the impact in this and all other AQMAs will be insignificant and the impact at AQMAs has not been considered further.

4.2 National modelling – mapped background data

The Department for Environment Food and Rural Affairs (Defra) provides modelled background concentrations of pollutants across the UK on a 1 km by 1 km grid under the Modelling of Ambient Air Quality (MAAQ) contract. This model is based on known pollution sources and background measurements and provides a source of background concentrations in lieu of suitable monitoring data. Mapped background concentrations have been downloaded for the grid squares containing the Facility and immediate surroundings. In addition, mapped atmospheric concentrations of ammonia are available from APIS via the National Environment Research Council (NERC) Centre for Ecology and Hydrology (CEH) throughout the UK.

The mapped background data is calibrated against monitoring data. The most recently available 2024 mapped background concentrations are based on 2024 meteorological data and are calibrated against monitoring undertaken in 2024.

Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentrations from within 5 km of the Facility have been calculated, as presented in Table 5, together with the concentrations at the Site.

Table 5: Mapped Background Data

Pollutant	Annual mean concentration (µg/m³)		Dataset
	At the Site	Max within 5 km	
Nitrogen dioxide	8.55	20.77	Defra 2024 Dataset
Sulphur dioxide	1.13	2.45	Defra 2024 Dataset
Particulate matter (as PM_{10})	11.32	12.90	Defra 2024 Dataset
Particulate matter (as $PM_{2.5}$)	6.02	7.19	Defra 2024 Dataset
Carbon monoxide	211	227	Defra 2010 Dataset(1)
Benzene	0.29	0.40	Defra 2024 Dataset
Ammonia	1.40	1.40	APIS 2022 – 2024 average

Note:
(1) Carbon monoxide mapping has not been updated since 2010.

Source: © Crown 2026 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

4.3 AURN and LAQM monitoring data

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of the Defra. This includes automatic monitoring of oxides of nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and particulates.

Monitoring sites are broadly categorised into 'background' sites and 'roadside' sites. Background sites are positioned that they are not influenced significantly by any single source or street but rather by the contribution from all sources upwind of the station and are considered broadly representative for several square kilometres. Roadside sites are predominately determined by emissions from nearby traffic and are only representative of air quality for the immediate area of the analyser. As such, background sites within 5 km of the Facility and roadside sites within 3 km of the Facility have been considered in this analysis.

The closest AURN monitoring stations to the Facility are at Bristol Patchway, an urban background PM_{10} and $PM_{2.5}$ monitor approximately 5.5 km east, and in Bristol city centre, approximately 10 km south-east. Bristol Patchway commenced monitoring in November 2025, so a full year of data is not yet available. Due to the distance from the Facility and the city centre setting, the Bristol City Centre monitoring sites are not considered to be representative of the areas close to the Facility. Therefore, AURN monitoring data has not been considered further.

In addition to the national AURN, local authorities undertake monitoring of a range of pollutants as part of the LAQM review process. A review of the most recent Air Quality Annual Status Reports (ASRs) published by BCC and SGDC shows that there is only one background site within 5 km of the Facility and no roadside sites within 3 km of the Facility. The background site is a diffusion tube monitoring nitrogen dioxide at an urban background location in Severn Beach approximately 3 km north of the Facility. A summary of monitoring data from this background site is shown in Table 6.

Table 6: Diffusion Tube Monitoring within 10 km of the Facility

Diffusion Tube	Location		Nitrogen dioxide annual mean concentration (µg/m³)					
	X	Y	2024 mapped bg	2020	2021	2022	2023	2024
38 Severn Beach	354282	184653	12.96	9.8	10.8	12.4	8.8	8.7

Source: SGDC Annual Status Report 2025

As shown, the diffusion tube monitoring data from the background site shows concentrations slightly lower than the mapped background for the grid square containing the diffusion tube, demonstrating that the mapped background is a conservative estimate of concentrations at background locations away from local road sources.

4.4 Summary of mapped background, AURN and LAQM data

In summary, there is very little local monitoring available. However, where background monitoring is available it shows concentrations slightly higher than the 2024 mapped background dataset. Therefore, in the first instance the maximum mapped background concentrations within the modelling domain, as presented in Table 5, have been used as a conservative estimate of the

baseline concentrations for this assessment. Further consideration has been given to the choice of baseline concentration in section 8 for any impacts that cannot be screened out as 'insignificant'.

4.5 Other national monitoring networks data

Neither the Defra mapped background dataset, AURN or LAQM include monitoring of other pollutants released from the Facility such as hydrogen chloride, hydrogen fluoride, VOCs, metals or dioxins. As such reference has been made to national modelling to determine a suitable baseline concentration.

4.5.1 Hydrogen chloride

Hydrogen chloride was measured until the end of 2015 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). Monitoring of hydrogen chloride ceased at the end of 2015 and none of the historic sites were located within 10 km of the Facility.

The maximum annual average monitored within the UK between 2011 and 2015 was 0.76 µg/m³. In lieu of any recent representative monitoring this has been used as the baseline concentration for this assessment as a conservative estimate.

4.5.2 Hydrogen fluoride

Baseline concentrations of hydrogen fluoride are neither measured locally nor nationally, since these are 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 µg/m^3 to 2.35 µg/m^3.

In lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has been used for the purpose of this assessment as a conservative estimate.

4.5.3 Ammonia

Ammonia is also measured as part of the UKEAP project at rural background locations. There are no UKEAP monitoring locations within 10 km of the Facility. In lieu of any local UKEAP monitoring, the maximum mapped background value from APIS from within 5 km of the Facility (1.40 µg/m³). has been used for the purpose of this assessment.

4.5.4 Volatile Organic Compounds

As part of the Automatic and Non-Automatic Hydrocarbon Network, benzene concentrations are measured at sites co-located with the AURN across the UK.

There are no benzene monitoring sites within 10 km of the Facility. The closest sites are at Bath and Newport, both approximately 25 km from the Facility. Therefore, the maximum mapped background value within 5 km of the Facility, 0.40 µg/m³, has been used as the baseline concentration of benzene.

4.5.5 Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks (previously the Lead, Multi-Element and Industrial Metals Networks). The closest metals monitoring site is located at Port Talbot, over 75 km to the west. As no representative local monitoring is available, a review of the metals monitoring across the UK has been carried out and the maximum annual mean concentration from urban background sites has been determined as shown in Table 7. This is considered appropriate for the setting of the Facility; although the Avonmouth area is industrial, it does not contain any significant sources of metals such as steelworks.

Table 7: Metals Monitoring – Maximum Annual Mean Concentrations at Urban Background Sites

Substance	Annual mean concentration (ng/m³)						Max (as % of AQAL)
	AQAL	2021	2022	2023	2024	2025	
Arsenic	6	0.98	0.90	0.80	0.94	1.00	16.7%
Cadmium	5	0.35	0.29	0.29	0.25	0.28	7.0%
Chromium	-	4.80	4.60	4.80	4.60	4.70	-
Cobalt	-	0.65	1.50	0.86	0.56	0.78	-
Copper	-	10.00	10.00	9.60	9.30	9.60	-
Lead	250	15.00	8.00	7.60	5.40	6.10	6.0%
Manganese	150	7.60	8.50	8.00	7.00	6.80	5.7%
Nickel	20	2.20	2.50	2.40	1.80	1.90	12.5%
Vanadium	-	3.00	1.90	1.90	1.20	1.60	-

Notes:

Excludes data from Sheffield Tinsley and Swansea for chromium, lead, manganese,nickel, and cooper – although these are background sites, they are located close to significant industrial sources of metals and as such have high levels of these pollutants far greater than that monitored at other background sites.

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As shown, the concentrations monitored were significantly lower than the AQALs. As a conservative assumption the maximum monitored annual mean concentrations of each metal from an urban background monitor between 2021 and 2025 as presented in Table 7 have been used as the baseline concentrations within this assessment.

There are also AQALs for antimony and mercury, for which no recent monitoring data is available. With reference to these pollutants:

- Monitoring of antimony across the UK ceased at the end of 2013. The maximum monitored at any background site in 2013 was 1.3 ng/m³ at Detling.
- Monitoring of mercury ceased in August 2018 and at from 2016 this was only carried out at two sites across the UK - London Westminster and Runcorn Weston Point. Concentrations at both sites were well below the AQAL. Concentrations at both sites were well below the AQALs although higher at Runcorn due to its proximity to industrial sources. The monitored concentration at London Westminster in 2018 was 2.8 ng/m³.

The values of 1.30 ng/m³ for antimony and 2.8 ng/m³ for mercury have been used as the baseline concentrations for this assessment.

4.5.6 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PCBs were monitored at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. Monitoring of dioxins ceased at the end of 2016 and monitoring of PCBs ceased at the end of 2018. None of the monitoring locations were located within 10 km of the Facility. A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 8 and Table 9.

Table 8: TOMPS – Dioxin and Furans Monitoring

Site	Annual mean concentration (fgTEQ/m³)				
	2012	2013	2014	2015	2016
Auchencorth Moss	0.13	0.86	0.01	0.01	0.13
Hazelrigg	8.75	2.02	2.61	5.27	4.59
High Muffles	4.32	0.6	1.07	0.54	2.73
London Nobel House	15.42	3.47	2.89	4.34	21.27
Manchester Law Courts	32.99	10.19	16.52	5.94	12.23
Weybourne	9.3	2.34	1.61	1.42	16.32

Source: © Crown 2026 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

Table 9: TOMPS – PCB Monitoring

Site	Annual mean concentration (pg/m³)				
	2014	2015	2016	2017	2018
Auchencorth Moss	23.23	24.27	25.32	19.09	12.31
Hazelrigg	25.84	41.68	52.58	33.15	22.22
High Muffles	26.11	33.43	37.76	31.63	8.86
London Nobel House	107.49	121.39	110.46	121.87	46.63
Manchester Law Courts	128.93	97.99	92.6	97.27	40.10
Weybourne	17.00	20.95	38.61	32.26	11.23

Source: © Crown 2026 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

As shown, the concentrations vary significantly between sites and years. As there are no monitoring sites located within close proximity of the Facility, or any mapped background datasets, the maximum monitored concentrations from the most recent 5 years of monitoring have been used as the background concentrations within this assessment. These values are 32.99 fg/TEQ/m³ for dioxins and furans and 128.93 pg/m³ for PCBs.

4.5.7 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are monitored at a number of stations in the UK as part of the PAH network. For the purpose of this assessment, benzo(a)pyrene is considered as this is the only PAH which an AQAL has been set. The closest PAH analysers to the Facility is Bristol St Pauls, 9.5 km to the southeast. This is unlikely to be representative of the concentrations in the vicinity of the Facility.

A summary of benzo(a)pyrene concentrations from all background sites in the UK is presented in Table 10.

Table 10: National Monitoring - Benzo(a)pyrene

Site Type	Quantity	AQAL (ng/m³)	Annual mean concentration (ng/m³)				
			2021	2022	2023	2024	2025
All background sites	Min	0.25	0.02	0.02	0.01	0.01	0.01
	Max		0.68	0.60	0.62	0.52	0.48
	Average		0.19	0.19	0.16	0.12	0.14

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As shown the maximum monitored concentration exceeds the AQAL of 0.25 ng/m^3. In lieu of any local monitoring of PAHs or any mapped background datasets, the maximum concentration from any background site (0.68 ng/m^3) has been used as a screening assumption noting that this exceeds the AQAL.

4.6 Summary

Table 11 outlines the values for the annual average baseline concentrations that have been used to evaluate the impact of the Facility. The choice of baseline concentration will be considered further if the impact of the Facility cannot be screened out as 'insignificant'.

Table 11: Summary of Baseline Concentrations

Pollutant	Annual mean concentration	Units	Justification
Nitrogen dioxide	20.77	µg/m³	Maximum mapped background concentration within modelling domain (2024 Defra MAAQ dataset/ 2010 dataset for carbon monoxide)
Sulphur dioxide	2.45	µg/m³	
Particulate matter (as PM_{10})	12.90	µg/m³	
Particulate matter (as $PM_{2.5}$)	7.19	µg/m³	
Carbon monoxide	227	µg/m³	
Hydrogen chloride	0.76	µg/m³	Maximum monitored concentration across the UK 2011 to 2015
Hydrogen fluoride	2.35	µg/m³	Maximum measured concentration from EPAQS report
Ammonia	1.40	µg/m³	Maximum mapped background concentration within modelling domain (APIS 2022-2024)
Benzene	0.40	µg/m³	Maximum mapped background concentration within modelling domain (2001 Defra dataset)
Arsenic	1.0	ng/m³	Maximum monitored 2021 to 2025 at any UK urban background site. Chromium VI assumed to be 20% of total chromium.
Cadmium	0.35	ng/m³	
Chromium	4.8	ng/m³	
Chromium VI	0.96	ng/m³	
Cobalt	1.50	ng/m³	
Copper	18.0	ng/m³	
Lead	15.0	ng/m³	

Pollutant	Annual mean concentration	Units	Justification
Manganese	8.5	ng/m³	
Nickel	2.5	ng/m³	
Vanadium	3.0	ng/m³	
Antimony	1.3	ng/m³	The maximum monitored at any background site from the last year this was monitored (2013)
Mercury	2.8	ng/m³	Monitored annual mean concentration, London Westminster, 2018.
Dioxins and furans	32.99	fg/m³	Maximum UK monitored concentration between 2012 and 2016
Polychlorinated biphenyls (PCBs)	128.93	pg/m³	Maximum UK monitored concentration between 2014 and 2018
Benzo(a)pyrene (PAHs)	0.68	ng/m³	Maximum monitored 2021 to 2025 at any urban background site

5 Sensitive Receptors

5.1 Human sensitive receptors

The general approach to the assessment is to evaluate the highest predicted PCs at a height of 1.5m, to represent typical breathing height. In addition, the predicted PCs at nearby sensitive receptors have been evaluated. These sensitive receptors have been selected to represent the residential properties and schools most likely to be impacted by emissions from the Facility. The receptors are displayed in Figure 2 of Appendix A and listed in Table 12.

Table 12: Sensitive Receptors

ID	Receptor name	Location			Distance from the stack (km)
		X (m)	Y (m)	Z (m)	
R1	Oasis Academy Bank Leaze Primary School	354968	178939	1.5	2.91
R2	Berwick Lodge	356047	180752	1.5	2.35
R3	Elmington Manor Farm	355666	181552	1.5	1.81
R4	Berwick Farm	355558	180980	1.5	1.82
R5	Hallen Farm	354654	180371	1.5	1.48
R6	Brook Farm	356177	182237	1.5	2.39

5.2 Ecological sensitive receptors

The EA has provided a nature and heritage conservation screening report which identifies the following sites of ecological importance in accordance with Air Emissions Guidance criteria:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the Facility;
- Sites of Special Scientific Interest (SSSIs) within 2 km of the Facility; and
- Local Nature Sites[6] within 2 km of the Facility.

The sensitive ecological receptors identified are presented by distance from the stack in Table 13 and are displayed in Figure 3 of Appendix A.

Table 13: Sensitive Ecological Receptors

ID	Name	Location (closest point)		Distance from stack at closest point (km)
		X (m)	Y (m)	
European and UK Designated Sites				
E1	Severn Estuary SAC, SPA, Ramsar, SSSI	353100	182250	0.98
E2	Avon Gorge Woodlands SAC	354800	175640	6.06
E3	River Wye SAC	354450	191110	9.50

[6] National Nature Reserves (NNR), Local Nature Reserves (LNRs), Local Wildlife Sites and ancient woodlands.

ID	Name	Location (closest point)		Distance from stack at closest point (km)
		X (m)	Y (m)	
Local Nature Sites				
E4[(1)]	Point of maximum impact	-	-	-

Note:
[(1)] A total of ten local nature sites have been identified in the nature and conservation screening report. As a screening assumption it has been assumed that the maximum impact of emissions from the Facility occurs at a local nature site.

The Severn Estuary covers a large area in close proximity to the Facility. For the assessment of impacts at the Severn Estuary, the maximum impact across the designated site has been calculated. For the Avon Gorge Woodlands SAC and River Wye SAC the impact has been assessed using a single receptor point at the closest point of each SAC to the Facility.

6 Modelling Methodology

6.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS 6, developed and supplied by Cambridge Environmental Research Consultants (CERC) This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for planning and Environmental Permitting purposes to the satisfaction of the EA and local authorities.

6.2 Source and emissions data

The source and emissions input data utilised within the modelling are presented in Table 14 to Table 16. The data for the Operational Facility has been taken from data recorded by the continuous emissions monitoring system (CEMS) for the calendar year 2025.

The data on the waste throughput and NCV recorded at the Facility shows that during 2025 the average thermal input was 62.5 MWth per line, which is 109.1% of the design thermal input of 57.3 MWth. To represent the Proposed Facility operating at 126% of the thermal capacity, the average flue gas flow rate recorded by the CEMS has been increased by a factor of 126/109.1 = 1.155.

Table 14: Source Data

Item	Unit	Operational Facility	Proposed Facility
Stack data			
Height	m	90	
Effective internal diameter	m	2.404	
Location	m, m	353862, 181627	
Flue gas conditions			
Temperature	°C	143.7	
Pressure	kPa	98.2	
Reference pressure	kPa	101.3	
Exit moisture content	% v/v	19.03%	
Exit oxygen content	% v/v dry	6.81%	
Reference oxygen content	% v/v dry	11%	
Volume at reference conditions (dry, 273.15K, ref pressure and O_2)	Nm^3/h	285,985	330,588
	Nm^3/s	79.44	91.83
Volume at actual conditions	Am^3/h	391,564	452,633
	Am^3/s	108.77	125.73
Flue gas exit velocity	m/s	23.96	27.70

The effective internal diameter of 2.404 m is representative of the two individual flues of diameter 1.7 m combined. These have been entered into the model as a single combined source.

Table 15: Stack Emissions Data – Daily or Periodic ELV

Pollutant	Daily or periodic	Operational Facility	Proposed Facility
	Conc. (mg/Nm³)	Release rate (g/s)	
Oxides of nitrogen (as NO_2)	180	14.69	16.53
Sulphur dioxide	40	3.265	3.673
Carbon monoxide[1]	50	4.081	4.591
Fine particulate matter (PM)[2]	5	0.408	0.459
Hydrogen chloride	8	0.653	0.735
Volatile organic compounds (as TOC)	10	0.816	0.918
Hydrogen fluoride	1	0.082	0.092
Ammonia	15	1.224	1.377
Cadmium and thallium	0.02	1.633 mg/s	1.837 mg/s
Mercury	0.02	1.633 mg/s	1.837 mg/s
Other metals[3]	0.3	24.49 mg/s	27.55 mg/s
Benzo(a)pyrene (PAHs)[4]	0.2 µg/Nm³	16.33 µg/s	18.37 µg/s
Dioxins and furans[5]	0.06 ng/Nm³	4.898 ng/s	5.510 ng/s
PCBs[6]	5 µg/Nm³	0.408 mg/s	0.459 mg/s

Notes:

All emissions are expressed at reference conditions of dry gas, 11% oxygen, 101.3 kPa, 273.15K.

[1] Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.

[2] As a worst-case it has been assumed that the entire PM emissions consist of either PM_{10} or $PM_{2.5}$ for comparison with the relevant AQALs.

[3] Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

[4] 0.2 µg/m³ is the maximum recorded at a UK plant (2019 Waste Incineration BREF, Figure 8.121). This is assumed to be the emission concentration for the Facility.

[5] The EP includes a limit of 0.06 ng I-TEQ/Nm³ as an average over a minimum of 6 hours, and a limit of 0.08 ng I-TEQ/Nm³ as a long-term average over a minimum of 2 weeks. The long-term average sampling is only required if it cannot be demonstrated that emissions are low and stable. It has been assumed that the long-term average monitoring will not be required and an emission limit of 0.06 ng I-TEQ/Nm³ is representative of the maximum annual mean emission concentration from the Facility.

[6] Table 3.8 of the 2006 Waste Incineration BREF states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). In lieu of other available operational data, this has been assumed to be the emission concentration for the Facility.

As shown in Table 14, the volumetric flow rate on a normalised and actual basis is greater for the Proposed Facility than the Operational Facility. As a result, a greater quantity of pollutants would

be released on a g/s basis from the Proposed Facility due to the increase volume of flue gas through the stack. However, these would be released at a greater velocity.

Table 16: Stack Emissions Data – Short Term

Pollutant	Half-hourly ELV	Operational Facility	Proposed Facility
	mg/Nm³		Release rate (g/s)
Oxides of nitrogen (as NO_2)	400	32.65	36.73
Sulphur dioxide	200	16.33	18.37
Carbon monoxide[(1)]	150	12.24	13.77
Fine particulate matter (PM)	30	2.449	2.755
Hydrogen chloride	60	4.898	5.510
Volatile organic compounds (as TOC)	20	1.633	1.837

Notes:
All emissions are expressed at reference conditions of dry gas, 11% oxygen, 101.3 kPa, 273.15K.
(1) Averaging period for carbon monoxide is 95%ile of all 10-minute averages in any 24-hour period.

6.3 Other inputs

6.3.1 Modelling domain

Modelling has been undertaken over a grid of 9 x 9 km with grid spacing of 90 m, with a nested grid of 3 x 3 km with a grid spacing of 30 m. The nested grid option has been used to ensure that the variations in concentrations around the point of maximum impact can be accurately accounted for, while also covering a wider area to consider the more distant receptors. Reference should be made to Figure 4 of Appendix A for a graphical representation of the modelling domain.

Table 17: Modelling Domain

Nested grid	Nested grid	Wider area
Grid Spacing (m)	30	90
Grid Start X	352500	349500
Grid Finish X	355500	358500
Grid Start Y	180200	177200
Grid Finish Y	180200	186200

6.3.2 Meteorological data and surface characteristics

The impact of meteorological data has been taken into account by using meteorological data from the Avonmouth meteorological recording station for the years 2016 – 2020 sourced from Air Pollution Services (APS) Limited; data is not available after the end of 2020. The Avonmouth recording station was located approximately 4.5 km southwest of the Facility and is considered the most representative meteorological station available. The most recent five years of data available has been used to allow for inter-annual variability in meteorological conditions. Wind roses for each year of meteorological data can be found in Figure 5 of Appendix A.

The minimum Monin-Obukhov length utilised in ADMS can be selected for both the dispersion site and 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. Surface conditions at the Facility are mixed industrial uses whilst conditions at Avonmouth are influenced by its coastal location. As such, the minimum Monin-Obukhov length has been set to 30 m at the dispersion site as recommended by CERC for 'mixed urban/industrial', whilst the meteorological site has been set to 1 m due to its coastal location as the immediate proximity of the sea can result in stable conditions if the sea is cooler than the air.

The surface roughness length can be selected in ADMS for both the dispersion site and the meteorological site. The surface roughness has been set to 0.061 m for the meteorological site, which was recommended by APS as a weighted average of the land uses around the meteorological site.

The surface roughness length varies widely across the modelling domain, from very low values over the Severn estuary to much higher values over built-up areas. To account for the varying surface roughness length a spatially-varying surface roughness file has been generated. The land-use class for each point in the file has been extracted from the CORINE Land Cover database[7] and cross-referenced with the most likely surface roughness length value[8].

The parameters for the spatially-varying surface roughness file are shown in Table 18 and a visual representation shown in Figure 6.

Table 18: Spatially Varying Surface Roughness File Parameters

Parameter	Value
Grid spacing (m)	150
Grid points	67 x 67
Modelled resolution	64 x 64
Grid Start X (m)	348975
Grid Finish X (m)	359025
Grid Start Y (m)	176700
Grid Finish Y (m)	186750

Table 19: Surface Roughness Lengths Used for Different Land Use Classes

Land use classification	Corine 2018 land use codes	Surface roughness length (m)
Broad-leaved forest Coniferous forest	311 312	0.75
Green urban areas Transitional woodland/shrub	141 324	0.6
Discontinuous urban fabric Construction sites Industrial or commercial units	112 133 121	0.5

[7] https://land.copernicus.eu/pan-european/corine-land-cover

[8] Taken from "Roughness length classification of Corine Land Cover classes", Megajoule Consultants, 2007.

Land use classification	Corine 2018 land use codes	Surface roughness length (m)
Sport and leisure facilities Port areas	142 123	
Road and rail networks and associated land	122	0.075
Non-irrigated arable land Inland marshes Salt marshes	211 411 421	0.05
Pastures	231	0.03
Airports Mineral extraction sites Sparsely vegetated areas	124 132 333	0.005
Intertidal flats	423	0.001
Water*	511	0.0001
**CLC roughness classification for water is 0, but this is not a valid input for ADMS. The value has been set to 0.0001m, which is the value recommended by CERC for 'sea'.*		

The closest points of ecological receptors E2 and E3 lie outside of the surface roughness file extent (and terrain file extent, see section 6.3.3). Therefore, the impact at these receptors has been assessed without the effect of terrain and spatially varying surface roughness length. The effect of wind turbines (see section 6.3.5) has also been excluded, as the wind turbines wakes will not interact with the plume from the Facility when it is blowing towards receptors E2 and E3. A constant surface roughness length of 0.3 m has been used for this model run. It is noted that the sensitivity analyses presented in section 7 show that the results away from the point of maximum impact are not highly sensitive to the choice of surface roughness length or the inclusion of terrain effects.

A summary of the meteorological parameters used in the dispersion modelling is shown in Table 20.

Table 20: Meteorological parameters

Parameter	Dispersion site value (m)	Met site value (m)
Surface roughness length	Variable	0.061
Minimum Monin-Obukhov length	30	1

6.3.3 Terrain

Where gradients within 500 m of the modelling domain are greater than 1 in 10, CERC recommends that the complex terrain module within ADMS (FLOWSTAR) is used. A review of the local area has deemed that the effect of terrain should be taken into account in the modelling, although gradients greater than 1 in 10 are located towards the southeast of the modelling domain and are unlikely to have a large effect on concentrations at the point of maximum impact.

A terrain file large enough to cover the output grid of points was created using Ordnance Survey Terrain 50 data. The parameters of the terrain file used the same as for the surface roughness file detailed in Table 18, and a graphical representation of the file provided in Figure 7.

6.3.4 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The EA recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

The ADMS 6 user guide also states that buildings less than one third of the stack height will not have any effect on dispersion.

A review of the site layout has been undertaken, and the details of the applicable buildings are presented in Table 21. A site plan showing which buildings have been included in the model is presented in Figure 8 of Appendix A.

Table 21: Building Details

Buildings	Centre point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
A	353738	181758	25	80.4	153.7	33
B (main building)	353848	181687	50	78.6	108.8	33
C	353927	181636	30	63.8	78.2	33

6.3.5 Wind turbines

Wind turbine wakes have the potential to interfere with dispersion of pollutants when the stack is within 12 – 15 rotor diameters of the turbine, with the wind turbine effects becoming more noticeable when the stack is within a few rotor diameters of the turbine.

There are three wind turbines located within close proximity to the Facility. Due to the proximity of the turbines, it is considered that they should be included in the dispersion modelling. The details of the turbines are presented in Table 22 and their locations shown on Figure 9.

Table 22: Wind Turbines Included in Dispersion Modelling

Ref	Turbine type	Hub height (m)	Rotor diameter (m)	X (m)	Y (m)	Distance from stack (m)
A	Nordex N100	80	100	353135	181967	803
B	Nordex N100	80	100	353395	181825	507
C	Enercon E115	92	115	353352	182327	866

As shown, these turbines are all well within 12 rotor diameters of the stack. The sensitivity of the model results to the inclusion or exclusion of wind turbine effects is considered in section 7.4.

6.4 Chemistry

The Facility will release nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as oxides of nitrogen (NOx). In the atmosphere, NO will be converted to NO_2 in a reaction with ozone (O_3) which is influenced by solar radiation. Since the AQALs are expressed in terms of NO_2, it is important to be able to assess the conversion rate of NO to NO_2.

Ground level NOx concentrations have been predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 70% conversion from NOx to NO_2 for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario specified in the EA's guidance for dispersion modelling[9] which is appropriate where the primary NO_2 to NOx ratio is less than 10%. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

6.5 Baseline concentrations

Baseline concentrations for the assessment have been derived from monitoring and national mapping as summarised in Table 11. For short term averaging periods, the baseline concentration has been assumed to be twice the long-term ambient concentration following the EA recommendation within the Air Emission Guidance.

Other local point sources may contribute to the baseline concentrations, in particular the Severnside Energy Recovery Centre, an energy from waste plant, and the Seabank combined cycle gas turbine (CCGT) power station, both located approximately 1 km to the north. As both of these sources have been operational for several years, their contribution to baseline concentrations is captured in the latest Defra background maps. The maximum 2024-based mapped background concentrations from within 5 km of the Facility have been used to determine baseline concentrations for some pollutants; for other pollutants, conservative baseline values have been taken from older mapped background data or national monitoring datasets. Therefore, these local point sources are highly unlikely to increase baseline concentrations to above the conservative values presented in Table 11 and these sources have not been explicitly modelled.

[9] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

7 Sensitivity Analysis

The sensitivity of the dispersion modelling results to various input parameters has been tested in accordance with EA guidance on dispersion modelling reports[10]. This has been undertaken using meteorological data for 2016, which is the year which results in the maximum annual mean impact.

7.1 Surface roughness

The sensitivity of the results to using varying surface roughness length has been considered by running the model with a variety of surface roughness lengths for the dispersion site. For all sensitivity analyses the impact of changing model parameters on the maximum annual mean and short-term concentrations of oxides of nitrogen have been considered.

The following parameters have been kept constant:

- Scenario – Proposed Facility;
- Grid – nested 3 km x 3 km at 30 m resolution within wider 9 km x 9 km at 90 m resolution;
- Buildings – included;
- Wind turbines – included;
- Terrain file – included at 64 x 64 resolution;
- Meteorological site surface roughness – 0.061 m;
- Dispersion site Monin-Obukhov length – 30 m;
- Meteorological site Monin-Obukhov length – 1 m; and
- Meteorological data used – Avonmouth 2016.

The contribution of the Facility to the ground level concentrations of oxides of nitrogen at the point of maximum impact and at the maximum impacted receptor are presented in Table 23.

Table 23: Surface Roughness Sensitivity Analysis

Surface roughness (m)	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Variable	**2.21**	**46.64**	**0.85**	**24.48**
0.1	2.85	39.37	0.90	31.46
0.2	3.09	39.74	0.86	29.83
0.3	3.24	40.18	0.86	27.51
0.5	3.43	41.26	0.87	26.93
0.7	3.56	41.71	0.87	25.65
% Change from Variable				
0.1	29.4%	-15.6%	5.7%	28.5%
0.2	39.9%	-14.8%	0.7%	21.8%
0.3	46.7%	-13.9%	1.0%	12.4%

[10] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

Surface roughness (m)	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
0.5	55.7%	-11.5%	1.8%	10.0%
0.7	61.6%	-10.6%	1.8%	4.8%

As shown, higher surface roughness lengths result in higher annual mean concentrations but lower short-term concentrations. The use of a spatially varying surface roughness file results in a lower maximum annual mean concentration and higher short-term concentration than any of the constant surface roughness lengths modelled. At the maximum impacted receptor the results are not as sensitive to the choice of surface roughness.

Due to the sensitivity of the maximum results to the choice of surface roughness length, it is considered appropriate to use the spatially varying surface roughness file in the main model runs as this most accurately represents the variations in land use and surface roughness around the Facility.

7.2 Building parameters

ADMS 6 has a buildings effects module to account for the impact of buildings when it calculates the air flow and dispersion of pollutants from a source. The sensitivity of the results to the effect of buildings has been considered by running the model with the building presented in Table 21 and with no buildings at all.

The following parameters have been kept constant:

- Scenario – Proposed Facility;
- Grid – nested 3 km x 3 km at 30 m resolution within wider 9 km x 9 km at 90 m resolution;
- Wind turbines – included;
- Terrain file – included at 64 x 64 resolution;
- Dispersion site surface roughness – spatially varying at 64 x 64 resolution;
- Meteorological site surface roughness – 0.061 m;
- Dispersion site Monin-Obukhov length – 30 m;
- Meteorological site Monin-Obukhov length – 1 m; and
- Meteorological data used – Avonmouth 2016.

The contribution of the Facility to the ground level concentrations of oxides of nitrogen at the point of maximum predicted concentration and maximum impacted receptor are presented in Table 24 for each scenario.

Table 24: Effect of Buildings

Scenario	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual Mean	Max 1-hour mean	Annual Mean	Max 1-hour mean
Including buildings	**2.21**	**46.64**	**0.85**	**24.48**

Scenario	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual Mean	Max 1-hour mean	Annual Mean	Max 1-hour mean
Excluding buildings	0.67	30.09	0.50	23.42
% Change	-69.7%	-35.5%	-40.6%	-4.3%

As shown, modelling the presence of buildings results in much higher annual mean and short-term concentrations at the point of maximum impact and the maximum impacted receptor. Building effects have been included in the dispersion model as this is the most realistic scenario.

7.3 Terrain

The sensitivity of the results to the effect of terrain has been considered by running the model with and without the terrain file.

The following parameters have been kept constant:

- Scenario – Proposed Facility;
- Grid – nested 3 km x 3 km at 30 m resolution within wider 9 km x 9 km at 90 m resolution;
- Buildings – included;
- Wind turbines – included;
- Dispersion site surface roughness – spatially varying at 64 x 64 resolution;
- Meteorological site surface roughness – 0.061 m;
- Dispersion site Monin-Obukhov length – 30 m;
- Meteorological site Monin-Obukhov length – 1 m; and
- Meteorological data used – Avonmouth 2016.

The contribution of the Proposed Facility to the ground level concentrations of oxides of nitrogen at the point of maximum predicted concentration and maximum impacted receptor are presented in Table 25 for each scenario.

Table 25: Effect of Terrain

Scenario	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Including terrain	**2.21**	**46.64**	**0.85**	**24.48**
Excluding terrain	2.18	46.25	0.87	24.29
% Change	-1.0%	-0.8%	2.3%	-0.8%

As shown, modelling the effect of terrain has a small effect on the annual mean and maximum 1-hour concentrations. The main model runs have included the effect of complex terrain as this is the most realistic scenario.

7.4 Wind turbines

The sensitivity of the results to the effect of nearby wind turbines has been considered by running the model with and without the wind turbines.

The following parameters have been kept constant:

- Scenario – Proposed Facility;
- Grid – nested 3 km x 3 km at 30 m resolution within wider 9 km x 9 km at 90 m resolution;
- Buildings – included;
- Terrain file – included at 64 x 64 resolution;
- Dispersion site surface roughness – spatially varying at 64 x 64 resolution;
- Meteorological site surface roughness – 0.061 m;
- Dispersion site Monin-Obukhov length – 30 m;
- Meteorological site Monin-Obukhov length – 1 m; and
- Meteorological data used – Avonmouth 2016.

The contribution of the Proposed Facility to the ground level concentrations of oxides of nitrogen at the point of maximum predicted concentration and maximum impacted receptor are presented in Table 25 for each scenario.

Table 26: Effect of Wind Turbines

Scenario	Oxides of nitrogen PC (µg/m³)			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Including wind turbines	**2.21**	**46.64**	**0.85**	**24.48**
Excluding wind turbines	2.14	46.29	0.83	24.63
% Change	-3.0%	-0.7%	-3.0%	0.6%

As shown, modelling the effect of wind turbines has a small effect on the annual mean and maximum 1-hour concentrations at the point of maximum impact and at the maximum impacted receptor. The greatest effects occur downwind of the turbines. The main model runs have included the effect of wind turbines as this is the most realistic scenario.

7.5 Operating below the design point

Dispersion modelling has been undertaken using the emission parameters based on the revised design point for the Facility. The Facility is operated as a commercial plant, so it is beneficial to operate at full capacity. If the Facility was operated below the design point, the volumetric flow rate and the exit velocity of the exhaust gases would reduce. The effect of this would be to decrease the quantity of pollutants emitted but also to reduce the buoyancy of the plume due to momentum. The reduction in buoyancy, which would lead to reduced dispersion, would be more than offset by the decrease in the quantity of pollutants being emitted, and the impact of the Facility when operating below the design point would be lower than compared to operating at the design point.

8 Impact on Human Health

Table 27 and Table 28 present the results of the dispersion modelling of process emissions from the Operational Facility and the Proposed Facility at the point of maximum impact. This is a summary of the maximum predicted impact using 5 years of weather data. Detailed results tables for each year of weather data are provided in Appendix D. Results are presented as the maximum predicted concentration based on the following:

- Grid – nested 3 x 3 km at 30 m resolution within wider 9 x 9 km at 90 m resolution;
- Buildings – included;
- Stack height – 90 m;
- Spatially varying surface roughness and terrain – included at 64 x 64 resolution;
- Wind turbine effects – included;
- Five years of weather data 2016 to 2020 from the Avonmouth meteorological recording station;
- Operation at the long term ELVs for the entire year;
- Operation at the short term ELVs during the worst-case conditions for dispersion of emissions (Table 28 only);
- EA's worst-case conversion of NOx to nitrogen dioxide;
- The entire dust emissions consist of either PM_{10} of $PM_{2.5}$;
- The entire VOC emissions are assumed to consist of benzene; and
- Cadmium is released at the combined emission limit for cadmium and thallium.

PCs that cannot be screened out as 'insignificant' are highlighted. Where the PC cannot be screened out as 'insignificant', further analysis has been undertaken.

Table 27: Dispersion Modelling Results – Point of Maximum Impact - Daily ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	Operational Facility		Proposed Facility				Change in PC	
					Max PC	% of AQAL	Max PC	% of AQAL	Max PEC	% of AQAL	Conc.	% of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	20.8	1.54	**3.85%**	1.54	**3.86%**	22.3	55.78%	0.005	0.01%
	99.79th %ile of hourly means	µg/m³	200	41.5	9.7	4.85%	10.0	5.00%	51.5	25.77%	0.30	0.15%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	4.90	3.92	3.13%	4.02	3.22%	8.92	7.14%	0.10	0.08%
	99.73rd %ile of hourly means	µg/m³	350	4.90	5.92	1.69%	6.03	1.72%	10.9	3.12%	0.11	0.03%
	99.9th %ile of 15 min. means	µg/m³	266	4.90	7.20	2.71%	7.43	2.79%	12.3	4.63%	0.23	0.09%
PM_{10}	Annual mean	µg/m³	40	12.9	0.06	0.15%	0.06	0.15%	13.0	32.40%	<0.01	<0.01%
	90.41st %ile of daily means	µg/m³	50	25.8	0.22	0.43%	0.22	0.44%	26.0	52.04%	<0.01	<0.01%
$PM_{2.5}$	Annual mean	µg/m³	10	7.19	0.06	0.61%	0.06	0.61%	7.25	72.51%	<0.01	<0.01%
Carbon monoxide	8 hour running mean	µg/m³	10,000	454	7.84	0.08%	8.03	0.08%	462.0	4.62%	0.20	<0.01%
	Hourly mean	µg/m³	30,000	454	14.0	0.05%	13.4	0.04%	467.4	1.56%	-0.63	<0.01%
Hydrogen chloride	Hourly mean	µg/m³	750	1.52	2.25	0.30%	2.15	0.29%	3.67	0.49%	-0.10	-0.01%
Hydrogen fluoride	Annual mean	ng/m³	16,000	2,350	12.2	0.08%	12.3	0.08%	2,362	14.76%	0.04	<0.01%
	Hourly mean	ng/m³	160,000	4,700	281	0.18%	268	0.17%	4,968	3.11%	-12.64	-0.01%
Ammonia	Annual mean	µg/m³	180	1.40	0.18	0.10%	0.18	0.10%	1.58	0.88%	<0.01	0.00%
	Hourly mean	µg/m³	2,500	2.80	4.21	0.17%	4.03	0.16%	6.83	0.27%	-0.19	-0.01%
VOCs (as benzene)	Annual mean	µg/m³	5	0.40	0.12	**2.44%**	0.12	**2.45%**	0.52	10.45%	<0.01	0.01%
	Daily mean	µg/m³	30	0.80	1.09	3.62%	1.11	3.70%	1.91	6.37%	0.02	0.08%
Mercury	Daily mean	ng/m³	60	5.60	2.17	3.62%	2.22	3.70%	7.82	13.03%	0.05	0.08%
	Hourly mean	ng/m³	600	5.60	5.62	0.94%	5.37	0.89%	11.0	1.83%	-0.25	-0.04%
Cadmium	Annual mean	ng/m³	5	0.35	0.2	**4.89%**	0.25	**4.90%**	0.60	11.90%	0.00	0.01%

Pollutant	Quantity	Units	AQAL	Bg conc.	Operational Facility		Proposed Facility				Change in PC	
					Max PC	% of AQAL	Max PC	% of AQAL	Max PEC	% of AQAL	Conc.	% of AQAL
	Daily mean	ng/m³	30	0.70	2.17	7.24%	2.22	7.40%	2.92	9.74%	0.05	0.16%
PAHs	Annual mean	pg/m³	250	680	2.44	0.98%	2.45	0.98%	682.5	272.98%	0.01	<0.01%
Dioxins	Annual mean	fg/m³	-	33.0	0.73	-	0.74	-	33.7	-	<0.01	-
PCBs	Annual mean	ng/m³	200	0.13	0.06	0.03%	0.06	0.03%	0.19	0.10%	<0.01	<0.01%
	Hourly mean	ng/m³	6,000	0.26	1.40	0.02%	1.34	0.02%	1.60	0.03%	-0.06	<0.01%

Table 28: Dispersion Modelling Results – Point of Maximum Impact - Short-Term ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	Operational Facility		Proposed Facility				Change in PC	
					Max PC	% of AQAL	Max PC	% of AQAL	Max PEC	% of AQAL	Conc.	% of AQAL
Nitrogen dioxide	99.79th%ile of hourly means	µg/m³	200	41.5	21.57	**10.79%**	22.23	**11.12%**	63.8	31.89%	0.66	0.33%
Sulphur dioxide	99.73rd%ile of hourly means	µg/m³	350	4.90	29.60	8.46%	30.16	8.62%	35.1	10.02%	0.57	0.16%
	99.9th%ile of 15 min. means	µg/m³	266	4.90	35.99	**13.53%**	37.14	**13.96%**	42.0	15.81%	1.15	0.43%
Carbon monoxide	8 hour running mean	µg/m³	10,000	454	23.51	0.24%	24.10	0.24%	478.1	4.78%	0.59	0.01%
	Hourly mean	µg/m³	30,000	454	42.15	0.14%	40.25	0.13%	494.3	1.65%	-1.90	-0.01%
Hydrogen chloride	Hourly mean	µg/m³	750	1.52	16.86	2.25%	16.10	2.15%	17.6	2.35%	-0.76	-0.10%

As shown, the change in impact is less than 10% of the short-term AQAL and less than 1% of the annual mean AQAL and can be screened out as 'insignificant' for all pollutants and averaging periods. The EP variation results in a slight increase in pollutant concentrations for all averaging periods except for the maximum hourly concentrations, for which there is a slight decrease.

The total impact of the Proposed Facility is less than 10% of the short-term AQAL and less than 1% of the annual mean AQAL for all pollutants considered, and can be screened out as 'insignificant', except for the following:

- Annual mean nitrogen dioxide;
- Annual mean VOCs as benzene;
- Annual mean cadmium;
- Hourly mean nitrogen dioxide; and
- 15-minute mean sulphur dioxide.

Further analysis of these impacts at areas of relevant exposure has been undertaken to define the significance of annual mean impacts.

8.1 Further analysis

8.1.1 Annual mean nitrogen dioxide

As shown in Table 27, the change in annual mean nitrogen dioxide impact is only 0.01% of the AQAL at the point of maximum impact. Therefore, the change in impact can be screened out as insignificant as the change is less than 1% of the AQAL.

The PC from the Operational Facility and the Proposed Facility at receptor locations is presented in Table 29, along with the PEC for the Proposed Facility.

Table 29: Annual Mean Nitrogen Dioxide at Receptor Locations

Receptor	Operational Facility PC		Proposed Facility PC		Proposed Facility PEC		Change	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL	µg/m³	as % of AQAL	µg/m³	as % of AQAL
R1	0.10	0.25%	0.10	0.26%	20.87	52.18%	<0.01	0.01%
R2	0.32	0.80%	0.34	0.86%	21.11	52.78%	0.02	0.06%
R3	0.66	**1.66%**	0.71	**1.76%**	21.48	53.69%	0.04	0.11%
R4	0.39	0.97%	0.41	**1.02%**	21.18	52.95%	0.02	0.05%
R5	0.23	0.59%	0.24	0.59%	21.01	52.52%	<0.01	0.01%
R6	0.52	**1.29%**	0.55	**1.38%**	21.32	53.31%	0.04	0.09%

Figure 10 of Appendix A provides a contour plot of the impacts. As shown, the area of impact greater than 1% of the AQAL for the Proposed Facility is marginally larger than the Operational Facility. This shows that spatially there is a marginal difference in impact associated with the proposed EP variation. In addition, there are no sensitive receptors within the 1% contour for the Proposed Facility that are close to busy roads which may result in a locally-elevated PEC. Therefore, the PEC is less than 70% of the AQAL at all areas of relevant exposure where the PC from the

Proposed Facility is predicted to exceed 1% of the AQAL, so the absolute impact of the Proposed Facility is 'not significant'.

8.1.2 Annual mean VOCs

As shown in Table 27, the change in annual mean VOC impacts is only 0.01% of the AQAL for benzene at the point of maximum impact. Therefore, the change in impact can be screened out as insignificant as the change in impact is less than 1% of the AQAL.

The PC of benzene from the Operational Facility and the Proposed Facility at receptor locations is presented in Table 30, along with the PECs for the Proposed Facility.

Table 30: Annual Mean Benzene at Receptor Locations

Receptor	Operational Facility PC		Proposed Facility PC		Proposed Facility PEC		Change	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL	µg/m³	as % of AQAL	µg/m³	as % of AQAL
R1	0.01	0.16%	0.01	0.16%	0.41	8.16%	<0.001	0.01%
R2	0.03	0.51%	0.03	0.54%	0.43	8.54%	0.002	0.04%
R3	0.05	**1.05%**	0.06	**1.12%**	0.46	9.12%	0.003	0.07%
R4	0.03	0.62%	0.03	0.65%	0.43	8.65%	0.002	0.03%
R5	0.02	0.37%	0.02	0.38%	0.42	8.38%	<0.001	<0.01%
R6	0.04	0.82%	0.04	0.88%	0.44	8.88%	0.003	0.06%

The PEC is less than 70% of the AQAL at all areas of relevant exposure where the PC from the Proposed Facility is predicted to exceed 1% of the AQAL, so the absolute impact of the Proposed Facility is 'not significant'.

Figure 11 of Appendix A shows the contour plot of impacts of VOCs compared to the AQAL for benzene. As shown, the area of impact greater than 1% of the AQAL for the Proposed Facility is marginally larger than the Operational Facility. This shows that spatially there is a marginal difference in impact from the Proposed Facility compared to the Operational Facility.

8.1.3 Annual mean cadmium

As shown in Table 27, the change in annual mean cadmium impacts is only 0.01% of the AQAL at the point of maximum impact. This conservatively assumes that the Operational Facility and Proposed Facility operate at the combined ELV for cadmium and thallium and the entire emissions consist only of cadmium. Under this assumption, the maximum annual mean impact from the Proposed Facility is 4.90% of the AQAL. Figure 12 of Appendix A shows the contour plot of impacts. As shown, the area of impact greater than 1% of the AQAL for the Proposed Facility is marginally larger than the Operational Facility.

Emissions of cadmium and thallium from the Operational Facility are periodically monitored and these results reported to the EA. A review of this periodic monitoring data from the last two years is provided in Table 31.

Table 31: Summary of Cadmium and Thallium Monitoring from Existing Facility

Monitoring period	Monitored combined concentration of cadmium and thallium			
	mg/m³		As % of ELV	
	Line 1	Line 2	Line 1	Line 2
2024 – H2	0.00094	< 0.00082	4.7%	4.1%
2025 – H1	0.002	0.002	10.0%	10.0%
2025 – H2	< 0.0009	< 0.0009	4.5%	4.5%
2026 – H1	0.001	< 0.0008	5.0%	4.0%
Max		0.002		10.0%
Average		0.00117		5.9%
Note: *Results indicated by "<" were below the limit of detection (LOD). Therefore, the LOD (i.e. the maximum possible emission concentration) has been reported.*				

Source: Viridor Avonmouth Extractive Monitoring Reports 202, 2025, and 2026, Element

As shown the combined emissions of cadmium and thallium are well below the ELV. The maximum monitored concentration over the last two years of monitoring results was only 10% of the ELV and the average 5.9% of the ELV. If it is assumed that emissions Facility are at the maximum from the monitoring detailed in Table 31 (i.e. 10.0% of the ELV) and this only consists of cadmium, the maximum PC of cadmium from the Operational Facility would be only 0.49% of the AQAL at the point of maximum impact, and can therefore, be screened out as 'insignificant'.

8.1.4 Short-term impacts

As shown in Table 28, when the Proposed Facility operates at the half-hourly ELV during the worst-case weather conditions for dispersion, the PC at the point of maximum impact is predicted to be 11.12% of the AQAL for the 99.79th percentile of hourly mean nitrogen dioxide, and 13.96% of the AQAL for the 99.9th percentile of 15-minute mean sulphur dioxide. The change in impact between the Operational Facility and the Proposed Facility is less than 1% of the AQAL for both pollutants and is 'insignificant'.

Figure 13 and Figure 14 of Appendix A show the contour plot of short-term impacts for nitrogen dioxide and sulphur dioxide. These illustrate that the areas where the PC from the Operational Facility and the Proposed Facility cannot be screened out as 'insignificant'. Spatially there is a marginal difference in impact from the Proposed Facility compared to the Operational Facility.

Consideration has also been given to the headroom for each pollutant for the Operational Facility and the results presented in Table 32.

Table 32: Short-Term PC as % of Headroom

Pollutant	Quantity	Headroom (µg/m³)	Proposed Facility PC	
			µg/m³	% of Headroom
Nitrogen dioxide	99.79th%ile of hourly means	158.5	22.23	14.03%
Sulphur dioxide	99.9th %ile of 15 min. means	261.1	37.14	14.23%

As shown, the PC from the Proposed Facility is less than 20% of the headroom so the absolute impact of the Proposed Facility is considered to be 'not significant'.

8.1.5 Heavy metals – at the point of maximum impact

The assessment of the impact of heavy metals has been undertaken based EA's metals guidance[11]. The purpose of this guidance is to allow applicants to assess their PC and PEC against the environmental standards (i.e. AQALs). In the first instance the PCs from the Proposed Facility have been assessed against the AQALs using this guidance; if any significant impacts are predicted, the change from the Operational Facility has also been considered.

The results tables below (Table 33 and Table 34) detail the following:

1. The PC and PEC for each metal, assuming that each metal is released at the combined long-term metal ELV set out in the EP (stage 1 screening); and
2. The PC and PEC for metal, assuming that each metal is released at the maximum monitored concentration presented in the EA's metals guidance.

[11] Environment Agency, June 2016, Guidance on assessing group 3 metal stack emissions from incinerators (V.4)

Table 33: Long-Term Metals Results at Point of Maximum Impact – Proposed Facility

Metal	AQAL	Baseline conc.	Metals emitted at combined metal limit				Metal as % of ELV (1)	Each metal emitted at the maximum concentration from the EA metals guidance document			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	6	1.0	3.68	**61.25%**	4.68	77.92%	8.3%	0.31	**5.10%**	1.31	21.77%
Antimony	5,000	1.3	3.68	0.07%	4.98	0.10%	3.8%	0.14	0.003%	1.44	0.03%
Chromium		4.8	3.68	-	8.48	-	30.7%	1.13	-	5.93	-
Chromium (VI)	0.25	1.0	3.68	**1,470.09%**	4.64	**1,854.09%**	0.043%	0.0016	0.64%	0.96	**384.64%**
Cobalt	-	1.5	3.68	-	5.18	-	1.9%	0.07	-	1.57	-
Copper		10.0	3.68	-	13.68	-	9.7%	0.36	-	10.36	-
Lead	250	15.0	3.68	**1.47%**	18.68	7.47%	16.8%	0.62	0.25%	15.62	6.25%
Manganese	150	8.5	3.68	**2.45%**	12.18	8.12%	20.0%	0.74	0.49%	9.24	6.16%
Nickel	20	2.5	3.68	**18.38%**	6.18	30.88%	73.3%	2.70	**13.48%**	5.20	25.98%
Vanadium	-	3.0	3.68	-	6.68	-	2.0%	0.07	-	3.07	-

Notes:
(1) Metal as maximum percentage of the group 3 ELV of 0.3 mg/Nm³, recalculated from the data presented in EA's metals guidance document (V.4) Table A1.

Table 34: Short-Term Metals Results at Point of Maximum Impact – Proposed Facility

Metal[1]	AQAL	Baseline conc.	Metals emitted at combined metal limit				Metal as % of ELV [2]	Each metal emitted at the max concentration from the EA metals guidance document			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	-	2.00	80.50	-	82.50	-	8.3%	6.71	-	8.71	-
Antimony	150,000	2.60	80.50	0.05%	83.10	0.06%	3.8%	3.09	0.002%	5.69	0.004%
Chromium - daily mean	2,000	9.60	33.31	1.67%	42.91	2.15%	30.7%	10.22	0.51%	19.82	0.99%
Chromium (VI)	-	1.92	80.50	-	82.42	-	0.0%	0.03	-	1.95	-
Cobalt	-	3.00	80.50	-	83.50	-	1.9%	1.50	-	4.50	-
Copper - daily mean	50	20	33.31	**66.62%**	53.31	**106.62%**	9.7%	3.22	6.44%	23.22	46.44%
Lead	-	30.00	80.50	-	110.50	-	16.8%	13.50	-	43.50	-
Manganese	1,500,000	17.00	80.50	0.0054%	97.50	0.007%	20.0%	16.10	0.0011%	33.10	0.002%
Nickel	700	5.00	80.50	**11.50%**	85.50	12.21%	73.3%	59.04	8.43%	64.04	9.15%
Vanadium - daily mean	1,000	6.0	33.31	3.33%	39.31	3.93%	2.0%	0.67	0.07%	6.67	0.67%

Notes:

(1) Hourly mean, unless otherwise stated.

(2) Metal as maximum percentage of the group 3 metals ELV, recalculated from the data presented in Environment Agency metals guidance document (V.4) Table A1.

If it is assumed that the entire emissions of metals consist of only one metal, the impact of the Proposed Facility is less than 1% of the long-term and less than 10% of the short-term AQAL, with the exception of annual mean impacts of arsenic, chromium (VI), lead, manganese, and nickel, and short-term impacts of copper and nickel, which have been highlighted. The PEC is only predicted to exceed the AQALs for annual mean chromium (VI) and daily mean copper using this worst-case screening assumption.

If it is assumed that the Proposed Facility would emit metals at the maximum concentration from the EA's metals guidance document, the PC is below 1% of the long term and 10% of the short term AQAL for all pollutants with the exception of annual mean arsenic and nickel. However, the annual mean PEC is well below the AQAL for both arsenic and nickel. Therefore, the impact of emissions of these metals can be screened out and is considered to be not significant. In addition, the PEC of chromium (VI) exceeds the AQAL but this due to the high assumed baseline concentration (20% of total chromium, in lieu of any direct monitoring of chromium (VI)). The contribution from the Proposed Facility is less than 1% of the AQAL and can be screened out as 'insignificant'. As such, it is concluded that there is no risk of the proposed variation to the EP resulting in an exceedance of an AQAL for any metal on either a long or short-term basis.

9 Impact at Ecological Receptors

9.1 Methodology

9.1.1 Atmospheric emissions – Critical Levels

The impact of emissions has been compared to the Critical Levels listed in Table 3. Further assessment would be undertaken where the PC of a particular pollutant is greater than 1% of the long term or 10% of the short-term Critical Level for European and UK designated sites, and where the PC of a particular pollutant is greater than 100% of the Critical Level for local nature sites.

9.1.2 Deposition of emissions – Critical Loads

In addition to the Critical Levels for the protection of ecosystems, habitat specific Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication) are outlined in APIS. In terms of acid deposition, the APIS Database contains a maximum critical load for sulphur (CLmaxS), a minimum Critical Load for nitrogen (CLminN) and a maximum Critical Load for nitrogen (CLmaxN). These components define the Critical Load function for acid deposition. Where the acid deposition flux falls within the area under the Critical Load function, no exceedances are predicted.

An assessment has been made for the most sensitive habitat features identified in APIS for the specific sites. The site-specific features tool in the APIS app has been used to identify the feature habitats and the habitat specific Critical Load for the specific points assessed within the designated sites. The relevant Critical Loads are presented in Appendix B. The lowest Critical Loads for each designated site have been used to ensure a robust assessment.

9.1.3 Calculation methodology

9.1.3.1 Nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

1. Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.
2. Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 35.
3. Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 35.
4. Compare this result to the nitrogen deposition Critical Load.

Table 35: Deposition Factors

Pollutant	Deposition velocity (m/s)		Conversion factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7

Pollutant	Deposition velocity (m/s)		Conversion factor (µg/m²/s to kg/ha/year)
	Grassland	Woodland	
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

Source: AQTAG 6 (March 2014)

9.1.3.2 Acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and should be taken into consideration when assessing the impact of the proposed development.

The steps to determine the acid deposition flux are as follows.

1. Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in section 9.1.3.1.
2. Apply the conversion factor for N outlined in Table 35 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.
3. Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.
4. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.
5. Add the contribution from S to HCl and treat this sum as the total contribution from S.
6. Plot the results against the Critical Load functions.

Table 36: Conversion Factors

Pollutant	Conversion Factor (kg/ha/year to keq/ha/year)
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

The March 2014 version of the AQTAG06 document states that, for installations with an HCl emission, the PC of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H+ from HCl should be added to the S contribution (and treated as S in APIS tool). This should include the contribution of HCl from wet deposition.

Consultation with AQMAU confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. For the purposes of this analysis, it has been assumed that wet deposition of HCl is double dry deposition.

The contribution from the proposed development has been calculated using APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

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

9.2 Results - atmospheric emissions - Critical Levels

The impact of emissions from the operation of the Operational Facility, the Proposed Facility, and the change in impact have been compared to the Critical Levels, refer to Table 37 and Table 38.

The maximum impact at any point in the Severn Estuary SAC/SPA/ Ramsar/SSSI has been presented, while the impact at the other UK and European designated sites has been assessed at the closest point in each site to the Facility. A screening approach has been used to determine the impacts at the local nature sites where the point of maximum impact has been compared to the relevant Critical Levels. The PC has been calculated based on the maximum predicted using all five years of weather data. This assumes operation at the daily ELVs as set out in Table 15. PCs that cannot be screened out in accordance with the screening criteria detailed in section 3.2 have been highlighted.

Table 37: Assessment Against Annual Mean Critical Levels

Site	NOx			SO_2[(1)]			NH_3[(1)]		
	Operational	Proposed	Change	Operational	Proposed	Change	Operational	Proposed	Change
Process Contribution as µg/m³									
E1 - Severn Estuary SAC, SPA, Ramsar, SSSI	0.57	0.55	-0.011	0.13	0.12	-0.003	0.05	0.05	-0.0009
E2 - Avon Gorge Woodlands SAC	0.06	0.07	0.004	0.01	0.02	0.001	0.01	0.01	0.0003
E3 - River Wye SAC	0.06	0.07	0.004	0.01	0.01	0.001	0.01	0.01	0.0003
E4 – Local nature sites (pt of max impact)	2.20	2.21	0.007	0.49	0.49	0.001	0.18	0.18	0.0006
Process Contribution as % of Critical Level									
E1 - Severn Estuary SAC, SPA, Ramsar, SSSI	**1.89%**	**1.85%**	-0.04%	0.63%	0.62%	-0.01%	**1.57%**	**1.54%**	-0.03%
E2 - Avon Gorge Woodlands SAC	0.22%	0.23%	0.01%	0.14%	0.15%	0.01%	0.54%	0.57%	0.03%
E3 - River Wye SAC	0.21%	0.22%	0.01%	0.14%	0.15%	0.01%	0.51%	0.55%	0.03%
E4 – Local nature sites (pt of max impact)	7.33%	7.35%	0.02%	4.89%	4.90%	0.01%	18.32%	18.38%	0.06%

Note:
(1) PCs of sulphur dioxide and ammonia have been assessed against the lower Critical Levels of 10 µg/m³ and 1 µg/m³ respectively, except for at E1 where lichens and bryophytes are not an important part of the ecosystem.

Table 38: Assessment Against Short-Term Critical Levels

Site	Daily mean NOx			Daily mean HF			Weekly mean HF		
	Operational	Proposed	Change	Operational	Proposed	Change	Operational	Proposed	Change
Process Contribution as µg/m³									
E1 - Severn Estuary SAC, SPA, Ramsar, SSSI	10.84	11.15	0.31	0.060	0.062	0.002	0.025	0.025	0.0008
E2 - Avon Gorge Woodlands SAC	1.71	1.81	0.10	0.009	0.010	0.001	0.002	0.002	0.0001
E3 - River Wye SAC	0.99	1.04	0.05	0.006	0.006	0.000	0.001	0.002	0.0001
E4 – Local nature sites (pt of max impact)	19.56	19.99	0.43	0.109	0.111	0.002	0.043	0.042	-0.0007
Process Contribution as % of Critical Level									
E1 - Severn Estuary SAC, SPA, Ramsar, SSSI	**14.46%**	**14.87%**	0.41%	1.20%	1.24%	0.03%	4.92%	5.09%	0.17%
E2 - Avon Gorge Woodlands SAC	2.28%	2.41%	0.13%	0.19%	0.20%	0.01%	0.37%	0.39%	0.02%
E3 - River Wye SAC	1.32%	1.38%	0.06%	0.11%	0.12%	0.01%	0.30%	0.32%	0.02%
E4 – Local nature sites (pt of max impact)	26.08%	26.65%	0.57%	2.17%	2.22%	0.05%	8.59%	8.45%	-0.13%

As shown, the change in impact at all European and UK sites for all pollutants is less than 1% of the long-term and 10% of the short-term Critical Levels and is screened out as 'insignificant'. The change in impact at the point of maximum impact, used as a screening assessment for local nature sites, is less than 100% of the long-term and short-term Critical Levels and is also screened out as 'insignificant'.

The impact of the Proposed Facility at all European and UK sites is less than 1% of the long-term and 10% of the short-term Critical Levels and is screened out as 'insignificant', except for annual mean and short-term NOx and annual mean ammonia at the Severn Estuary, although the maximum annual mean impact at this site is predicted to decrease as a result of the EP variation. The impact at the point of maximum impact is less than 100% of the long-term and short-term Critical Levels. Therefore, it can be concluded that the impact at all local nature sites can be screened out as 'insignificant'.

Further assessment has been undertaken to determine if there is a risk of exceeding the Critical Levels for NOx and ammonia at the Severn Estuary. Figure 15 and Figure 16 show the annual mean and short-term impact of the Facility on NOx concentrations and Figure 17 shows the annual mean impact on ammonia concentrations. As shown, the area of the Severn Estuary designated site where the annual mean PC from the Proposed Facility cannot be screened out as 'insignificant' extends southwest from the Facility.

APIS provides background concentrations of NOx and ammonia for the coastal grid squares in this area. The maximum NOx and ammonia PEC using the maximum background concentrations across the nearby grid squares is presented in Table 39.

Table 39: Further Assessment Against Critical Levels

Pollutant	Baseline (µg/m³)	PC (µg/m³)	PEC	
			µg/m³	% of Critical Level
NOx – annual mean	16.4	0.55	16.95	56.5%
NOx – daily mean	32.80(1)	11.15	43.95	58.6%
Ammonia – annual mean	1.50	0.05	1.535	51.7%
Note: *(1) Short-term baseline concentration assumed to be twice the annual mean concentration.*				

All PECs are less than 70% of the Critical Level, so the impacts are 'not significant'.

9.3 Results - deposition - Critical Loads

The results of the deposition analysis are presented in Appendix C. This shows that the change in PC as a result of the EP variation is less than 1% of the Critical Loads for all habitats identified at all European and UK designated sites, and less than 100% of the Critical Loads for the assessment at Local Nature Sites. Therefore, the change in PC can be screened out as 'insignificant'.

The PC from the Proposed Facility exceeds 1% of the Critical Load for nitrogen deposition at the Severn Estuary designated site and for nitrogen and acid deposition at the River Wye SAC. Considering the impacts at each designated site:

- at the Severn Estuary designated site, the maximum impact is predicted to decrease slightly as a result of the proposed EP variation.

- For the River Wye SAC this is a highly conservative assessment as it has been assumed that the most sensitive habitat is present at the point of maximum impact within the designated site. The most sensitive habitat (bog woodland) is highly unlikely to be present near the point of maximum impact within the site, which is at the tidal section of the River Wye where it enters the Severn Estuary.

The following Illustrative plot files of nitrogen and acid deposition have been produced:

- Figure 18 – Nitrogen deposition to grassland habitats;
- Figure 19 – Nitrogen deposition to woodland habitats;
- Figure 20 – Acid deposition to grassland habitats; and
- Figure 21 – Acid deposition to woodland habitats.

At the Severn Estuary designated site, the impact is predicted to decrease slightly as a result of the EP variation. At the River Wye designated site, the change as a result of the EP variation is extremely small at a maximum of 0.13% of the Critical Load. These changes would be imperceptible and will not have a significant effect on the integrity of the designated sites.

10 Conclusions

This Dispersion Modelling Assessment has been undertaken to support an application for a variation to the EP for the Facility. As the Facility is already operational a comparison has been made to the impact of the Operational Facility. To ensure that a direct comparison is being made between the Proposed Facility and Operational Facility dispersion modelling has been carried out for both.

This assessment has included a review of baseline pollution levels, dispersion modelling of emissions and quantification of the impact of these emissions on local air quality.

The primary conclusions of the assessment are presented below.

1. In relation to the impact on human health:
    a. Emissions from the operation of the Proposed Facility will not cause a breach of any AQAL.
    b. For all pollutants the change in impact as a result of the EP variation can be screened out as 'insignificant'.
    c. For all pollutants the overall impact of the Proposed Facility can either be screened out as 'insignificant' or is 'not significant' when the total concentration is taken into consideration.
2. In relation to the impact on ecologically sensitive sites:
    a. At all identified European and UK designated ecological receptors, the change in impact can be screened out as 'insignificant' as it is less than 1% of the long-term Critical Levels and Critical Loads and less than 10% of the short-term Critical Levels.
    b. The impact of the Proposed Facility cannot be screened out as 'insignificant' at the Severn Estuary and River Wye designated sites. However, as the change in impact from the Operational Facility is extremely small and would be imperceptible, it is considered that there would be no significant effects on the integrity of these designated sites.
    c. As a screening assessment it has been assumed that a local nature site is present at the overall point of maximum impact. The change in impact and the overall impact of the Proposed Facility at the point of maximum impact are both less than 100% of the Critical Levels and Loads and can be screened out as 'insignificant'.

In summary, the assessment has shown that the change in air quality impact associated with the proposed EP variation is marginal and emissions would not have a significant impact on local air quality, the general population or the local community. As such there should be no air quality constraint in granting a variation to the existing EP for the increased throughput as proposed.

Appendices

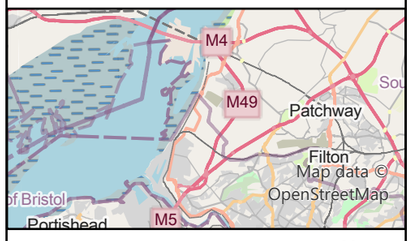
A Figures



Legend

Stack

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 1. Site Location
Drawn by: SMN	Date: 07/10/2026



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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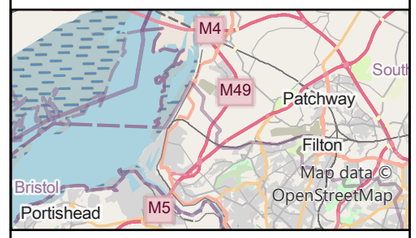
Legend

- Stack
- Human Receptors

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 2. Human Sensitive Receptors
Drawn by: SMN	Date: 07/10/2026



0 0.2 0.4 0.8 km

N

Scale: 1:20,000

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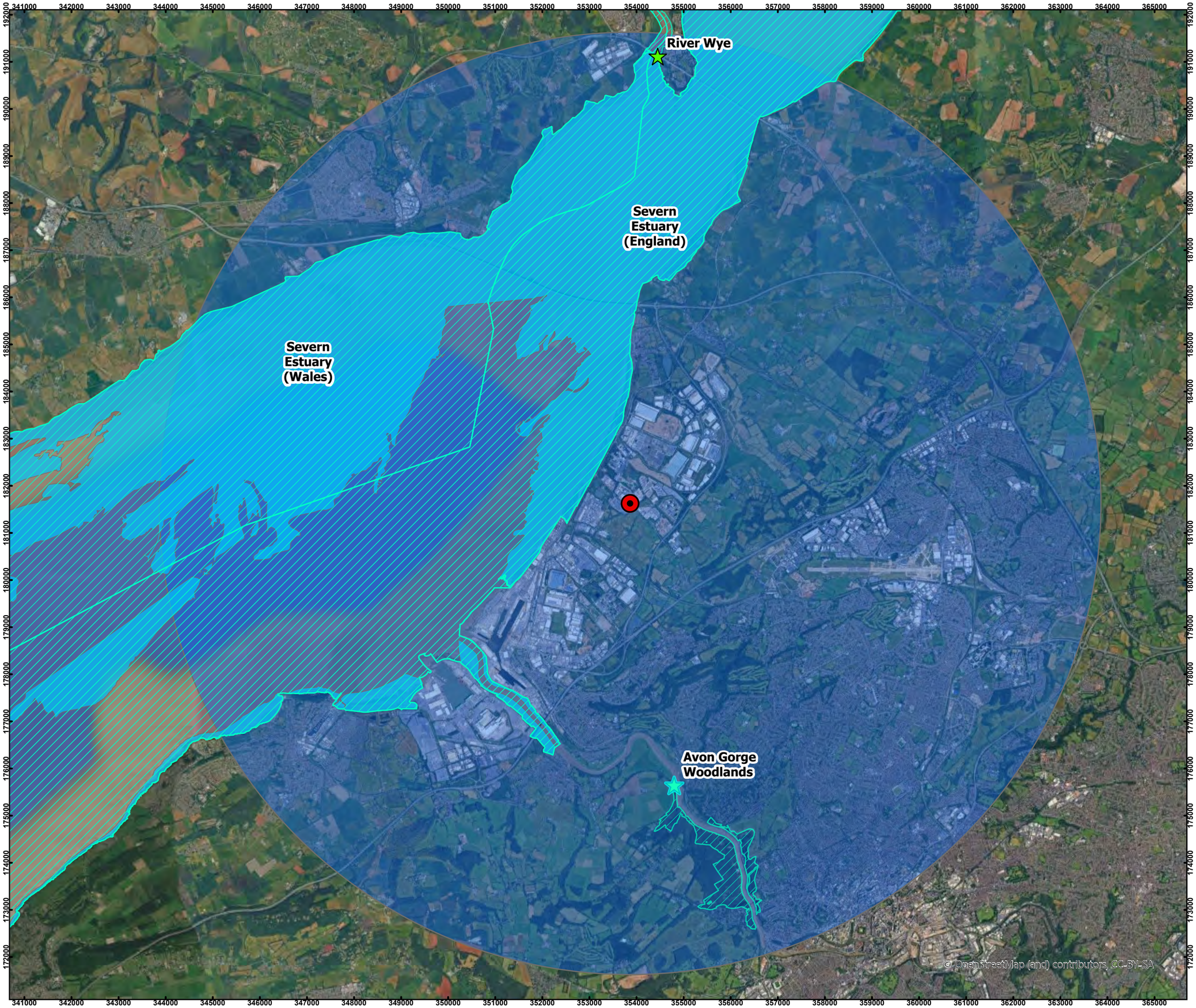
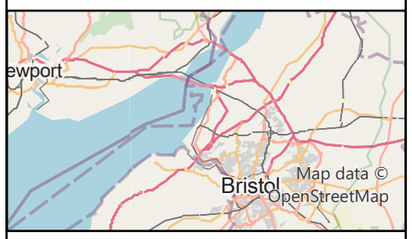


Legend

- Stack
- SACs
- Ramsars
- 10 km Stack Buffer
- Discrete Ecological Receptor Points

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 3. Ecological Sensitive Receptors
Drawn by: SMN	Date: 07/10/2026



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Scale: 1:75,000

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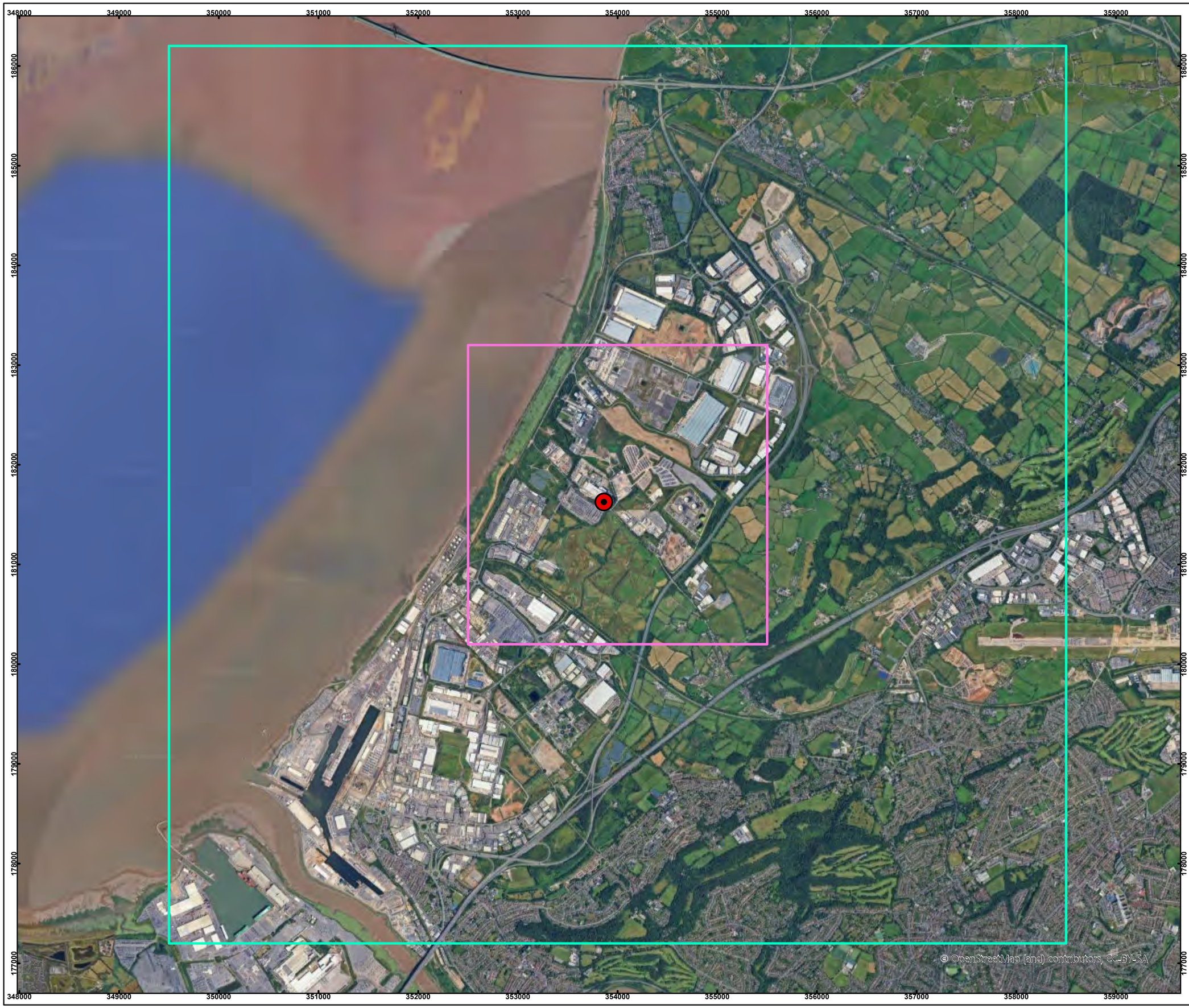
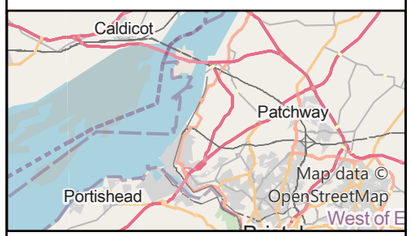


Legend

- Stack
- Fine Grid Extent
- Wide Grid Extent

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 4. Modelling Domain
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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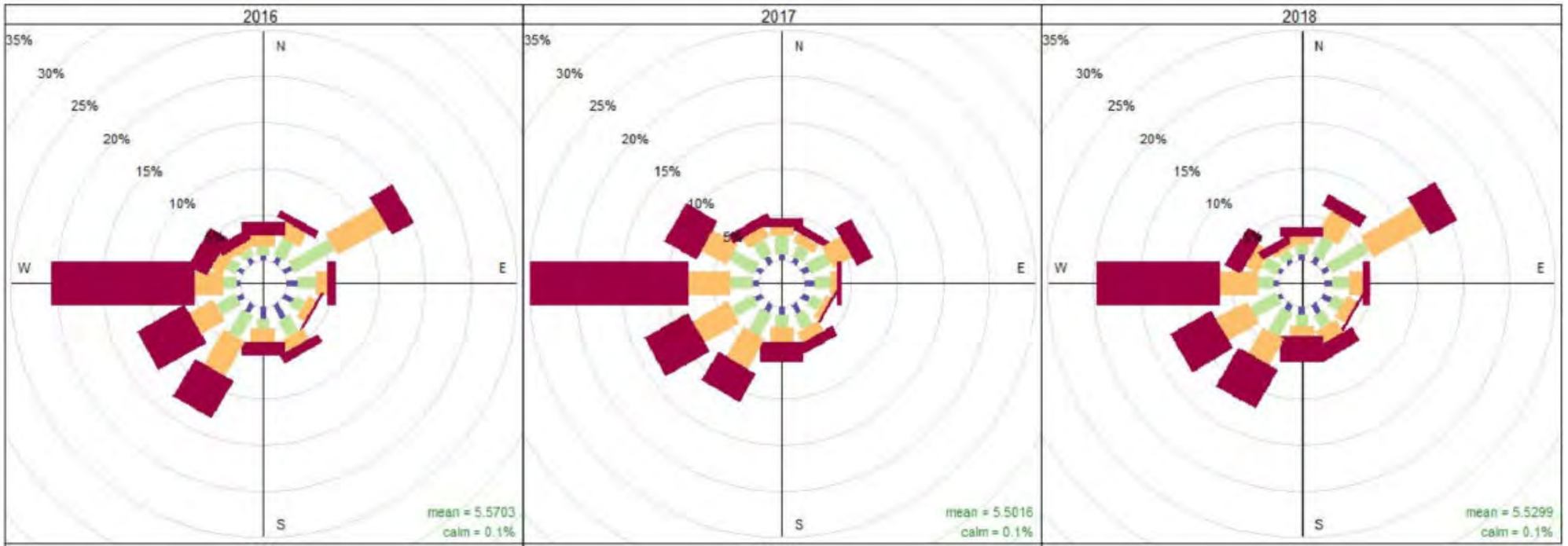

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment

Title:

Figure 5. Wind Roses Avonmouth 2016 - 2020

Drawn by: SMN	Date: 07/10/2026

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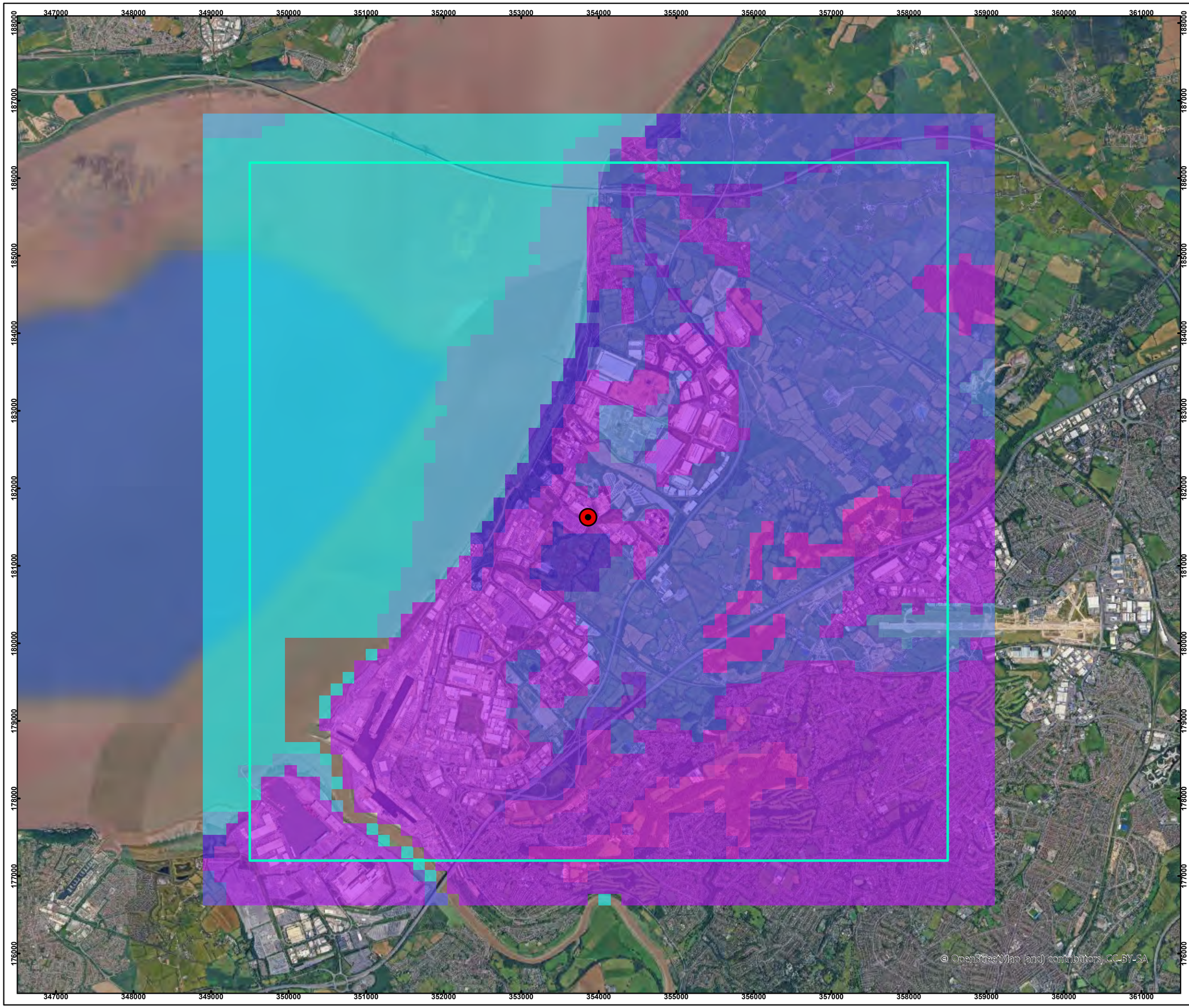


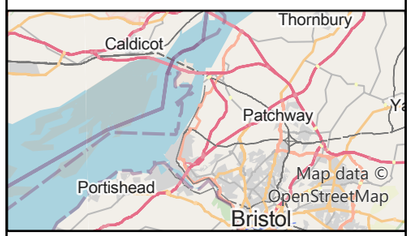
Legend

- Stack
- Wide Grid Extent

Surface roughness (m)

- 0.0001
- 0.0005
- 0.005
- 0.03
- 0.05
- 0.075
- 0.5
- 0.6
- 0.75

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 6. Spatially Varying Surface Roughness File
Drawn by: SMN	Date: 07/10/2026



0 0.45 0.9 1.8 km

Scale: 1:45,000

N

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Legend

- Stack
- Wide Grid Extent

Elevation

- 0 - 15 m
- 15 - 30 m
- 30 - 50 m
- 50 - 70 m
- >70 m

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment

Title:

Figure 7. Terrain File

Drawn by: SMN	Date: 07/10/2026



0 0.45 0.9 1.8 km

N

Scale: 1:45,000

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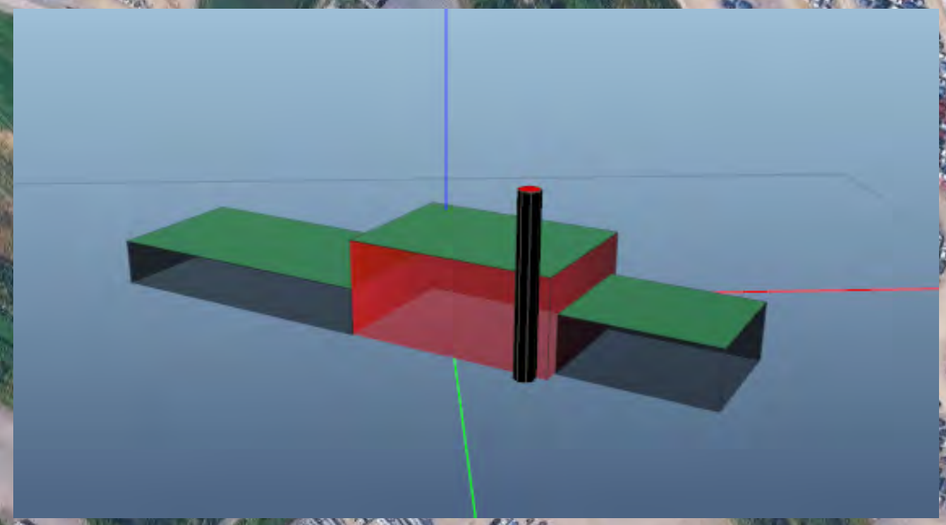
354000

182000



Building A

Building B

Building C

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354000

182000

Legend

Stack

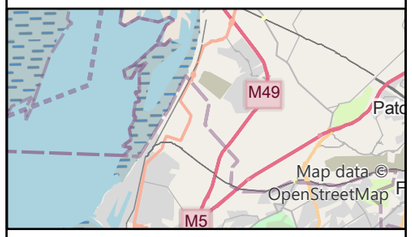
Buildings

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment

Title:

Figure 8. Buildings Modelled

Drawn by: SMN	Date: 07/10/2026



0 0.02 0.04 0.08 km

N

Scale: 1:2,000

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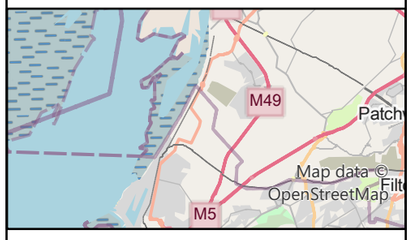
Legend

- Stack
- Wind Turbines

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 9. Wind Turbines
Drawn by: SMN	Date: 07/10/2026



0 0.05 0.1 0.2 km

Scale: 1:5,000

N

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Legend

- Stack
- Wide Grid Extent
- Annual mean NO2 as % of AQAL - Operational Facility
- Annual mean NO2 as % of AQAL - Proposed Facility

Notes:

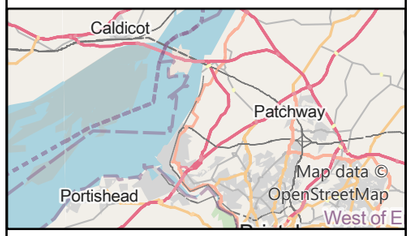
Assumes 70% NOx to NO2 conversion rate

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment

Title:

Figure 10. Annual Mean Nitrogen Dioxide

Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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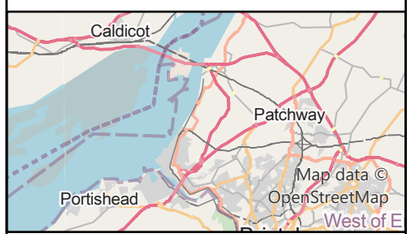
Legend

- Stack
- Wide Grid Extent
- Annual mean benzene as % of AQAL - Operational Facility
- Annual mean benzene as % of AQAL - Proposed Facility

Notes:

Assumes all VOCs are emitted as benzene

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 11. Annual Mean VOCs as Benzene
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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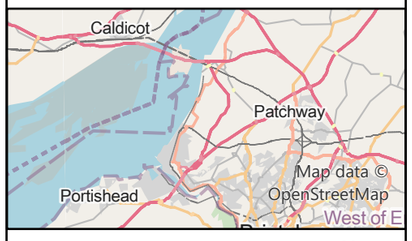
Legend

- Stack
- Wide Grid Extent
- Annual mean cadmium as % of AQAL - Operational Facility
- Annual mean cadmium as % of AQAL - Proposed Facility

Notes:
Assumes cadmium emitted at the combined ELV for cadmium and thallium

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 12. Annual Mean Cadmium
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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Legend

- Stack
- 99.79th %ile of hourly mean NO2 as % of AQAL - Operational Facility
- 99.79th %ile of hourly mean NO2 as % of AQAL - Proposed Facility

Notes:

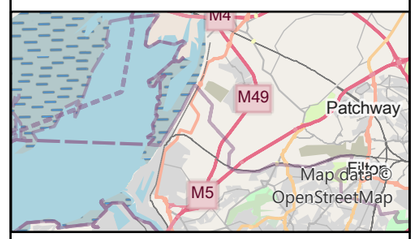
Assumes 35% NOx to NO2 conversion rate

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment

Title:

Figure 13. Hourly Mean Nitrogen Dioxide

Drawn by: SMN	Date: 07/10/2026



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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Legend

- Stack
- 99.9th %ile of 15-min mean SO2 as % of AQAL - Operational Facility
- 99.9th %ile of 15-min mean SO2 as % of AQAL - Proposed Facility

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment

Title:

Figure 14. 15-Minute Mean Sulphur Dioxide

Drawn by: SMN	Date: 07/10/2026



0 0.15 0.3 0.6 km

Scale: 1:16,000

N

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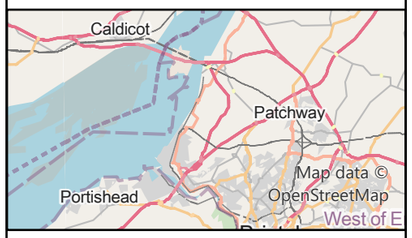
Legend

- Stack
- Wide Grid Extent
- SACs
- Ramsars
- Annual mean NOx as % of Critical Level - Operational Facility
- Annual mean NOx as % of Critical Level - Proposed Facility

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 15. Annual Mean Oxides of Nitrogen
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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Legend

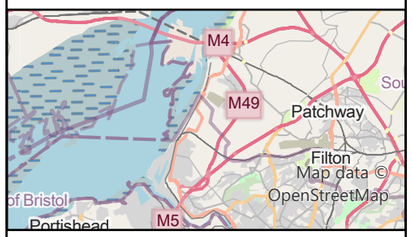
- Stack
- SACs
- Ramsars
- Daily mean NOx as of Critical Level - Proposed Facility
- Daily mean NOx as of Critical Level - Operational Facility

Notes:
PC as % of Critical Level of 75 µg/m³

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	

Figure 16. Daily Mean Oxides of Nitrogen

Drawn by: SMN	Date: 07/10/2026



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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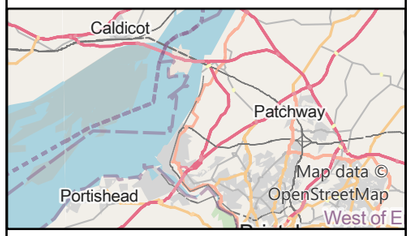
Legend

- Stack
- Wide Grid Extent
- SACs
- Ramsars
- Annual mean ammonia as of Critical Level - Operational Facility
- Annual mean ammonia as of Critical Level - Proposed Facility

Notes:
PC as % of higher Critical Level of 3 µg/m³

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 17. Annual Mean Ammonia
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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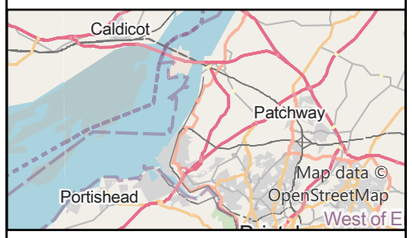
Legend

- Stack
- Wide Grid Extent
- SACs
- Ramsars
- Nitrogen deposition to grassland - Operational Facility
- Nitrogen deposition to grassland - Proposed Facility

Notes:
PC as kgN/ha/yr

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 18. Nitrogen Deposition to Grassland Habitats
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

Scale: 1:35,000

N

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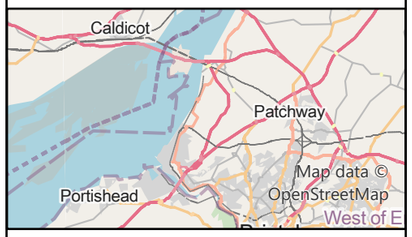
Legend

- Stack
- Wide Grid Extent
- SACs
- Ramsars
- Nitrogen deposition to woodland - Operational Facility
- Nitrogen deposition to woodland - Proposed Facility

Notes:
PC as kgN/ha/yr

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 19. Nitrogen Deposition to Woodland Habitats
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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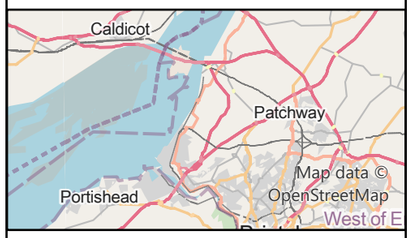
Legend

- Stack
- Wide Grid Extent
- SACs
- Ramsars
- Acid deposition to grassland - Operational Facility
- Acid deposition to grassland - Proposed Facility

Notes:
PC as keq/ha/yr

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 20. Acid Deposition to Grassland Habitats
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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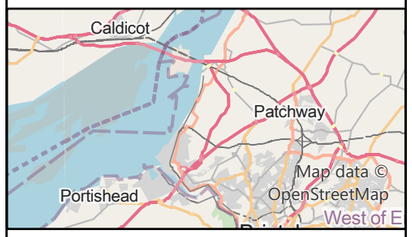
Legend

- Stack
- Wide Grid Extent
- SACs
- Ramsars
- Nitrogen deposition to woodland - Operational Facility
- Nitrogen deposition to woodland - Proposed Facility

Notes:
PC as keq/ha/yr

Client:	Viridor
Site:	SRRRC – EfW Facility
Project:	Dispersion Modelling Assessment
Title:	Figure 21. Acid Deposition to Woodland Habitats
Drawn by: SMN	Date: 07/10/2026



0 0.35 0.7 1.4 km

N

Scale: 1:35,000

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B APIS Critical Loads

Table 40: Nitrogen Deposition Critical Loads

Site	Habitat	NCL class	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Maximum background (kgN/ha/yr)(1)
E1 Severn Estuary SAC, SPA, Ramsar, SSSI	Atlantic salt meadows	Atlantic upper-mid & mid-low salt marshes	10	20	14.66
E2 Avon Gorge Woodlands SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	Semi-dry Perennial calcareous grassland (basic meadow steppe).	10	20	13.24
	Tilio-Acerion forests of slopes, screes and ravines	Carpinus and Quercus mesic deciduous forest	10	20	22.53
E3 River Wye SAC	European dry heaths	Dry heaths	5	15	19.13
	Bog woodland	Raised and blanket bogs	5	10	28.57
E4 Local nature sites (grid max)	European dry heaths	Dry heaths	5	15	12.04
	Woodland	Broadleaved deciduous woodland	10	15	20.72

Note:
(1) Maximum background within each designated site.

Table 41: Acid Deposition Critical Loads

Site	Species/habitat type	Acidity class	Critical Load function (keq/ha/yr)			Maximum background N+S (keq/ha/yr) [1]
			CLminN	CLmaxN	CLmaxS	
E1 Severn Estuary SAC, SPA, Ramsar, SSSI	Freshwater	No CL function defined	-	-	-	-
E2 Avon Gorge Woodlands SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	Calcareous grassland (using base cation)	0.856	4.854	4	1.019
	Tilio-Acerion forests of slopes, screes and ravines	Unmanaged Broadleafed/ Coniferous Woodland	0.142	1.219	1.077	1.706
E3 River Wye SAC	European dry heaths	Dwarf shrub heath	0.499	0.798	0.21	1.375
	Bog woodland	Bogs	0.321	0.487	0.166	2.084
E4 Local nature sites (grid max)	European dry heaths	Dwarf shrub heath	0.714	4.824	4.11	0.92
	Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	11.162	10.805	1.56

Note:

(1) Maximum background within each designated site. For European and UK designated sites APIS provides total acid deposition (N+S) as a single figure, which is reported in this table.

C Deposition Analysis at Ecological Sites

Table 42: Annual Mean PC for Deposition Analysis

Site	Annual mean PC (ng/m³)							
	Nitrogen dioxide		Sulphur dioxide		Hydrogen chloride		Ammonia	
	Operational	Proposed	Operational	Proposed	Operational	Proposed	Operational	Proposed
E1 Severn Estuary SAC, SPA, Ramsar, SSSI	396.0	388.1	125.7	123.2	25.1	24.6	47.1	46.2
E2 Avon Gorge Woodlands SAC	45.4	48.1	14.4	15.3	2.9	3.1	5.4	5.7
E3 River Wye SAC	43.1	45.8	13.7	14.5	2.7	2.9	5.1	5.5
E4 Local nature sites (grid max)	1539.1	1543.7	488.6	490.1	97.7	98.0	183.2	183.8

Table 43: Deposition Calculation – Operational Facility

Site	Deposition velocity	Deposition (g/ha/yr)				N deposition (gN/ha/yr)	Acid deposition (keq/ha/yr x 1000)	
		NO_2	SO_2	HCl	NH_3		N	S
E1 Severn Estuary SAC, SPA, Ramsar, SSSI	Grassland	57.0	237.9	385.6	244.9	301.9	21.56	25.73
E2 Avon Gorge Woodlands SAC	Grassland	6.5	27.3	44.2	28.1	34.6	2.47	2.95
	Woodland	13.1	54.6	106.2	42.1	55.2	3.95	6.40
E3 River Wye SAC	Grassland	6.2	25.9	42.0	26.6	32.8	2.35	2.80
	Woodland	12.4	51.8	100.7	40.0	52.4	3.74	6.07
E4 Local nature sites (grid max)	Grassland	221.6	924.6	1,498.5	951.6	1,173.3	83.80	100.00
	Woodland	443.3	1,849.2	3,596.4	1,427.5	1,870.7	133.62	216.88

Table 44: Deposition Calculation – Proposed Facility

Site	Deposition velocity	Deposition (g/ha/yr)				N deposition (gN/ha/yr)	Acid deposition (keq/ha/yr x 1000)	
		NO_2	SO_2	HCl	NH_3		N	S
E1 Severn Estuary SAC, SPA, Ramsar, SSSI	Grassland	55.9	233.1	377.9	240.0	301.9	21.56	25.73
E2 Avon Gorge Woodlands SAC	Grassland	6.9	28.9	46.9	29.8	34.6	2.47	2.95
	Woodland	13.9	57.8	112.5	44.6	55.2	3.95	6.40
E3 River Wye SAC	Grassland	6.6	27.5	44.6	28.3	32.8	2.35	2.80
	Woodland	13.2	55.0	107.1	42.5	52.4	3.74	6.07
E4 Local nature sites (grid max)	Grassland	222.3	927.4	1,503.0	954.5	1,173.3	83.80	100.00
	Woodland	444.6	1,854.8	3,607.2	1,431.8	1,870.7	133.62	216.88

Table 45: Detailed Results – Nitrogen Deposition

Site	NCL class	Deposition velocity	PC						Proposed Facility PEC	
			Operational Facility		Proposed Facility		Change			
			N dep kgN/ha/yr	% of Lower CL	N dep kgN/ha/yr	% of Lower CL	N dep kgN/ha/yr	% of Lower CL	PEC N dep kgN/ha/yr	% of Lower CL
E1 Severn Estuary SAC, SPA, Ramsar, SSSI	Atlantic upper-mid & mid-low salt marshes	Grassland	0.30	**3.02%**	0.30	**2.96%**	-0.006	-0.06%	14.96	149.56%
E2 Avon Gorge Woodlands SAC	Semi-dry Perennial calcareous grassland (basic meadow steppe).	Grassland	0.03	0.35%	0.04	0.37%	0.002	0.02%	13.28	132.77%
	Carpinus and Quercus mesic deciduous forest	Woodland	0.06	0.55%	0.06	0.59%	0.003	0.03%	22.59	225.89%
River Wye SAC	Dry heaths	Grassland	0.03	0.66%	0.03	0.70%	0.002	0.04%	19.16	383.30%
	Raised and blanket bogs	Woodland	0.05	**1.05%**	0.06	**1.11%**	0.003	0.07%	28.63	572.51%
E4 Local nature sites (grid max)	Dry heaths	Grassland	1.17	23.47%	1.18	23.54%	0.004	0.07%	13.22	264.34%
	Broadleaved deciduous woodland	Woodland	1.87	18.71%	1.88	18.76%	0.006	0.06%	22.60	225.96%

Table 46: Detailed Results – Acid Deposition

Site	Acidity Class	Deposition velocity	PC									Proposed Facility PEC	
			Operational Facility			Proposed Facility			Change				
			N keq/ ha/yr	S keq/ ha/yr	% CL	N keq/ ha/yr	S keq/ ha/yr	% CL	N keq/ha/ yr	S keq/ha/ yr	% CL	Total keq/ha/ yr	% of CL
E1 Severn Estuary SAC, SPA, Ramsar, SSSI	No CL function defined	Grassland	0.022	0.026	-	0.021	0.025	-	-0.0004	-0.0005	-	-	-
E2 Avon Gorge Woodlands SAC	Calcareous grassland (using base cation)	Grassland	0.002	0.003	0.11%	0.003	0.003	0.12%	0.0001	0.0002	0.01%	1.025	21.11%
	Unmanaged Broadleafed/ Coniferous Woodland	Woodland	0.004	0.006	0.85%	0.004	0.007	0.90%	0.0002	0.0004	0.05%	1.717	140.85%
E3 River Wye SAC	Dwarf shrub heath	Grassland	0.002	0.003	0.64%	0.002	0.003	0.69%	0.0001	0.0002	0.04%	1.380	172.99%
	Bogs	Woodland	0.004	0.006	**2.01%**	0.004	0.006	**2.14%**	0.0002	0.0004	0.13%	2.094	**430.07%**
E4 Local nature sites (grid max)	Acid grassland	Grassland	0.084	0.100	3.81%	0.084	0.100	3.82%	0.0003	0.0003	0.01%	1.104	22.89%
	Unmanaged broadleafed/ coniferous woodland	Woodland	0.134	0.217	3.14%	0.134	0.218	3.15%	0.0004	0.0007	0.01%	1.912	17.13%

D Detailed Results Tables

Table 47: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Operational Facility

Pollutant	Quantity	Units	AQAL	Bg conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	20.8	1.54	1.52	1.11	1.18	1.28	1.54	3.85%	22.31	55.77%
	99.79th %ile of hourly means	µg/m³	200	41.5	9.7	8.5	8.5	8.9	9.3	9.7	4.85%	51.2	25.62%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	4.90	3.92	3.67	3.30	2.75	3.50	3.92	3.13%	8.82	7.05%
	99.73rd %ile of hourly means	µg/m³	350	4.90	5.92	5.34	5.25	5.27	5.52	5.92	1.69%	10.82	3.09%
	99.9th %ile of 15 min. means	µg/m³	266	4.90	7.20	6.61	6.72	6.87	6.98	7.20	2.71%	12.10	4.55%
Particulates (PM_{10})	Annual mean	µg/m³	40	12.9	0.06	0.06	0.04	0.05	0.05	0.06	0.15%	12.96	32.40%
	90.41st %ile of daily means	µg/m³	50	25.8	0.22	0.21	0.16	0.16	0.18	0.22	0.43%	26.02	52.03%
Particulates ($PM_{2.5}$)	Annual mean	µg/m³	10*	7.19	0.06	0.06	0.04	0.05	0.05	0.06	0.61%	7.25	72.51%
Carbon monoxide	8 hour running mean	µg/m³	10,000	454.0	7.84	6.30	6.48	7.35	6.86	7.84	0.08%	461.84	4.62%
	Hourly mean	µg/m³	30,000	454.0	14.0	13.2	10.0	11.0	10.0	14.0	0.05%	468.0	1.56%
Hydrogen chloride	Hourly mean	µg/m³	750	1.52	2.25	2.11	1.59	1.75	1.61	2.25	0.30%	3.77	0.50%
Hydrogen fluoride	Annual mean	ng/m³	16,000	2,350.0	12.2	12.1	8.8	9.4	10.2	12.2	0.08%	2,362.2	14.76%
	Hourly mean	ng/m³	160,000	4,700.0	281	263	199	219	201	281	0.18%	4,981	3.11%
Ammonia	Annual mean	µg/m³	180	1.40	0.18	0.18	0.13	0.14	0.15	0.18	0.10%	1.58	0.88%

Pollutant	Quantity	Units	AQAL	Bg conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
	Hourly mean	µg/m³	2,500	2.80	4.21	3.95	2.99	3.29	3.01	4.21	0.17%	7.01	0.28%
VOCs (as benzene)	Annual mean	µg/m³	5	0.40	0.12	0.12	0.09	0.09	0.10	0.12	2.44%	0.52	10.44%
	Daily mean	µg/m³	30	0.80	1.07	1.06	0.91	0.84	1.09	1.09	3.62%	1.89	6.29%
Mercury	Daily mean	ng/m³	60	5.60	2.15	2.11	1.82	1.69	2.17	2.17	3.62%	7.77	12.95%
	Hourly mean	ng/m³	600	5.60	5.62	5.27	3.98	4.39	4.02	5.62	0.94%	11.22	1.87%
Cadmium	Annual mean	ng/m³	5	0.35	0.24	0.24	0.18	0.19	0.20	0.24	4.89%	0.6	11.89%
PaHs	Daily mean	ng/m³	30	0.70	2.15	2.11	1.82	1.69	2.17	2.17	7.24%	2.87	9.58%
Dioxins and Furans	Annual mean	pg/m³	250	680.0	2.44	2.41	1.77	1.88	2.04	2.44	0.98%	682.44	272.98%
PCBs	Annual mean	fg/m³	-	33.0	0.73	0.72	0.53	0.56	0.61	0.73	-	33.72	-
	Annual mean	ng/m³	200	0.13	0.06	0.06	0.04	0.05	0.05	0.06	0.03%	0.19	0.09%

Note:

Assumes continuous operation at the daily ELVs.

**Annual mean AQAL of 10 µg/m³ for $PM_{2.5}$ is the target value to be achieved by 2040.*

Table 48: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	20.8	1.54	1.52	1.11	1.17	1.28	1.54	3.86%	22.31	55.78%
	99.79th %ile of hourly means	µg/m³	200	41.5	10.0	8.8	8.6	9.0	9.6	10.0	5.00%	51.5	25.77%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	4.90	4.02	3.80	3.27	2.74	3.60	4.02	3.22%	8.92	7.14%
	99.73rd %ile of hourly means	µg/m³	350	4.90	6.03	5.53	5.45	5.50	5.67	6.03	1.72%	10.93	3.12%
	99.9th %ile of 15 min. means	µg/m³	266	4.90	7.43	6.86	6.75	7.01	7.21	7.43	2.79%	12.33	4.63%
Particulates (PM_{10})	Annual mean	µg/m³	40	12.9	0.06	0.06	0.04	0.05	0.05	0.06	0.15%	12.96	32.40%
	90.41st %ile of daily means	µg/m³	50	25.8	0.22	0.22	0.16	0.16	0.18	0.22	0.44%	26.02	52.04%
Particulates ($PM_{2.5}$)	Annual mean	µg/m³	10*	7.19	0.06	0.06	0.04	0.05	0.05	0.06	0.61%	7.25	72.51%
Carbon monoxide	8 hour running mean	µg/m³	10,000	454.0	8.03	6.53	6.74	7.49	7.10	8.03	0.08%	462.03	4.62%
	Hourly mean	µg/m³	30,000	454.0	13.0	13.4	10.3	11.0	10.3	13.4	0.04%	467.4	1.56%
Hydrogen chloride	Hourly mean	µg/m³	750	1.52	2.07	2.15	1.65	1.76	1.65	2.15	0.29%	3.67	0.49%
Hydrogen fluoride	Annual mean	ng/m³	16,000	2,350.0	12.3	12.1	8.8	9.3	10.1	12.3	0.08%	2,362.3	14.76%
	Hourly mean	ng/m³	160,000	4,700.0	259	268	206	220	206	268	0.17%	4,968	3.11%
Ammonia	Annual mean	µg/m³	180	1.40	0.18	0.18	0.13	0.14	0.15	0.18	0.10%	1.58	0.88%
	Hourly mean	µg/m³	2,500	2.80	3.89	4.03	3.09	3.30	3.09	4.03	0.16%	6.83	0.27%
	Annual mean	µg/m³	5	0.40	0.12	0.12	0.09	0.09	0.10	0.12	2.45%	0.52	10.45%

Pollutant	Quantity	Units	AQAL	Bg conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
VOCs (as benzene)	Daily mean	µg/m³	30	0.80	1.10	1.09	0.93	0.87	1.11	1.11	3.70%	1.91	6.37%
Mercury	Daily mean	ng/m³	60	5.60	2.19	2.18	1.85	1.73	2.22	2.22	3.70%	7.82	13.03%
	Hourly mean	ng/m³	600	5.60	5.18	5.37	4.12	4.40	4.12	5.37	0.89%	10.97	1.83%
Cadmium	Annual mean	ng/m³	5	0.35	0.25	0.24	0.18	0.19	0.20	0.25	4.90%	0.6	11.90%
PaHs	Daily mean	ng/m³	30	0.70	2.19	2.18	1.85	1.73	2.22	2.22	7.40%	2.92	9.74%
Dioxins and Furans	Annual mean	pg/m³	250	680.0	2.45	2.41	1.75	1.86	2.03	2.45	0.98%	682.45	272.98%
PCBs	Annual mean	fg/m³	-	33.0	0.74	0.72	0.53	0.56	0.61	0.74	-	33.73	-
	Annual mean	ng/m³	200	0.13	0.06	0.06	0.04	0.05	0.05	0.06	0.03%	0.19	0.10%

Note:

Assumes continuous operation at the daily ELVs.

**Annual mean AQAL of 10 µg/m³ for $PM_{2.5}$ is the target value to be achieved by 2040.*

Table 49: Dispersion Modelling Results – PC at Point of Maximum Impact - Short-Term ELVs – Operational Facility

Pollutant	Quantity	Units	AQAL	Bg conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	41.5	21.6	18.8	18.9	19.7	20.6	21.6	10.79%	63.1	31.56%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	4.9	29.6	26.7	26.3	26.3	27.6	29.6	8.46%	34.5	9.86%
	99.9th %ile of 15 min. means	µg/m³	266	4.9	36.0	33.0	33.6	34.4	34.9	36.0	13.53%	40.9	15.37%
Carbon monoxide	8 hour running mean	µg/m³	10,000	454.0	23.5	18.9	19.4	22.1	20.6	23.5	0.24%	477.5	4.78%
	Hourly mean	µg/m³	30,000	454.0	42.1	39.5	29.9	32.9	30.1	42.1	0.14%	496.1	1.65%
Hydrogen chloride	Hourly mean	µg/m³	750	1.5	16.9	15.8	12.0	13.2	12.1	16.9	2.25%	18.4	2.45%

Note:

Assumes continuous operation at the short term ELVs

Table 50: Dispersion Modelling Results – PC at Point of Maximum Impact - Short-Term ELVs – Operational Facility

Pollutant	Quantity	Units	AQAL	Bg conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	41.5	22.2	19.5	19.2	20.0	21.4	22.2	11.12%	63.8	31.89%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	4.9	30.2	27.6	27.2	27.5	28.3	30.2	8.62%	35.1	10.02%
	99.9th %ile of 15 min. means	µg/m³	266	4.9	37.1	34.3	33.7	35.1	36.1	37.1	13.96%	42.0	15.81%
Carbon monoxide	8 hour running mean	µg/m³	10,000	454.0	24.1	19.6	20.2	22.5	21.3	24.1	0.24%	478.1	4.78%
	Hourly mean	µg/m³	30,000	454.0	38.9	40.3	30.9	33.0	30.9	40.3	0.13%	494.3	1.65%
Hydrogen chloride	Hourly mean	µg/m³	750	1.5	15.5	16.1	12.4	13.2	12.4	16.1	2.15%	17.6	2.35%

Note:

Assumes continuous operation at the short term ELVs

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