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Consulting Engineers Limited



Cardiff Energy Recovery Facility



Viridor Trident Park Limited

Supporting Information – Environmental Permit Variation

Document approval

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Non-Technical Summary

An Environmental Permit (EP) (Ref: EPR/LP3030XA) was granted by Natural Resources Wales (NRW) to Viridor Trident Park Limited for the Cardiff Energy Recovery Facility (the Facility) on 04 November 2010. The Facility consists of a two line energy from waste plant which is used to recover energy from non-hazardous municipal, commercial and industrial waste by incineration, and a back-up generator for provision of emergency electrical power.

Viridor is proposing to vary the EP to allow for an increase in the annual waste processing capacity from 425,000 to 500,000 tonnes per annum (tpa).

Viridor is also applying to change the half-hourly emission limit for Total Organic Carbon (TOC) from 20 mg/Nm³ to 10 mg/Nm³ reported as the 97th percentile. The reduction allows for occasional short-lived fluctuations, minor load changes, and events to occur such as rogue gas bottles unseen by site staff igniting on the grate, without penalising the Operator.

This application is supported by a Dispersion Modelling Assessment, Dioxin Pathway Intake Assessment and an Abnormal Emissions Assessment which have been produced to quantify the impact of the proposals on air quality, human health and ecology during normal operation and abnormal operations as defined within the Industrial Emissions Directive. In addition a noise survey has been carried out to quantify the impact of the increased ID fan speed on noise levels.

As demonstrated within this application, the proposed changes will not have a significant impact on human health or the environment.

This application is being submitted as a substantial variation to the EP.

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1 Introduction

1.1 Background

Viridor Trident Park Limited (Viridor) operate the Cardiff Energy Recovery Facility (the Facility). The Environmental Permit (EP) was granted by Natural Resources Wales (NRW) on 04 November 2010 (Ref: EPR/LP3030XA). Viridor has subsequently been granted nine separate variations to the EP.

The Facility consists of a two line energy from waste plant (the Energy Recovery Facility (ERF)) which is used to recover energy from non-hazardous municipal, commercial and industrial waste by incineration, and a back-up generator for provision of emergency electrical power. The maximum permitted quantity of waste to be incinerated is 425,000 tonnes per annum (tpa).

Section 1 of this document provides a brief overview of the application, including the proposed changes and type of variation, whilst Section 2 and 3 describes the proposed changes in further detail. Section 4 considers additional information for the application, including the environmental impacts associated with the proposed changes.

1.2 Proposed changes

Within this application, Viridor is proposing the following changes to the EP:

- Increase the annual waste processing capacity of the ERF (the plant); and
- Change the emission limit value (ELV) for Total Organic Carbon (TOC).

1.3 Type of variation

NRW has published guidance (Regulatory Guidance Note 8 – Substantial Change) which defines a substantial change. The guidance defined a substantial change as:

‘... a change in operation of installations or mining waste facilities, which in our opinion may have significant negative effects on human beings or the environment. Certain changes are automatically regarded as substantial, namely:

- a. a change in operation of a Part A installation which in itself meets the thresholds, if any, set out in Part 2 of Schedule 1 EPRs; or*
- b. a change in operation of an incineration or co-incineration plant for non-hazardous waste which would involve the incineration or co-incineration of hazardous waste.’*

An assessment for the proposed increase in plant capacity on air quality has been undertaken. A summary of the assessment is presented in Section 4.1. As can be seen from the conclusions of the assessment, the air quality impacts will not have a significant impact on local air quality, the general population or the local community.

Furthermore, as explained in Section 2 of this document, the proposed increase in plant capacity is equivalent to 2.65 tonnes per hour (tph) per line. The ERF is a two line design. Therefore, the overall increase in processing capacity is 5.3 tph. The proposed increase in capacity is explained in further detail in Section 2.2.

The threshold for a non-hazardous waste incineration plant within Part 2, Schedule 1, Section 5.1 (b) of the Environmental Permitting Regulations (EPRs) is 3 tph. Therefore, the proposed increase in capacity is more than the threshold in ‘Part 2 of Schedule 1 EPRs’.

To conclude, Viridor considers that this application should be determined as a Substantial Variation.

2 Proposed changes to capacity

The proposed increase in the permitted capacity of the ERF is to reflect changes to the combustion control system and revised maintenance schedule.

To understand the proposed increase in capacity, it is important to understand how the capacity of is calculated. The annual capacity (annual fuel throughput) is calculated as follows:

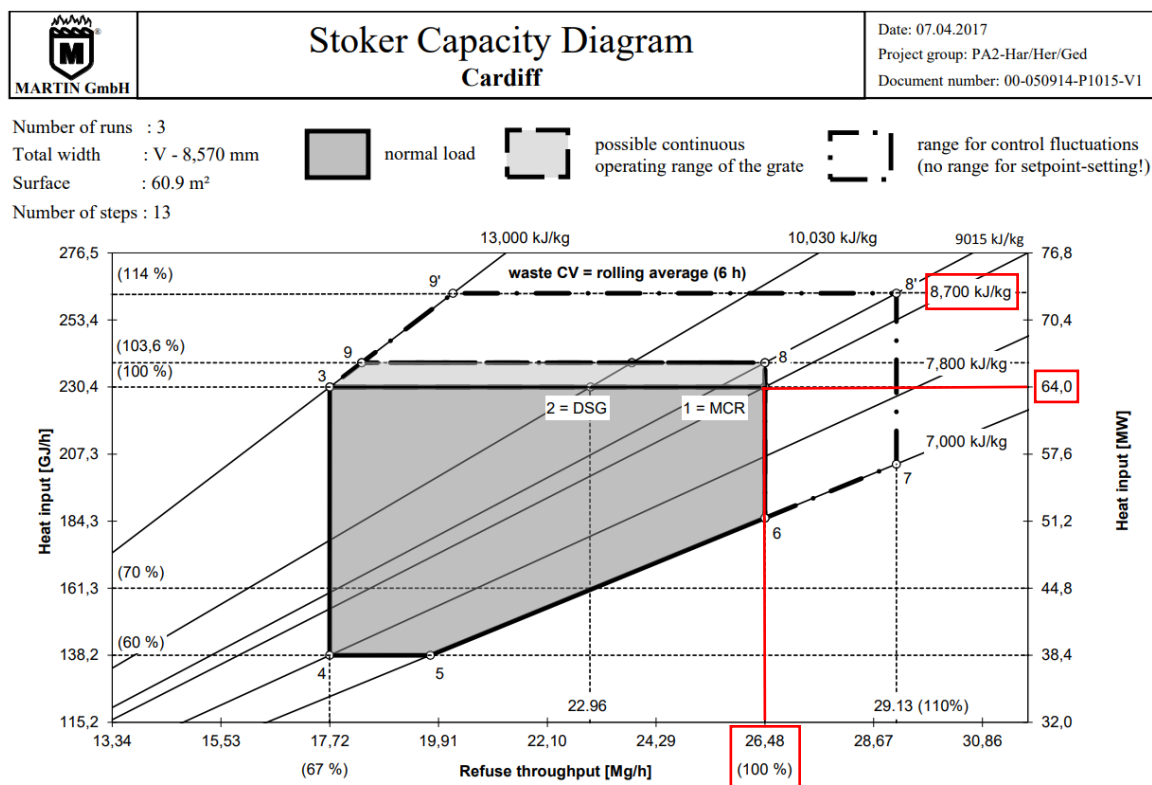
$$\text{Annual Fuel Throughput} = \text{Hourly Throughput} \times \text{Operational Period} \times \text{Number of Lines}$$

The design basis for the capacity as permitted is set out within Section 2.1 and as proposed within Section 2.2.

2.1 Permitted capacity

The firing diagram is presented in Figure 1.

Figure 1: Firing diagram



As highlighted, based on the Maximum Continuous Rating (point MCR) the ERF is capable of processing 26.48 tph per line (52.96 tph in total) of waste with a net calorific value (NCV) of 8.7 MJ/kg. This equates to a thermal input of 64 MW. Based on 92% availability (or 8,025 hours of operation) this equates to an annual throughput of 425,000 tpa.

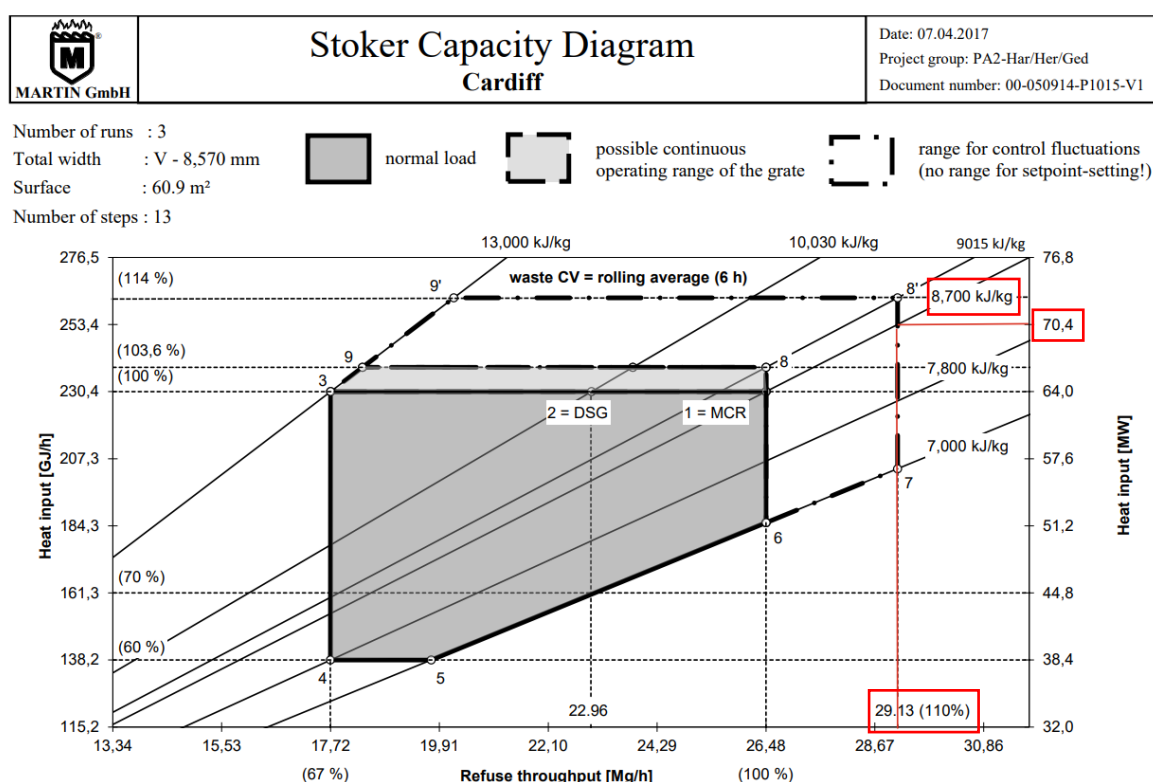
2.2 Proposed capacity

Viridor is proposing an increase to the limit in the existing EP on the annual throughput of waste to 500,000 tpa. This is to reflect a change to the settings within the combustion control system and a

revised maintenance schedule. Minor upgrades have been undertaken to change the settings within the combustion control system to achieve a new nominal load point of 110% heat input, and to address the increase in the steam flow as a consequence of the proposed processing of additional waste. In the most recent outage, the auxiliary systems have been improved to support the necessary increase in the steam flow rate, such as the upgrades to the feedwater pumps to allow for additional feedwater to be provided. The ID fans have also been upgraded to accommodate the increased flue gas flow associated with an increase in fuel flow. The added resilience of the ERF, as a result of these minor upgrades, means that the major outage period can be extended to 24-months. As a result, the annual throughput of waste could exceed the currently permitted limit in the years without a major outage.

The revised maximum load point is highlighted in Figure 2.

Figure 2: Firing diagram - proposed maximum load point



As highlighted, the change to the settings in the control system the ERF is capable of processing up to 29.13 tph per line (58.26 tph in total) of waste with a net calorific value (NCV) of 8.7 MJ/kg. This equates to a thermal input of 70.4 MW (i.e. 110% of MCR). Based on 98% availability (or 8,585 hours of operation) this equates to an annual throughput of 500,150 tpa (i.e. 500,000 tpa).

Table 1 provides a summary of the design parameters changes that are proposed.

Table 1: Comparison of design parameters – permitted vs proposed

Parameter	Unit	Value – Permitted	Value – Proposed	Proportional increase – Proposed
Maximum hourly throughput (per line)	tph	26.48	29.13	10%
Maximum thermal output (per line)	MW	64.0	70.4	10%
Corresponding NCV	MJ/kg	8.7	8.7	No change

3 Proposed change to Total Organic Carbon limit

Annex VI, Part 3 of the Industrial Emissions Directive (IED) (Directive 2010/75) allows waste incineration plants to operate with an ELV for TOC as a daily average of 10 mg/Nm³ (expressed at 11% oxygen, dry gas, 273.15K, 101.3 kPa) and a half-hourly ELV of either:

- 20 mg/Nm³ expressed as the 100th percentile of monitored values; or
- 10 mg/Nm³ expressed as the 97th percentile of monitored values in a calendar year.

Specifically, Annex VI, Part 8 of the IED, states that:

“The emission limit values for air shall be regarded as being complied with if:

either none of the half-hourly average values exceeds any of the emission limit values set out in column A of the table under point 1.2 of Part 3 or, where relevant,

97% of the half-hourly average values over the year do not exceed any of the emission limit values set out in column B of the table under point 1.2 of Part 3.”

A summary of the ELVs for TOC are presented in Table 2.

Table 2: ELVs for Total Organic Carbon

Reporting period	ELV (mg/Nm ³) expressed as 11% oxygen	Reported as
Daily average	10	100 th percentile
Half-hourly average – current ELV	20	100 th percentile
Half-hourly average – proposed ELV	10	97 th percentile

Source: IED, Annex VI, Part 3, para 1.1 and 1.2

Viridor is applying to change the half-hourly limit for TOC from 20 mg/Nm³ to 10 mg/Nm³ reported as the 97th percentile. The environmental implications of the proposed change are detailed in Section 4.3.

The rationale for the proposed limit for TOC is to directly align with the IED. The reduction in the ELV and reporting the 97th percentile allows for occasional short-lived fluctuations, minor load changes, and events to occur such as rogue gas bottles unseen by site staff igniting on the grate, without penalising the Operator.

3.1 Monitoring and compliance

The ERF already employs continuous emissions monitoring (CEMS) for TOC, so no changes to monitoring equipment or reporting are needed. The system can calculate and report the 97th percentile as required.

4 Additional Information

The following section provides the additional information requested within the EP application forms.

4.1 Management system

Viridor has an Environment Management System (EMS) accredited to ISO 14001. The EMS is not proposed to be amended because the arrangements and controls for the storage and handling of raw materials and waste will not change.

4.2 Environmental risk assessment – increase in capacity

A Dispersion Modelling Assessment, Dioxin Pathway Intake Assessment and Abnormal Emissions Assessment has been carried out to support this EP variation.

The Dispersion Modelling Assessment is provided in Appendix A. This has been undertaken to quantify the impact of emissions from the ERF and compare these to the impacts previously consented by NRW. In order to make a direct comparison, the assessment considered the impact of emissions from the ERF based on the parameters set in the Air Quality Assessment produced in 2014 which was carried out to determine the impact from the final design of the ERF (the 'Permitted ERF'). The parameters for the 'Proposed ERF' (i.e. the ERF operating with the increase in capacity) have been determined using operational data when operating at a throughput of 26.48 tph per line of waste with an NCV of 8.7 MJ/kg and increasing the throughput by 10% - i.e. to 29.13 tph per line. It has conservatively been assumed that the ERF continually operates at the ELVs set in the EP.

The impacts have been compared to the air quality assessment levels (AQALs) for the protection of human health, and the Critical Levels and Critical Loads for the protection of ecosystems.

In relation to impacts on human health it is concluded that:

1. The change in impact can be screened out as 'insignificant' as it is less than 1% of the long term AQALs and 10% of the short term AQALs.
2. Where the overall impact of emissions from ERF cannot be screened out as 'insignificant', the total impact is described as 'not significant'.

In relation to impacts on ecology it is concluded that:

3. At all ecological receptors, the change in impact associated with the proposed increase in capacity can be screened out as 'insignificant' as the change in impact is less than 1% of the long term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels.
4. Whilst the change in impacts associated with the proposed EP variation is 'insignificant' at all ecological receptors. However, the total contribution from the ERF with the proposed increase in capacity cannot be screened out as 'insignificant' even when taking into account the spatial distribution of emissions and habitats for two ecological receptors– the Severn Estuary and Cwm Cydfin, Leckwith.
 - a. At the Severn Estuary the impact of the Permitted ERF and the Proposed ERF cannot be screened out 'insignificant' as the impact of ammonia exceeds 1% of the lower Critical Level.
 - b. At Cwm Cydfin, Leckwith SSSI, the impact of the Permitted ERF and the Proposed ERF cannot be screened out 'insignificant' as the impact of ammonia, nutrient nitrogen and acid deposition impacts exceed 1% of the relevant Critical Level and lower Critical Loads. However, in relation to the upper Critical Loads the impact is 'insignificant'.

- c. This conservatively assumes that emissions of ammonia are at the ELV stated in the existing EP (15 mg/Nm³). A review of the operational emissions data has shown that daily mean ammonia emissions have been significantly lower than this (approximately 46% of the daily mean ELV), and the monthly daily mean has been even lower (approximately 20% of the daily mean ELV). As such it is anticipated that the likely impact of the Proposed ERF would be lower than that consented by NRW for the Permitted ERF and is likely that actual impacts of the Proposed ERF would be 'insignificant'.

A Dioxin Pathway Intake Assessment is provided in Appendix B. This has been undertaken to quantify the impact of emissions of dioxins to allow a comparison with the Tolerable Daily Intake (TDI) which is expressed as the total daily intake from ingestion and inhalation which is *"an estimate of the amount of a contaminant, expressed on a bodyweight basis, which can be ingested daily over a lifetime without appreciable health risk"*. As a conservative assumption this has quantified the impact of the ERF operating with the increased capacity at the point of maximum impact within the modelling domain and the maximum impact on land, assumed that the ERF continually operates at the ELV for dioxins, and a hypothetical maximum impacted receptor which only ingests food and drink sourced from the area with the maximum contribution from the ERF. The results show that the combined intake from the ERF and the existing sources is well below the TDI. Therefore, there would not be an appreciable health risk based on the operation of the ERF with the increased capacity and the impact on human health is not significant.

An Abnormal Emissions Assessment is provided in Appendix C. This has been undertaken to quantify the impact of emissions from the ERF with the proposed increase in capacity when operating during abnormal operations as defined within the IED. A review of monitoring data from operational facilities of a similar type in the UK has been carried out to determine the plausible abnormal emissions from the ERF. The predicted impact on air quality associated with the identified plausible abnormal emissions has been calculated by pro-rating the impact associated with normal operations associated with the increase in capacity by the ratio between the normal and plausible abnormal emission values. With regard to short-term impacts this is considered to be a highly conservative assessment as it assumes that the plausible abnormal emissions occur on both lines concurrently and they coincide with the worst-case meteorological conditions. This assessment has shown that even with these highly conservative factors, there are no predicted exceedences of any of the short term or long-term air quality limits associated with abnormal operation. It is concluded that during periods of abnormal operation as permissible under the IED (Article 46) is not predicted to give rise to an unacceptable impact on air quality or the environment.

4.3 Environmental risk assessment – change to ELV for TOC

TOC represents a range of chemical species, typically referred to as 'volatile organic compounds' (VOCs). There is no single environmental assessment level set for VOCs. The EA guidance document "Air emissions risk assessment for your environmental permit"¹ (the Air Emissions Guidance) states:

"If you release volatile organic compounds into the air you should provide details of all emissions. If you cannot identify what all the substances in them are, treat the unknowns as 100% benzene in your risk assessment. If you want to treat them as something else, you'll need to explain why."

Waste incinerator operators are not required to measure or report the speciation of emissions of VOCs; the only requirement is to monitor and report the concentration of TOC. Therefore, a risk

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

assessment has been undertaken with reference to the AQALs set for benzene. As set out in the Dispersion Modelling Assessment provided in Appendix A, there are two AQALs set for benzene:

- an annual mean - 5 µg/m³; and
- a daily mean - 30 µg/m³.

There are no AQALs for benzene for averaging periods shorter than a day.

The impact of emissions of TOC associated with the ERF operating with the proposed increase in capacity compared to the AQAL for benzene is provided in the Dispersion Modelling Assessment provided in Appendix A. This is summarised in Table 3.

Table 3: Impact of VOC emissions

Averaging period	ELV for TOC (mg/Nm ³)	Maximum impact (as benzene)		
		AQAL (ng/m ³)	ng/m ³	% AQAL
Annual mean	10	5,000	65.8	1.3%
Daily mean		30,000	466.7	1.6%

The impact of emissions of TOC (as benzene) from the ERF is less than 10% of the daily mean AQAL and can be screened out as 'insignificant'. The annual mean PEC is predicted to be 1.67 µg/m³ which is only 33% of the AQAL. This is not a significant impact.

The ERF will be required to comply with the daily ELV regardless of the magnitude of any short-term spikes in TOC emissions. Therefore, the proposed variation to the EP would provide greater environmental protection owing to the reduced ELV.

4.4 Fugitive emissions

As this variation is not proposed to result in any changes to the operating techniques for the handling and storage of waste and residues at the Facility, it is not anticipated that there will be any changes to the types and amounts of fugitive generated at the Facility. Therefore, it is not proposed to produce a fugitive emissions management plan to support this EP variation.

4.5 Odour

As this variation is not proposed to result in any changes to the operating techniques for the handling and storage of waste and residues at the Facility, it is not anticipated that there will be any changes to the types and amounts of odour generated at the Facility. Therefore, it is not proposed to amend an odour management plan to support this EP variation.

4.6 Noise

As this variation is not proposed to result in any changes to the waste processing equipment or the associated Operating Techniques listed within EP, there will not be any changes to the noise levels associated with the Facility. There will be no changes to the modes of transport or expected time of waste deliveries – the only change would possibly be a small increase in the number of deliveries per day and is not a consideration for the permitting regime. However, these are not expected to result in any significant increases in noise levels.

An assessment was commissioned by Viridor to investigate the impact of increasing the MCR of the ID fans. This included pre and post MCR noise surveys at key offsite locations. This is provided in Appendix D. As shown, the post-MCR survey confirmed that the increase in the MCR of the ID fans resulted in an increase in on-site ID Fan operational noise levels (1 dB(A) during the daytime and 5 dB(A) during the night-time). However, the survey comparison demonstrates that the ambient and the background noise levels at the majority of noise-sensitive receptors remained equal to or below the pre-increase measurements with the exception of Lewis Road. Notably, the ID fans are not audible at any of the noise-sensitive receptor locations. As such, the measured change in ambient noise, including the increase at Lewis Road, is likely attributable to other external factors and unrelated to the site's MCR increase. It is therefore concluded that the MCR increase has had a negligible impact on the nearest noise-sensitive receptors.

4.7 Fire

Through implementation of this variation, there will not be any changes to the quantity or arrangements for the storage of waste within the Facility. Furthermore, it is understood that:

- there will be no increase in the potential risk of fire at the Facility, including the volumes or types of wastes which will be held at the Facility in the bunker; and,
- there will be no changes to the proposed management techniques to prevent or mitigate fire associated with this variation.

Taking this into consideration, a Fire Prevention Plan (FPP) is not required to be submitted in support of this EP variation.

4.8 Raw material consumption

The proposed increase in capacity will result in the consumption of additional quantities of the raw materials currently consumed during the operation of the Facility.

A summary of proposed changes to raw material consumption is presented in Table 4.

Table 4: Raw material consumption

Raw material	Unit (per annum)	Current raw material consumption	Proposed raw material consumption
Auxiliary fuel	litres	297,500	297,500 ⁽¹⁾
Activated Carbon	tonnes	234	275
Hydrated Lime Usage	tonnes	8,096	9,528
Urea Usage	tonnes	621	730
Note: ⁽¹⁾ Diesel is used as a start-up (and shutdown fuel). It is not proposed to change the number of these events as a result of the proposed increase in capacity and as such this is not changed.			

Aside from diesel (see note ⁽¹⁾ in Table 4 above), the current raw material consumption (based on 2024 data) has been scaled to increase in accordance with the proposed increase in capacity of the ERF to reflect the proposed raw material consumption.

The proposed increase in capacity will not result in any changes to the arrangements for the storage and handling of raw materials or any additional types of raw materials to be consumed at the Facility.

4.9 Residue generation

The proposed increase in capacity of the ERF will result in the generation of additional residues, as presented in Table 5.

Table 5: Residues generated

Residues	Units (per annum)	Current generation	Proposed generation
Bottom ash (including metals)	tonnes	92,225	108,533
Fly ash / Air Pollution Control Residues (APCR)	tonnes	12,750	15,005

The residues generated quoted are based on the maximum generation during 2023 to 2024 and have been scaled proportionally to the proposed increase in capacity of the ERF. The proposed increase in capacity will not result in any changes to the arrangements for the storage and handling of residues generated by the Facility. Adequate storage capacity is provided by the existing infrastructure at the Facility.

Whilst the proposed changes may result in a small increase in the volumes of process effluent (boiler blow down) generated by the ERF, this will be accommodated within the existing constraints of the Dŵr Cymru Welsh Water Trade Effluent Consent. No change to the composition of the effluent is expected as a consequence of the increased throughput.

4.10 Energy efficiency

Assuming an availability of 8,059 hours per annum (92%) the ERF is capable of exporting up to 320,997 MWh per annum. However, when operating with the proposed throughput of 500,000 tpa and assuming an availability of 98% (i.e. 8,585 hours per annum), the ERF is expected to be capable of exporting up to 343,392 MWh per annum.

The proposed increase in capacity has been considered against the relevant energy efficiency requirements of the waste incineration sector guidance (EPR5.01) and the Waste Incineration BREF (referred to as the WI BREF). As can be seen from the findings presented in Table 6, the maximum capacity of the plant compares favourably with the relevant benchmarks.

Table 6: Energy efficiency

Parameter	Unit	Current	Proposed	Benchmark
Gross power generation, nominal design	MWh/t waste	0.755	0.687	0.415-0.644
Net power generation, nominal design	MWh/t waste	0.659	0.599	0.279-0.458
Internal power consumption, nominal design	MWh/t waste	0.096	0.088	0.15
Power generation (assumed gross) for 100,000 tpa of waste	MWe	9.41	8.00	4.00 - 9.00

Full scale commercial heat export is anticipated to commence by the end of 2025, and Viridor is currently in the hot commissioning phase. Intermittent heat flows are currently being supplied to the Cardiff Heat Network for the purpose of validation and assessing reliability.

4.11 Letter of authorisation

The letter of authorisation for the declaration of the EP variation application is provided in Appendix E.

Appendices

A Dispersion Modelling Assessment

FICHTNER

Consulting Engineers Limited



Cardiff Energy Recovery Facility



Viridor Trident Park Ltd

Dispersion Modelling Assessment

Document approval

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Management Summary

Fichtner Consulting Engineers Ltd (“Fichtner”) has been engaged by Viridor Trident Park Ltd (“Viridor”) to undertake a dispersion modelling assessment to support the application for a variation to the Environmental Permit (EP) for the Cardiff Energy Recovery Facility (ERF). The ERF was granted an EP to recover energy from 425,000 tonnes per annum of non-hazardous municipal waste and are now seeking an increase of 75,000 tonnes in waste throughput and a revision to the Total Organic Carbon (TOC) emission limit value (ELV). Full details of the proposed changes being applied for can be found in the Supporting Information document for this EP variation application.

Dispersion Modelling of Emissions

The ADMS dispersion model is routinely used for air quality assessments to the satisfaction of Natural Resource Wales (NRW). The model uses weather data from Cardiff Airport 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 ERF operates for the whole year and releases emissions at the ELVs continuously. The model has been used to predict the ground level 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.

The predicted impact of ERF as permitted and proposed has been quantified. The impact of the proposed variation has been calculated as the difference between the two scenarios. The impacts have been predicted at ground level for human health and ecology.

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 NRW. Using this approach, in relation to the Air Quality Assessment Levels (AQALs) set for the protection of human health the following can be concluded from the assessment.

1. The operation of ERF will not cause a breach of any AQAL.
2. The change in impact associated with the proposed EP variation can be screened out as ‘insignificant’ as the change in impact is less than 1% of the long term AQALs and 10% of the short term AQALs.
3. Whilst the change in impacts associated with the proposed EP variation is ‘insignificant’, the total contribution from the ERF with the proposed increase in capacity at the point of maximum impact of emissions is greater than 1% of the long term AQALs for nitrogen dioxide, cadmium and benzene. However, the total concentrations of these pollutants including baseline sources are less than 70% of the AQAL. This is not a significant impact. Further to this, there are no areas of relevant exposure to the annual mean AQAL where the contribution from the ERF with the proposed increase in capacity is greater than 1% of the long term AQAL. Therefore, at all areas of relevant exposure to the annual mean AQALs the impacts of emissions from the ERF with the proposed increase in capacity can be screened out as ‘insignificant’.

4. In relation to the change in the half-hourly TOC ELV, the proposed change would result in far fewer Schedule 5 Notifications being submitted to NRW, whilst providing the greater environmental protection owing to the reduced ELV.

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

The impact of emissions from the ERF on ecology has been assessed using a standard approach based on guidance provided by NRW. 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 ecological receptors, the change in impact associated with the proposed increase in capacity can be screened out as 'insignificant' as the change in impact is less than 1% of the long term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels.
2. Whilst the change in impacts associated with the proposed EP variation is 'insignificant' at all ecological receptors. However, the total contribution from the ERF with the proposed increase in capacity cannot be screened out as 'insignificant' even when taking into account the spatial distribution of emissions and habitats for two ecological receptors– the Severn Estuary and Cwm Cydfin, Leckwith.
 - a. At the Severn Estuary the impact of the Permitted ERF and the Varied ERF permit cannot be screened out 'insignificant' as the impact of ammonia exceeds 1% of the lower Critical Level.
 - b. At Cwm Cydfin, Leckwith SSSI, the impact of the Permitted ERF and the Varied ERF permit cannot be screened out 'insignificant' as the impact of ammonia, nutrient nitrogen and acid deposition impacts exceed 1% of the relevant Critical Level and lower Critical Loads. However, in relation to the upper Critical Loads the impact is 'insignificant'.
 - c. This conservatively assumes that emissions of ammonia are at the ELV stated in the existing EP (15 mg/Nm³). A review of the operational emissions data has shown that daily mean ammonia emissions have been significantly lower than this (approximately 46% of the daily mean ELV), and the monthly daily mean has been even lower (approximately 20% of the daily mean ELV). As such it is anticipated that the likely impact of the Varied ERF permit would be lower than that consented by NRW for the Permitted ERF and is likely that actual impacts of the Varied ERF permit would be 'insignificant'.

Summary and Conclusions

In summary, the assessment has shown that the change in air quality impact associated with proposed EP variation would be 'insignificant'. In addition, the total impact of Varied ERF permit operating as proposed would have an acceptable impact on local air quality, ecological receptors, the general population or the local community. As such there should be no air quality constraint in granting the proposed variation to the existing EP.

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1 Introduction

1.1 Background

Viridor Trident Park Limited (Viridor) operate the Cardiff Energy Recovery Facility (the Facility). The Environmental Permit (EP) was granted by Natural Resources Wales (NRW) on 04 November 2010 (Ref: EPR/LP3030XA). Viridor has subsequently been granted nine separate variations to the EP the most recent variation was granted by NRW on 5 June 2024 (EPR/LP3030XA/V009).

The Facility consists of a two line energy from waste plant (herein referred to as the Energy Recovery Facility (ERF)) which is used to recover energy from non-hazardous municipal, commercial and industrial waste by incineration, and a back-up generator for provision of emergency electrical power. The maximum permitted quantity of waste to be incinerated is 425,000 tonnes per annum (tpa).

Viridor is proposing the following changes to the EP:

- Increase the limit in the existing EP on the annual throughput of waste from 425,000 tpa to 500,000 tpa. This is to reflect a change to the settings within the combustion control system and a revised maintenance schedule; and
- Change the half-hourly emission limit value (ELV) for Total Organic Carbon (TOC) from 20 mg/Nm³ to 10 mg/Nm³ reported as the 97th percentile. This is to allow for occasional short-lived fluctuations, minor load changes, and events to occur such as rogue gas bottles unseen by site staff igniting on the grate, without penalising the operator

Full details of the proposed changes can be found in the Supporting Information document.

This Dispersion Modelling Assessment has been produced to quantify the impact of the proposed changes on local air quality. As the ERF is currently operating, this assessment has considered the following scenarios:

- “Permitted ERF” – the impact of the ERF operating at the currently permitted throughput and the permitted ELVs; and
- “Varied ERF permit” – the impact of the ERF operating at the proposed throughput and ELVs.

The difference in impact has been quantified to determine the impact of this variation application.

When considering the impact on human health, the predicted atmospheric concentrations have been compared to the Air Quality Assessment Levels (AQALs) for the protection of human health. It is noted that for dioxins a Tolerable Daily Intake (TDI) is set which considers 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. A separate Dioxin Pathway Intake Assessment has been undertaken to assess the pathway intake of these pollutants and impacts compared to the TDI. This is provided as a separate technical report to support the EP variation application.

When considering the impact on ecosystems the predicted atmospheric concentrations have been compared to the Critical Levels for the protection of ecosystems. 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.

A separate abnormal emissions assessment has been produced to support the EP variation application which considers the impact of abnormal operations of the ERF as defined within the Industrial Emissions Directive (IED) (Directive 2010/75/EU) for the combustion of waste.

The existing EP includes ELVs for emissions to air for emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans, as well as other substances. The proposed variation includes a change to the ELV for TOC to align with current IED values and requirements of the Waste Incineration BREF, specifically it is proposed that the half-hourly ELV will be changed from 20 mg/Nm³ expressed as 100% of all half-hourly concentrations to 10 mg/Nm³ reported as the 97th percentile. The dispersion modelling has been carried out assuming the Permitted ERF operates at the existing ELVs and the Varied ERF permit operates at the ELVs proposed in the EP application.

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 residential and ecological receptors which are sensitive to changes in air quality associated with the ERF and identified in section 3.
- The background levels of ambient air quality are described in section 4.
- The inputs used for the dispersion model are presented in section 5.
- Details of the sensitivity analysis carried out are presented in section 6.
- A discussion of the validity of the model and uncertainty is presented in section 7.
- The assessment methodology and results of the assessment of the impact of emissions on human health are presented in section 8.
- The assessment methodology and results of the assessment of the impact of emissions at ecological sites are 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

European air quality legislation is consolidated under the Ambient Air Quality Directive (Directive 2008/50/EC), which came into force on 11 June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides Ambient Air Directive (AAD) Limit Values, including nitrogen dioxide and carbon monoxide. Directives 2008/50/EC and 2004/107/EC are transposed under Welsh Law into the Air Quality Standards (Wales) Regulations (2010).

The Environment Agency's (EA's) environmental management guidance 'Air Emissions Risk Assessment for your Environmental Permit'¹ ("Air Emissions Guidance") has also been considered for other AQALs. The long-term and short-term EALs from these documents have been used when the AQS or Air Quality Standards (Wales) Regulations 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 on the Air Pollution Information System (APIS)² website.

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. The AQALs relevant to the assessment are summarised in Table 1 to Table 3.

Table 1: Air Quality Assessment Levels (AQALs)

Pollutant	Limit Value (µg/m ³)	Averaging Period	Frequency of Exceedances	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79 th percentile)	AQS Wales Limit Value
	40	Annual	-	AQS Wales Limit Value
Sulphur dioxide	266	15 minute	35 times per year (99.9 th percentile)	AQS Limit Value
	350	1 hour	24 times per year (99.73 rd percentile)	AQS Wales Limit Value
	125	24 hours	3 times per year (99.18 th percentile)	AQS Wales Limit Value
Particulate matter (PM ₁₀)	50	24 hours	35 times per year (90.4 th percentile)	AQS Wales Limit Value
	40	Annual	-	AQS Wales Limit Value
Particulate matter (PM _{2.5}) ⁽¹⁾	20	Annual	-	AQS Average Exposure Indicator.
Carbon monoxide	10,000	8 hours, running	-	AQS Wales Limit Value
	30,000	1 hour	-	Air Emissions Guidance

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

² www.apis.ac.uk

Pollutant	Limit Value (µg/m³)	Averaging Period	Frequency of Exceedances	Source
Hydrogen chloride	750	1 hour	-	Air Emissions Guidance
Hydrogen fluoride	160	1 hour	-	Air Emissions Guidance
	16	Monthly	-	Air Emissions Guidance
Ammonia	2,500	1 hour	-	Air Emissions Guidance
	180	Annual	-	Air Emissions Guidance
Benzene	5	Annual		AQS Wales Limit Value
	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
Note: ⁽¹⁾ Under the Environment (Air Quality and Soundscapes) (Wales) Act 2024, the Welsh Government has a duty to set a target for PM _{2.5} by 14 February 2027, but to date no new target has been adopted into law.				

Table 2: Air Quality Assessment Levels for Metals

Pollutant	AQAL (ng/m³)	Averaging Period	Source
Cadmium	30	24 hours	Air Emissions Guidance
	5	Annual	AQS Wales Limit Value
Mercury	600	1 hour	Air Emissions Guidance
	60	24 hours	Air Emissions Guidance
Antimony	150,000	1 hour	Air Emissions Guidance
	5,000	Annual	Air Emissions Guidance
Arsenic	6	Annual	AQS Wales Limit Value
Chromium (III)	2,000	24 hours	Air Emissions Guidance
Chromium (VI)	0.25	Annual	Air Emissions Guidance
Copper	50	24 hours	Air Emissions Guidance
Lead	500	Annual	AQS Wales Limit Value
	250 ⁽¹⁾	Annual	Air Emissions Guidance
Manganese	1,500,000	1 hour	Air Emissions Guidance
	150	Annual	Air Emissions Guidance
Nickel	700	1 hour	Air Emissions Guidance
	20	Annual	AQS Wales Limit Value
Vanadium	1,000	24 hours	Air Emissions Guidance
Note:			

Pollutant	AQAL (ng/m ³)	Averaging Period	Source
⁽¹⁾ The Air Emissions Guidance includes a more stringent AQAL for lead than set in the AQS Wales Regulations. As such the more stringent AQAL has been applied in this assessment.			

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

Pollutant	Concentration (µg/m ³)	Measured as	Source
Nitrogen oxides (as nitrogen dioxide)	75 / 200*	Daily mean	Air Emissions Guidance / WHO
	30	Annual mean	AQS Wales Critical Level
Sulphur dioxide	10	Annual mean For the protection of lichens and bryophytes	Air Emissions Guidance
	20	Annual mean for all higher plants	AQS Wales Critical Level
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:

*only for detailed assessments where the 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 6,000 µg/m³ calculated from accumulated hourly ozone concentrations – AOT40 means the sum of the difference between each hourly daytime (08:00 to 20:00) ozone concentration greater than 80 µg/m³ (40 ppb) and 80 µg/m³, for the period between 01 May and 31 July.

In addition to the Critical Levels set out in the table above, provides habitat specific Critical Loads for nitrogen and acid deposition. Full details of the habitat specific Critical Loads can be found in Appendix C.

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 (TG22) (2022) (LAQM.TG(22)) 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, Local Air Quality Management Technical Guidance (TG22), Defra, August 2022

2.3 Industrial pollution regulation

Atmospheric emissions from industrial processes are controlled in Wales through the Environmental Permitting (England and Wales) Regulations (2016) (and subsequent amendments). The ERF operates in accordance with the conditions set in the existing EP. 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 IED, was adopted on 07 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 (Best Available Techniques Reference documents) become binding as BAT (Best Available Techniques) guidance, as follows.

- Article 15, paragraph 2, of the IED requires that 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 Wales this is NRW) has up to four years to revise permits for facilities covered by that activity to comply with the requirements of the sector specific BREF.

'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 EP for ERF has been varied to include the requirements of the Waste Incineration BREF.

2.4 Local air quality management

In accordance with Section 72 of the Environment Act (2021) (Part V), 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 Sensitive Receptors

3.1 Human sensitive receptors

The general approach to the assessment is to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution at a number of sensitive receptors has been evaluated at the same locations assessed in the 2014 Air Quality Assessment (the “2014 Air Quality Assessment”) produced for the EP variation by SLR³. These sensitive receptors are displayed in Figure 1 of Appendix A and listed in Table 5.

The receptors are considered to be a representative sample of the schools, hospitals, care homes (mostly within 5 km of the ERF) and allotments within the modelling domain. It is not possible to include every occupied area and as such the assessment also considers the point of maximum impact across the whole model domain and interpretation of plot files. All human health sensitive receptors have been modelled at a height of 1.5 m to represent typical breathing height.

Table 5: Human Health Sensitive Receptors

ID	Receptor name	Location		Distance from the ERF stack (km)
		X (m)	Y (m)	
R1	Willows High School	321116	176730.4	1.7
R2	Baden Powell County Primary School	320788.9	176837.1	1.6
R3	Splott Health centre	320656.7	176526.3	1.3
R4	Splott Rec South	320679.9	176623.7	1.4
R5	Splott Rec North	320621.9	176883.5	1.6
R6	Moorland Primary School #1	320473.4	176294.3	1.0
R7	College building	320314.5	176625.4	1.3
R8	Library	320017.6	176725.2	1.5
R9	Allotments	320358.6	178692.3	3.4
R10	Howardian Centre	320289	178569.3	3.3
R11	University of Wales Institute	320282.1	178279.4	3.0
R12	St Peters Rec	320182.3	177641.5	2.3
R13	Moorland park	320337.7	176219.5	0.9
R14	National Assembly	319419.1	174558.6	1.1
R15	County Hall	319298.5	175168.7	1.0
R16	St Cuthbert's RC Primary School	319034.1	175467.9	1.2
R17	Adamstown County Primary School	319569.9	176725.2	1.6
R18	College	319110.6	176669.5	1.8
R19	Cardiff Royal Infirmary #1	319247.5	176769.3	1.8
R20	Cardiff Royal Infirmary #2	319335.6	176845.8	1.8

³ SLR Feb 2014, Trident Park EfW: Permit Variation: Air Quality Assessment SLR Ref: 403-00036.00321

ID	Receptor name	Location		Distance from the ERF stack (km)
		X (m)	Y (m)	
R21	Cardiff Royal Infirmary #3	319423.8	176887.6	1.8
R22	St Peter's RC Primary School	319444.7	177098.7	2.0
R23	School building	318853.1	176834.2	2.1
R24	School building	318929.7	176973.4	2.1
R25	College building	318829.9	177249.4	2.4
R26	College building	319096.7	176978	2.0
R27	College building	318978.4	176776.2	2.0
R28	Moorland Primary School #2	320497.8	176365.6	1.1
R29	St Anne's Church in Wales Infant	319298.5	177437.3	2.3
R30	Marlborough Junior School	319539.8	177961.6	2.8
R31	College building	319196.5	178657.5	3.5
R32	Roath Park Recreation ground	319066.6	178355.9	3.3
R33	Roath Park Primary School	318887.9	178272.4	3.3
R34	School building	317999.5	178239.9	3.7
R35	School building	318997	177789.9	2.8
R36	University of Wales Cardiff	318136.4	177272.6	2.9
R37	Cathays Park	317994.9	177063.9	2.9
R38	Virgin Church in Wales Primary School	318614.2	175651.2	1.7
R39	Mountstuart Primary School	318855.5	174486.7	1.6
R40	Royal Hamadryad Hospital	318514.5	174354.5	2.0
R41	St Pauls Primary School	317739.7	174644.4	2.6
R42	St Patricks RC Primary School	317526.3	175242.9	2.7
R43	Ninian Park Primary School	317134.3	175152.5	3.1
R44	St Davids Hospital	317236.3	176576.7	3.3
R45	Castle Mews – College	317925.3	176929.3	2.8
R46	Nursery – plants	317621.4	177212.3	3.3
R47	Uni library	318006.5	177474.4	3.1
R48	Ysgol Mynydd Bychan School #1	317391.8	178413.9	4.2
R49	Ysgol Mynydd Bychan School #2	317582	178713.1	4.3
R50	Severn County Junior School	316802.6	176606.9	3.7
R51	St Marys Catholic Primary School	316860.6	176713.6	3.7
R52	Kitchener County Primary School	316756.2	176207.9	3.6
R53	Llandough Primary School	316888.4	173041.6	4.0
R54	Llandough Hospital N.H.S Trust	316621.6	172948.8	4.3

3.2 Ecological sensitive receptors

NRW's 'Assessing air quality impacts as part of your planning application'⁴ specifies "protected sites" as:

- Special Areas of Conservation (SAC)
- Special Protection Areas (SPAs)
- Ramsar Sites;
- Sites of Special Scientific Interest (SSSIs)
- National Nature Reserves (NNRs); and
- Marine Conservation Zones (MCZ).

Screening distances are set out for various combustion projects, but not incineration projects. The largest screening zone is 15 km.

The 2014 Air Quality Assessment used the following screening distances:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the ERF; and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNR), Local Nature Reserves (LNRs), Site of Importance for Nature Conservation (SINC) and ancient woodlands within 2 km of the ERF.

This does not align with the criteria now stated on the NRW website.

Therefore, this assessment considers the sites identified by NRW as "protected sites" within 15 km of the ERF. In lieu of any screening distance for local non-statutory designated sites, the following sites have been identified within 2 km of the ERF in accordance with the EA's 'Air emissions risk assessment for your environmental permit' screening criteria:

- Ancient Woodlands, Local Nature Reserves (LNRs), Sites of Importance for Nature Conservation (SINC) and ancient woodlands within 2 km of the Site.

The sensitive ecological receptors in Table 6 are the closest in a straight line distance from the ERF stack to the boundary of ecological sites of importance and are displayed in Figure 2 of Appendix A. Ecological receptors presented in Table 6 represent those with the maximum significant impact within the sites of ecological importance. All sensitive ecological receptors have been modelled at a height of 0 m. The most sensitive Critical Level and Critical Load across each statutory designated site has been adopted for initial screening.

Table 6: Sensitive Ecological Receptors

ID	Name	Location		Distance from stack at closest point (km)
		X (m)	Y (m)	
European and UK designated sites				
E1	Severn Estuary (Wales) SAC, SSSI, SPA and Ramsar	320900	175497	0.7
E2	River Usk / Afon Wysg SAC, SSSI, Newport Wetlands NNR	331782	183724	14.3

⁴ <https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/assessing-air-quality-impacts-as-part-of-your-planning-application/?lang=en>

ID	Name	Location		Distance from stack at closest point (km)
		X (m)	Y (m)	
E3	Cardiff Beech Woods SAC	314608	183218	9.7
E4	Severn Estuary (England) SAC, SSSI, SPA and Ramsar	328160	169408	9.9
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / Llanishen and Lisvane Reservoir Embankments SSSI	318633	181427	6.3
E8	Caeau Blaen-bielly SSSI	310416	182366	12.1
E9	Castell Coch Woodlands and Road Section SSSI	313103	182350	10.0
E10	Cefn Onn SSSI	317541	185119	10.2
E11	Cliff Wood - Golden Stairs SSSI	309440	167221	13.5
E12	Coed y Bedw SSSI	311640	182830	11.4
E13	Coedydd y Barri / Barry Woodlands SSSI	313217	171432	8.0
E14	Cog Moors SSSI	316093	169439	7.2
E16	Cwm Cydfin, Leckwith SSSI	316652	173808	3.9
E17	Ely Valley SSSI	311489	176685	8.9
E18	Fforestganol a Chwm Nofydd SSSI	315288	182495	8.7
E19	Flat Holm SSSI	322040	165200	10.3
E20	Garth Wood SSSI	312790	182003	10.0
E21	Glamorgan Canal / Long Wood SSSI	314341	180405	7.8
E22	Gwaun Gledyr SSSI	313582	186625	13.1
E23	Gwent Levels - St. Brides SSSI	326665	181660	9.0
E24	Gwlyptiroedd Casnewydd / Newport Wetlands SSSI	332374	183251	14.5
E26	Lisvane Reservoir SSSI	318826	181988	6.8
E27	Llynnoedd Cosmeston / Cosmeston Lakes SSSI	317727	169430	6.4
E28	Nant Whitton Woodlands SSSI	306709	172127	13.9
E29	Penarth Coast SSSI	318660	170112	5.4
E31	Plas Machen Wood SSSI	323790	187170	12.4
E35	Ruperra Castle and Woodlands SSSI	321960	186298	11.1
E38	Ty Du Moor SSSI	310990	179413	10.1
E40	Fferm Walters SSSI	310245	168985	11.8
E41	Gwent Levels - Rumney and Peterstone SSSI	322397	177818	3.3
Local sites				
E46	Cardiff Bay Wetland and Hamadryad Park LNR	318903	174260	1.7
E47	Cardiff Heliport Fields SINC	320982	175298	0.7
E48	Tidal Sidings SINC	320724	175422	0.5

ID	Name	Location		Distance from stack at closest point (km)
		X (m)	Y (m)	
E49	Ocean Park South SINC	320357	175298	0.1
E50	Beach Sidings SINC	320854	174452	1.0
E51	Cardiff Bay Wetland Reserve SINC	318884	174218	1.7
E52	River Taff SINC	318592	174748	1.7
E53	Pengam Moors SINC	321314	176674	1.7

The ecological receptors listed below have been identified due to their designated status. However, these are not classified as sensitive to air pollution as these have been designated due to geological interest:

- Barry Island SSSI;
- Brofiscin Quarry, Groes Faen SSSI;
- Cwarrau Ton Mawr a Ffynnon Taf - Ton Mawr and Taffs Well Quarries SSSI;
- Hayes Point to Bendrick Rock SSSI;
- Penylan Quarry SSSI;
- Rhymney River Section SSSI;
- Rumney Quarry SSSI;
- Sully Island SSSI; and
- Wern Ddu Claypits SSSI.

Therefore, these sites have been excluded from this assessment.

4 Baseline Air Quality

The Site is located within Cardiff City Council's area of jurisdiction, to the west of the Tremorfa Steelworks and north of Cardiff Port. The surrounding area is a mix of mostly light and heavy industrial/commercial units and residential properties. The location of the Site is shown in Figure 3, Appendix A.

4.1 Air quality management areas

There are currently two AQMAs within 5 km of the Site, Cardiff City Centre and Stephenson Court which are both declared due to elevated annual mean nitrogen dioxide concentrations from road transport. These AQMAs are displayed in Figure 3 of Appendix A. The impact of the proposed variation upon these AQMAs has been quantified as part of this assessment in section 8.2.4.

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 Site and immediate surroundings. In addition, mapped atmospheric concentrations of ammonia are available from the Air Pollution Information System (APIS) throughout the UK.

The most recent data under the MAAQ contract is for a base year of 2023. For the pollutants included in both datasets (nitrogen dioxide and particulate matter) the highest concentrations from across both datasets has been presented.

Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentration data within 10 km of the Site have been downloaded along with the concentrations for the grid squares containing the Site. A summary is presented in Table 7.

Table 7: Mapped Background Data

Pollutant	Annual mean concentration (µg/m ³)		Dataset
	At Site	Max within 10 km of Site	
Nitrogen dioxide	16.2	20.3	2023 Defra dataset
Sulphur dioxide	3.8	5.2	2023 Defra dataset
Particulate matter (as PM ₁₀)	10.3	13.2	2023 Defra dataset
Particulate matter (as PM _{2.5})	6.1	7.2	2023 Defra dataset
Carbon monoxide	229.5	0.3	2010 Defra dataset ⁽¹⁾
Benzene	0.6	1.6	2023 Defra dataset

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4.3 Monitoring data

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of Defra. This includes automatic monitoring of oxides of

nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and particulates. In addition to the national AURN, local authorities undertake monitoring of a range of pollutants as part of the LAQM review process, and Wales has its own air quality network.

AURN and local monitoring sites are broadly categorised as ‘background’ or ‘roadside’ sites. Background sites are positioned that they are not influenced significantly by any single source or street but rather by the integrate contribution from all sources upwind of the station and are considered broadly representative for several square kilometres. Conversely, roadside sites are intended to measure the effect of emissions from nearby traffic and are only representative of air quality for the immediate area of the analyser. Monitoring data from within 3 km has been considered for use as baseline values in this assessment.

A review of the monitoring undertaken in the area as set out on the Air Quality in Wales website has shown that the following continuous analysers require consideration:

- Cardiff Castle Street – a roadside site located 2.4 km to the north of Site;
- Cardiff Centre – an urban background site located 2.2 km to the north of Site;
- Cardiff Newport Road – a roadside site located 2.2 km to the north-east of Site.

These sites all monitor concentrations of nitrogen dioxide and particulate matter (as PM₁₀ and PM_{2.5}). The most recent five years of monitoring results are presented in Table 8. Any exceedances of an AQAL are highlighted.

Table 8: Continuous Monitoring Data

Site Name	2023 mapped bg (µg/m³)	Annual mean concentration (µg/m³)				
		2020	2021	2022	2023	2024
Nitrogen dioxide						
Cardiff Castle Street	17.6	25	26	34	33	30
Cardiff Centre	17.6	16	16	17	16	14
Cardiff Newport Road	14.6	19	22	22	19	17
PM ₁₀						
Cardiff Castle Street	12.1	16	18	20	18	17
Cardiff Centre	12.1	14	13	16	16	12
Cardiff Newport Road	11.5	17	17	18	16	15
PM _{2.5}						
Cardiff Castle Street	6.7	9	9	10	8	7
Cardiff Centre	6.7	7	9	11	10	8
Cardiff Newport Road	7.0	n/a	n/a	n/a	n/a	n/a

Source: Air Quality in Wales website

There are no exceedances recorded of AQALs across continuous analysers within 3 km of the Site.

At the urban background site (Cardiff Centre) the monitored concentration is similar to the mapped background concentration, indicating that the mapped background concentrations are reasonably accurate. At the roadside sites there has been a generally decreasing trend in concentrations, although the recorded concentrations in 2020 and 2021 will have been affected by the effects of the Covid-19 pandemic. During Covid-19 Castle Street was restricted to pedestrian access only, with

Castle Street reopening for the first full year in 2022 to road vehicles thereby contributing towards the increase in measured air pollutants.

In addition to the continuous analysers monitoring of nitrogen dioxide is undertaken using diffusion tubes in the local area. This monitoring has also demonstrated no exceedance of the annual mean AQAL. The location of these diffusion tubes and the continuous analysers is shown on Figure 3, Appendix A.

A conservative approach was taken and the higher of the 2023 Defra mapped background or monitored concentration at a background site have been used across the model domain to represent background concentrations- i.e. $20.3 \mu\text{g}/\text{m}^3$.

As part of the Automatic and Non-Automatic Hydrocarbon Network, benzene concentrations are measured at sites co-located with the AURN across the UK. The closest site in Newport, an urban background site, approximately 18 km north east. This site is classified as an urban background location. Monitoring is also carried out at Port Talbot approximately 45 km west of the Site at an urban industrial location with a coastal environ similar to the Site. A summary of benzene concentrations from Newport and Port Talbot is presented in Table 9.

Table 9: Benzene Monitoring

Site	AQAL ($\mu\text{g}/\text{m}^3$)	2023 mapped bg ($\mu\text{g}/\text{m}^3$)	Annual mean concentration (ng/ m^3)				
			2020	2021	2022	2023	2024
Newport	5	0.52	0.50	0.53	0.52	0.55	0.48
Port Talbot	5	0.95	0.55	0.80	0.86	0.77	0.43

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As shown the monitored concentration at Newport is similar to the mapped background concentration, indicating that the mapped background concentrations are reasonably accurate. Whereas at Port Talbot, the mapped background concentrations over-predict concentrations by a factor of 1.2 highlighting they are a conservative representation of concentrations.

The monitoring from Newport is appropriate for urban background locations, but the concentration monitored at Port Talbot may be more representative of the setting, but is located 45 km from the Site. The maximum mapped background concentration within 10 km of the Site as presented in Table 7 is $1.6 \mu\text{g}/\text{m}^3$. This is greater than the monitored concentrations at either Newport or Port Talbot. As such a conservative measure the maximum mapped background concentration within 10 km of the Site has been used as the baseline concentration in this assessment.

4.4 Other national monitoring networks data

Neither the Defra mapped background dataset, AURN, LAQM or LAQN include monitoring of other pollutants released from the ERF such as hydrogen chloride, hydrogen fluoride, metals and dioxins. As such reference has been made to data from national monitoring networks to determine appropriate background concentrations.

4.4.1 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. Prior to the cessation of the monitoring, concentrations were fairly constant.

The maximum annual average monitored within the UK between 2011 and 2015 was $0.76 \mu\text{g}/\text{m}^3$. In lieu of any recent representative monitoring this has conservatively been used as the background concentration for this assessment.

4.4.2 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 $0.036 \mu\text{g}/\text{m}^3$ to $2.35 \mu\text{g}/\text{m}^3$.

In lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has been conservatively used as the background concentration for the purpose of this assessment ($2.35 \mu\text{g}/\text{m}^3$).

4.4.3 Ammonia

Ammonia is also measured as part of the UKEAP project at rural background locations. There are no UKEAP monitoring locations within 3 km of the Site. The nearest monitoring site is at Castle Cary, 60 km to the south east. In lieu of any local UKEAP monitoring, the maximum mapped background value from Centre for Ecology and Hydrology's Concentration Based Estimated Deposition (CBED) within 10 km of the Site has been used for the purpose of this assessment ($1.4 \mu\text{g}/\text{m}^3$) when considering the impact with reference to the AQALs for the protection of human health, and the maximum background concentration across each designated site from APIS has been used when evaluating the impact at ecological receptors.

4.4.4 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, an urban industrial site 45 km to the west of the Site. In lieu of any local monitoring reference has been made to the national monitoring. The Site is located in a predominately industrial area and as such reference has been made to the monitoring carried out at urban industrial monitoring sites. The following table presents maximum concentrations from all UK industrial sites over five most recent years of monitoring data.

Table 10: Annual Mean Metals Concentrations – Maximum at Industrial Sites

Substance	Annual mean concentration (ng/m^3)						Max (as % of AQAL)
	AQAL	2020	2021	2022	2023	2024	
Cadmium	5	1.4	0.99	0.6	0.51	0.43	28.00%
Mercury	-	-	-	-	-	-	-
Antimony	5,000	-	-	-	-	-	-
Arsenic	6	0.95	0.85	0.81	0.76	0.66	15.8%
Chromium	-	6.1	5.6	4.5	4.2	5.3	-
Cobalt	-	5.50	2.90	0.83	0.90	0.96	-

Substance	Annual mean concentration (ng/m ³)						Max (as % of AQAL)
	AQAL	2020	2021	2022	2023	2024	
Copper	-	14	14	15	15	15	-
Lead	250	17.00	21.00	23.00	20.00	20.00	9.20%
Manganese	150	90.0	83.0	100.0	71.0	69.0	66.7%
Nickel ⁽¹⁾	20	1.2	1.2	1.4	1.2	1.5	7.5%
Vanadium	-	9.4	9.6	13.0	9.1	7.3	-
Note: ⁽¹⁾ the maximum measured nickel concentration across all UK urban industrial sites was 25 ng/m ³ at Pontardawe Tawe Terrace, on investigation this monitoring location is close to a nickel and cobalt alloy manufacturing site. Therefore data from this site is only considered to be representative of conditions close to this site and has been excluded.							

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In addition to the suite of metals monitored at urban background monitoring sites there would be releases of mercury and antimony from the ERF. With reference to these pollutants:

- Monitoring of mercury ceased in August 2018 and 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. For the purpose of this assessment the annual mean concentration from Runcorn in 2018 of 16.0 ng/m³ has been used.
- Monitoring of antimony across the UK ceased at the end of 2013. The maximum monitored at any background site in 2013 was 1.30 ng/m³ at Detling, which has been used as the background concentration for the assessment. This value is only 0.026% of the annual mean AQAL of 5,000 ng/m³.

As a conservative assumption the maximum monitored concentrations for each metal from the UK at urban industrial sites between 2020 and 2024 as presented in Table 10 has been used as the background concentration within this assessment, with the background concentration of mercury and antimony being from the most recent year of monitoring from Runcorn Western Point and Detling respectively.

4.4.5 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PCBs are monitored on a quarterly basis at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. There are no monitoring locations within 10 km of the Site. The closest monitoring site is located at London Nobel House, approximately 210 km to the east of the Site.

A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 11 and Table 12. Note that monitoring data for dioxins and furans is only available up to the end of 2016 from the UK-Air website. For PCBs, data is only available up to the end of 2018 from the UK-Air website.

Table 11: Dioxin and Furans Monitoring

Site	Annual mean concentration (fgTEQ/m ³)				
	2012	2013	2014	2015	2016
Auchencorth Moss	0.13	0.86	0.01	0.01	0.13

Site	Annual mean concentration (fgTEQ/m ³)				
	2012	2013	2014	2015	2016
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

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Table 12: PCB Monitoring

Site	Annual mean concentration (pg/m ³)				
	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

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

4.4.6 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 has been considered, as this is the only PAH which an AQAL has been set. The closest PAH analyser is at Cardiff Lakeside approximately 4.8 km to the north of the Site. This is an urban background analyser and as such is likely to be representative of concentrations for several square kilometres.

A summary of benzo(a)pyrene concentrations from Cardiff Lakeside is presented in Table 13.

Table 13: Benzo(a)pyrene

Site	AQAL (ng/m ³)	Annual mean concentration (ng/m ³)				
		2020	2021	2022	2023	2024
Cardiff Lakeside	0.25	0.20	0.18	0.21	0.18	0.10

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As shown, concentrations are compliant with the AQAL. The maximum monitored concentration from the past five years of available monitoring data has been used as the background concentration within this assessment (0.21 ng/m³).

4.5 Summary of baseline concentration used in assessment

In summary, there is some local monitoring of nitrogen dioxide and particulate matter. This includes a range of continuous analyser and diffusion tubes. A comparison of Defra 2023 mapped background concentrations and measurements has been undertaken which highlights that the Defra dataset is a conservative representation of background concentrations. As such these have been used in this assessment. For other pollutants in the first instance the maximum monitored concentrations from comparative sites across the UK has been used.

It has been assumed that baseline concentrations are as per those set out in the following table. These are based on a mixture of monitoring and modelled data sets. Where the contribution from the ERF cannot be screened out as 'insignificant' (see Section 8.1 for methodology), the choice of baseline concentration has been given additional consideration taking into account the choice of baseline concentration.

Table 14: Summary of Baseline Concentrations

Pollutant	Annual mean concentration	Units	Justification
Nitrogen dioxide	20.3	$\mu\text{g}/\text{m}^3$	Maximum mapped background within 10 km of the Site (2023 Defra dataset)
Sulphur dioxide	5.2	$\mu\text{g}/\text{m}^3$	
Particulate matter (as PM_{10})	13.2	$\mu\text{g}/\text{m}^3$	
Particulate matter (as $\text{PM}_{2.5}$)	7.2	$\mu\text{g}/\text{m}^3$	
Carbon monoxide	0.3	$\mu\text{g}/\text{m}^3$	Maximum mapped background within 10 km of the Site (2010 Defra dataset)
Hydrogen chloride	0.8	$\mu\text{g}/\text{m}^3$	Maximum monitored concentration across the UK 2011 to 2015
Hydrogen fluoride	2.4	$\mu\text{g}/\text{m}^3$	Maximum measured concentration from EPAQS report
Ammonia	1.4	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from APIS 3-year average (2020-2022)
Benzene	1.6	$\mu\text{g}/\text{m}^3$	Maximum mapped background within 10 km of the Site (2023 Defra dataset)
Mercury	16.0	ng/m^3	2018 monitored concentration from Runcorn Western Point
Cadmium	1.4	ng/m^3	Maximum monitored concentration between 2020 and 2024 taken from all UK urban industrial sites, chromium VI assumed to be 20% of total chromium in line with EA guidance.
Arsenic	1.0	ng/m^3	
Chromium	16.0	ng/m^3	
Chromium VI	1.06	ng/m^3	
Cobalt	0.3	ng/m^3	
Copper	8.8	ng/m^3	
Lead	11.8	ng/m^3	
Manganese	43.2	ng/m^3	

Pollutant	Annual mean concentration	Units	Justification
Nickel	7.1	ng/m ³	The maximum monitored at any background site most recent year of monitoring (2013)
Vanadium	4.9	ng/m ³	
Antimony	1.30	ng/m ³	
Dioxins and furans	32.99	fg/m ³	Maximum UK monitored concentration between 2012 and 2016
Polychlorinated biphenyl (PCBs)	128.93	pg/m ³	Maximum UK monitored concentration between 2014 and 2018
Benzo(a)pyrene (PAHs)	0.21	ng/m ³	Maximum monitored 2020 to 2024 from Cardiff Lakeside

4.6 Baseline conditions at ecological sites

APIS provides baseline data on a grid across the UK. Atmospheric concentrations of oxides of nitrogen, ammonia, acid and nitrogen deposition are provided on a 1 km x 1 km grid. Data is provided for the maximum across the ecological site. This data is the 2020 to 2022 average as presented on APIS. A summary of concentrations and deposition at the identified ecological sites is provided in Appendix C. This shows that the baseline data presented in APIS for oxides of nitrogen and sulphur dioxide are below the annual mean Critical Level at all sites. However, baseline concentrations of ammonia exceed the annual mean Critical Level at some of the identified sites.

5 Modelling Methodology

5.1 Selection of model

Detailed dispersion modelling has been undertaken 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 environmental permitting purposes to the satisfaction of the NRW. An analysis of the variation in model outputs has been undertaken and the maximum predicted concentration for each pollutant and averaging period has been used to determine the significance of any potential impacts.

5.2 Source and emissions data

The source and emissions input data for the ERF utilised within the modelling are presented in Table 15 to Table 18.

The existing EP currently allows for the processing of up to 425,000 tpa of non-hazardous municipal, commercial and industrial waste. The firing diagram provided in the Supporting Information document which supports the EP application shows that the Permitted ERF is capable of processing 26.48 tonnes per hour (tph) of waste per line (52.96 tph in total) with a net calorific value (NCV) of 8.7 MJ/kg. This equates to a thermal input of 64 MW. Based on 92% availability (or 8,025 hours of operation) this equates to an annual throughput of 425,000 tpa.

As set out in the Supporting Information document Viridor is proposing an increase to the limit in the existing EP on the annual throughput of waste to 500,000 tpa. This is to reflect a change to the settings within the combustion control system and a revised maintenance schedule to achieve a new nominal local point of 110% of heat input. The revised maximum load point is 29.13 tph per line (58.26 tph in total) of waste with a NCV of 8.7 MJ/kg. This equates to a thermal input of 70.4 MW (i.e. 110% of MCR). Based on 98% availability (or 8,585 hours of operation) this equates to an annual throughput of 500,150 tpa (i.e. 500,000 tpa).

The emission parameters for the 'Permitted ERF' are as those used in the previous air quality works which reflected the design at a throughput of 26.48 tph per line of waste with an NCV of 8.7 MJ/kg as set out in the 2014 Air Quality Assessment. The parameters for the 'Varied ERF permit' have been determined using operational data when operating at a throughput of 26.48 tph per line of waste with an NCV of 8.7 MJ/kg and increasing the throughput by 10% - i.e. to 29.13 tph per line.

The inputs for the dispersion modelling associated with the Varied ERF permit have been derived from an analysis of continuous emission monitoring system (CEMS) data from 01 January 2024 through to 28 August 2025. Flow rate, oxygen content, pressure and moisture content have been averaged over CEMS samples when the ERF operated with a waste throughput +/- 5% 26.48 tph with an NCV of 8.7 MJ/kg, thereby averaging a total of 1,451 (5% of total) and 1,209 (4.2% of total) samples across stack lines 1 and 2, respectively. To determine the flow rate for the Varied ERF permit, the volumetric flow rate has been uplifted by 10% to reflect the increase in waste throughput proposed. Given that the waste composition is assumed to be the same no changes have been applied to the oxygen content, pressure and moisture content. It has been assumed that the same parameters apply to each line of the ERF.

The review of the CEMS data has shown that the ERF operates at a temperature of approximately 152°C. As a conservative assessment a temperature of 140°C has been adopted, as per the 2014 Air Quality Assessment.

Table 15: Stack Data

Item	Unit	ERF
Height	m	90
Internal diameter (each line)	m	1.9
Stack location line 1	m, m	320250.4, 175293.4
Stack location line 2	m, m	320248.6, 175293.4

Table 16: Flue Gas Conditions – Per Line

Item	Unit	Permitted ERF	Varied ERF permit
Temperature	°C	140	140
Exit moisture content	% v/v	13.6%	15.9%
Exit oxygen content	% v/v dry	9.57%	8.7%
Volume at ref conditions (273.15K, dry, 11% O ₂)	Nm ³ /h	134,640	168,901
	Nm ³ /s	37.4	46.92
Volume at actual conditions	Am ³ /h	205,920	258,954
	Am ³ /s	57.2	71.93
Flue gas exit velocity	m/s	20.2	25.37

Table 17: Stack Emissions Data - Daily ELV – Per Line

Pollutant	ELV (mg/Nm ³ , unless stated)	Permitted ERF (g/s, unless stated)	Varied ERF permit (g/s, unless stated)
Oxides of nitrogen (as NO ₂)	180	6.732	8.446
Sulphur dioxide	40	1.496	1.877
Carbon monoxide	50	1.870	2.346
Total dust (PM) ⁽¹⁾	5	0.187	0.235
Hydrogen chloride	8	0.299	0.375
Volatile organic compounds (as TOC)	10	0.374	0.469
Hydrogen fluoride	1	0.037	0.047
Ammonia	15	0.561	0.704
Cadmium and thallium	0.02	0.748 mg/s	0.938 mg/s
Mercury	0.02	0.748 mg/s	0.938 mg/s
Other metals ⁽²⁾	0.3	11.22 mg/s	14.076 mg/s
Benzo(a)pyrene (PAHs) ⁽³⁾	0.2 µg/Nm ³	7.48 ng/s	9.384 ng/s

Dioxins and furans	0.06 ngTEQ/Nm ³	2.24 pgTEQ/s	2.815 pgTEQ/s
PCBs ⁽⁴⁾	5 µg/Nm ³	0.187 mg/s	0.234 mg/s

Notes:

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

⁽¹⁾ As a worst-case it has been assumed that the entire dust emissions consist of either PM₁₀ or PM_{2.5} for comparison with the relevant AQALs.

⁽²⁾ Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

⁽³⁾ 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 ERF.

⁽⁴⁾ 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 ERF.

Table 18: Stack Emissions Data – Half-hourly ELV – Per Line

Pollutant	Conc. (mg/Nm ³)	Release rate (g/s)	
		Permitted ERF	Varied ERF permit
Oxides of nitrogen (as NO ₂)	400	14.960	18.768
Sulphur dioxide	200	7.480	9.384
Carbon monoxide ⁽¹⁾	150	5.610	7.038
Total dust (PM) ⁽²⁾	30	1.122	1.408
Hydrogen chloride	60	2.244	2.815
Volatile organic compounds (as TOC)	20 / 10 ⁽¹⁾	0.748	0.469

Notes:

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

⁽¹⁾ half-hourly TOC for the Permitted ERF is 20 mg/Nm³, but a proposed ELV of 10 mg/Nm³ is being sought as part of this EP variation.

As shown, the increase in throughput would result in an increased volumetric flow rate and a greater quantity of pollutants released on a g/s basis. However, this is accompanied by a higher flue gas exit velocity which will aid dispersion.

5.3 Other inputs

Modelling has been undertaken over a grid of 9.5 km x 9.5 km with grid spacing of 94 m which is less than 1.5 times the stack height. Reference should be made to Figure 1 of Appendix A for a graphical representation of the modelling domain.

Table 19: Modelling Domain

Parameter	Grid
Grid Spacing (m)	94

Parameter	Grid
Grid Start X	315500
Grid Finish X	325000
Grid Start Y	170500
Grid Finish Y	180000

5.3.1 Meteorological data and surface characteristics

The impact of meteorological data has been taken into account by using meteorological data from Cardiff Airport meteorological recording station for the years 2020 – 2024 sourced from United States’ department of National Oceanic and Atmospheric Administration (NOAA). Cardiff Airport is located approximately 15 km from the ERF. Wind roses for each year of meteorological data can be found in Figure 4 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 surrounding the ERF are mixed industrial and urban whilst conditions at Cardiff Airport are grassland with the edge of the Barry town to the east and Rhoose village to the south. As such, the minimum Monin-Obukhov length has been set to 30 m at the dispersion site which is appropriate for cities and large towns and mixed urban areas, and 10 m at the meteorological site which is appropriate given the proximity to surrounding towns.

The surface roughness length utilised in ADMS can additionally be selected for both the dispersion site and meteorological site. The surface roughness length varies widely across the modelling domain, from very low values over the waterbodies to much higher values over built-up areas. To account for the varying surface roughness length, spatially-varying surface roughness files have been generated for each of the output grid extents shown in Table 20. Some of the ecological receptors lie outside of the extents of the variable surface roughness and terrain. As such a unique surface roughness has been created for ecological receptors and details have been provided within Table 20. The land-use class for each point in the file has been extracted from the CEH Land Cover database⁵ and cross-referenced with the most likely surface roughness length value⁶.

Table 20: Terrain and Surface Roughness Extents

Terrain and surface roughness	Main Grid	Wider Extents
Processing resolution	128 x 128	128 x 128
Grid Start X	314577	304709
Grid Finish X	325857	334109
Grid Start Y	169542	159170
Grid Finish Y	180901	189170

The surface roughness for the meteorological site has been set to 0.2 m which is considered appropriate considering the immediate land use surrounding the meteorological recording site.

⁵ Morton, R.D.; Marston, C.G.; O’Neil, A.W.; Rowland, C.S. (2025). Land Cover Map 2024 (land parcels, GB). NERC EDS Environmental Information Data Centre

⁶ Taken from “Roughness length classification of Corine Land Cover classes”, Megajoule Consultants, 2007

5.3.2 Terrain

It is recommended by CERC, where gradients within 500 m of the modelling domain are greater than 1 in 10, the complex terrain module within ADMS (FLOWSTAR) should be used. A terrain file to cover the output grid of points set out in Table 20 has been created using Ordnance Survey Terrain 50 data.

5.3.3 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.

It is recommended 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 the dispersion calculations in the model.

A review of the as-built site has been undertaken and there are no buildings 30% the height of the stack (i.e. greater than 30 m).

The ERF building is curved. The average height of the building is 29.1 m, but there is a small section over the boiler hall which is 46 m in height. The maximum height of the building on the eastern side is 26.5 m and the western side is 11.7 m. ADMS simplifies the representation of building height into a cuboid with the crosswind length and width and height as set as the main building. ADMS then calculates an area where an air flow across the building would produce a recirculation zone. The roofline of the building is such that air would follow the building roofline and produce a recirculation zone linked to the height of the building where the air flow diverges – i.e. the edge of the building. This would mean that for winds from the west the air flow would produce a recirculation zone on the eastern side of the building similar to that of a building height of the eastern part of the building (i.e. 26.5 m), and for winds from the east the air flow would produce a recirculation zone on the western side of the building similar to that of a building height of the western part of the building (i.e. 11.7 m).

As the base case in the dispersion model the average height of the building (29.1 m) has been set as the building height. This is considered to be conservative as during the prevailing winds (i.e. those from the west) the air flow would follow the building roofline and the height where the flow diverges on the eastern side of the building is 26.5 m. The associated details are presented in Table 21 and visualised in Figure 5. To confirm that alternative representations of ERF building height will not materially alter the conclusions of this assessment a sensitivity test has been undertaken and has been discussed in section 6.3.

Table 21: Building Details - Modelled

Buildings	Centre point		Height (m)	Width (m)	Length (m)	Angle (°)
	X (m)	Y (m)				
Main building	320185.7	175308.6	29.1	70.2	218.8	66.5

5.4 Plume depletion

Within ADMS when modelling deposition an option is to include plume depletion where the concentration of pollutants in the plume reduce as the pollutants are deposited. This has not been included in the model as a conservative assumption.

5.5 Chemistry

The ERF will release nitric oxide (NO) and nitrogen dioxide (NO₂) which are collectively referred to as oxides of nitrogen (NO_x). In the atmosphere, NO will be converted to NO₂ in a reaction with ozone (O₃) which is influenced by solar radiation. Since the AQALs are expressed in terms of NO₂, it is important to be able to assess the conversion rate of NO to NO₂.

Ground level NO_x concentrations have been predicted through dispersion modelling. NO₂ concentrations reported in the results section assume 70% conversion from NO_x to NO₂ for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario specified in EA's air emissions risk assessments⁷ which is appropriate where the primary NO₂ to NO_x ratio is less than 10%. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

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

6 Sensitivity Analysis

6.1 Surface roughness

As demonstrated in section 5.3.1, the surface roughness across the modelling domain is highly variable. The sensitivity of the results to using varying surface roughness length has been considered by running the model with a variable surface roughness file and a constant surface roughness value across the modelling domain. For all sensitivity analysis, the impact of changing model parameters on the maximum annual mean and 1-hour concentrations of oxides of nitrogen have been considered.

The following parameters have been kept constant:

- Source modelled – Varied ERF permit at operation at the daily mean ELV;
- Stack height – 90 m;
- Grid – 9.5 km x 9.5 km;
- Buildings – included;
- Terrain file – included at 128 x 128 resolution;
- Meteorological site surface roughness – 0.2 m;
- Dispersion site Monin-Obukhov length – 30 m;
- Meteorological site Monin-Obukhov length – 10 m; and
- Meteorological data used – Cardiff Airport 2024.

The contribution of oxides of nitrogen emissions from the Varied ERF permit at the point of maximum ground level impact and the maximum impacted human health receptor are presented in Table 22. In addition, the difference between impact using the variable surface roughness file has been calculated. Where the impact is less than using the variable surface roughness file this is highlighted in green, and where the impact is greater this is highlighted in yellow.

Table 22: Surface Roughness Sensitivity Analysis

Surface roughness (m)	Point of maximum impact – grid		Maximum impacted human health receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Variable	1.18	28.81	0.18	15.07
0.4 m (average)				
0.5 m	1.08	26.30	0.25	18.15
1.2 m	1.34	26.82	0.34	22.30
% of variable surface roughness file adopted				
0.4 m	86.7%	91.7%	122.7%	107.4%
0.5 m	91.2%	91.3%	134.6%	120.4%
1.2 m	113.5%	93.1%	188.4%	147.9%

As shown, using a constant surface roughness value leads to lower model estimates generally with the exception of maximum annual mean concentrations at human sensitive receptors. However, due to the variability in the surface roughness values across the modelling domain, in particular the presence of an estuarine environment upwind of the prevailing south westerly wind direction with a low surface roughness (0.0001 m), it is considered appropriate to use a variable surface roughness file. To strengthen the case for variable surface roughness, Figure 6 shows the difference in surface roughness values used across the grid and reflects the heterogeneity of land types in the model domain.

6.2 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:

- Source modelled – Varied ERF permit at operation at the daily mean ELV;
- Stack height – 90 m;
- Grid – 9.5 km x 9.5 km;
- Buildings – included;
- Dispersion site surface roughness – variable at 128 x 128 resolution;
- Meteorological site surface roughness – 0.2 m;
- Dispersion site Monin-Obukhov length – 30 m;
- Meteorological site Monin-Obukhov length – 10 m; and
- Meteorological data used – Cardiff Airport 2024.

The contribution of oxides of nitrogen emissions from the Varied ERF permit at the point of maximum ground level impact and the maximum impacted human health receptor are presented in Table 23. In addition, the difference including terrain has been calculated. Where the impact is less than including the effects of terrain this is highlighted in green, and where the impact is greater this is highlighted in yellow.

Table 23: Effect of Terrain

Scenario	Point of maximum impact – grid		Maximum impacted human health receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Including	1.18	28.81	0.18	15.07
Excluding	1.20	27.57	0.18	15.18
% of including terrain adopted				
Excluding	102.0%	95.7%	98.2%	100.7%

As shown, including terrain does not substantially change results ($< \pm 5\%$). Inclusion of terrain is considered conservative and essential due to the coastal location and topographical changes across the domain. Figure 7 presents terrain variability across the model domain.

The sensitivity of the results to the resolution of the terrain and surface roughness files has been considered by running the model with these files at 32 x 32 and 64 x 64 resolution as presented in Table 24. Where the impact is less than using a resolution of 128 x 128 this is highlighted in green, and where the impact is greater this is highlighted in yellow.

Table 24: Effect of Terrain and Surface Roughness Resolution

Scenario	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
128 x 128 resolution	1.18	28.81	0.18	15.07
32 x 32 resolution	1.18	28.92	0.17	15.14
64 x 64 resolution	1.18	28.82	0.18	15.12
% of 128 x 128 resolution adopted				
32 x 32 resolution	99.8%	100.4%	92.6%	100.4%
64 x 64 resolution	99.8%	100.0%	98.9%	100.3%

As shown, running the terrain and surface roughness files at a lower resolution results in very slight differences in maximum concentrations across the grid and sensitive receptors (< +/-5%). For the purpose of this assessment the 128 x 128 resolution is considered appropriate and conservative.

6.3 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 model works by combining the inputted individual buildings into a single effective building for each wind direction. As detailed in section 5.3.3, the building has been represented as a single building with the height set to the average height of the building. The dispersion model only accounts for buildings which are greater than a third of the stack height. Given that the building has been represented by the average height of the building (29.1 m) the building module is not activate in the dispersion model. As such the model has also been run with a building height set to a third of the stack height, and the maximum height of the building.

The following parameters have been kept constant:

- Source modelled – Varied ERF permit operation at the daily mean ELV;
- Stack height – 90 m;
- Grid – 9.5 km x 9.5 km;
- Terrain file – included at 128 x 128 resolution;
- Dispersion site surface roughness – variable at 128 x 128 resolution;
- Meteorological site surface roughness – 0.2 m;
- Dispersion site Monin-Obukhov length – 30 m;
- Meteorological site Monin-Obukhov length – 10 m; and
- Meteorological data used – Cardiff Airport 2024.

The contribution of oxides of nitrogen emissions from the Varied ERF permit at the point of maximum impact across the grid and at human health receptors are presented in Table 25. In addition, the difference in impact when excluding buildings and varying building height to reflect

variations in the ERF building height have been calculated. Where the impact is less than using a building height of 29.1 m this is highlighted in green, and where the impact is greater this is highlighted in yellow; where there is no change, no highlighting has been applied.

Table 25: Effect of Buildings

Scenario	Point of maximum impact – grid		Maximum impacted human health receptor	
	Annual Mean	Max 1-hour mean	Annual Mean	Max 1-hour mean
Building height of 29.1 m	1.18	28.81	0.18	15.07
Building height of 30 m – i.e. 30% of stack height	1.23	44.22	0.19	15.09
Building height of 46 m - maximum	2.18	44.07	0.18	15.07
Excluding buildings	1.18	28.81	0.18	15.07
% of 29.1 m building height as adopted				
Building height of 30% of stack height	104.5%	153.5%	102.3%	100.1%
Maximum building height	184.8%	153.0%	100.3%	100.0%
Excluding buildings	100.0%	100.0%	100.0%	100.0%

As demonstrated assuming the average building height, the effects of buildings are excluded. This is anticipated as the average height of the building is less than a third of the stack height.

The inclusion of buildings between 30 m and 46 m results in predicted impacts to increase between 1.05 through to 1.85 times the adopted building height of 29.1 m for the maximum annual mean and 1 hour grid concentration, respectively. Whereas differences at receptors are significantly less pronounced. Effectively a taller building as a proportion of stack height entrains a greater mass of plume pollutants near the building, as evidenced with peak concentrations increasing with building heights.

A review of the building layout and meteorological data shows that the prevailing wind direction is from the west and during these winds the air flow will flow over the building and the building wake effect would be small. As such, using the maximum building height would be a significant overestimation.

Figure 5 demonstrates that the maximum concentrations across the grid are not in locations with relevant exposure and impacts of building height at receptors should be given greater weight. As evidenced in section 5.3.3 the building height default of 29.1 m is considered more representative

7 Model Validation and Uncertainty

The results of the model validation documentation and the sensitivities have been considered, and the conservatism in the modelling has been reviewed.

7.1 Validation of ADMS model

7.1.1 Introduction

Dispersion modelling of process emission from the ERF has been carried out using ADMS (version 6) produced by CERC. This section of the report describes the model and explains why it is considered appropriate for modelling the impacts of the ERF.

7.1.2 Model description

ADMS 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.

Within ADMS, the FLOWSTAR module is used to generate a new flow and turbulence field based on the terrain. This simulates the changes to the movement of air in the horizontal and vertical direction as a result of the terrain features in that the air flow is simulated flowing above and around raised ground. This modified flow field is then used by the model to adjust the plume height and plume spread parameters calculated by the flat terrain model. The ADMS model can also handle cases of strongly stable flow using a separate plume impingement model.

The technical specification document for the complex terrain module⁸ explains that “*terrain should have no more than moderate slopes (up to 1:3) although the model is useful even when this criterion is not met (say up to 1:2)*”.

CERC notes that during very low wind stable conditions in hilly terrain, horizontal gradients in density can cause katabatic (downslope) winds, which may influence the background flow in deep valleys⁹. These effects are not specifically accounted for in ADMS. However, the local area does not include such valleys and as such this limitation of the model is not relevant to this assessment.

7.1.3 Model validation

CERC validates its models against available measured data obtained from real world situations, field campaigns and wind tunnel experiments. Validation studies are published on the CERC website¹⁰. Not all of the validation studies are for settings similar to the study area (flat and/or gently sloping terrain within an urban conurbation). There are two validation studies that are considered to be in locations similar to the study area. These are detailed in Table 26.

⁸ CERC, P14/01S/17 Complex Terrain Module, March 2020

⁹ CERC, Note 110 Temperature Inversions in ADMS, 20 April 2017

¹⁰ <https://www.cerc.co.uk/environmental-software/model-validation.html>

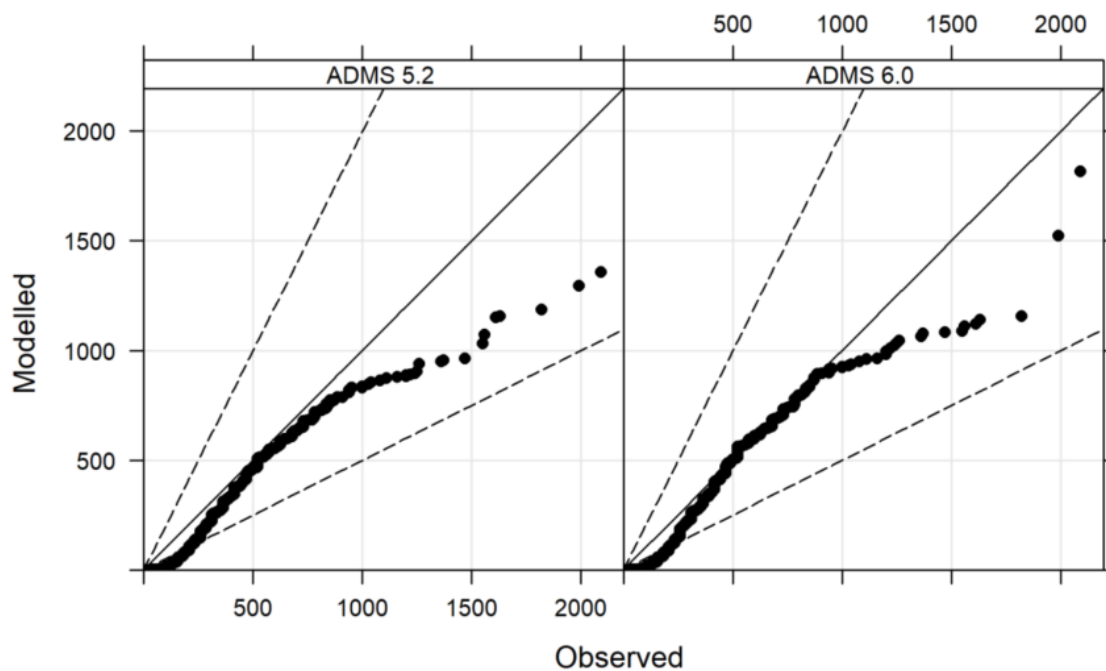
Table 26: Model Validation Studies

Study	Notes
Baldwin Power Plant	Characterised as “complex terrain below the stack height”. Complex terrain is included in model for ERF, but it does not rise above the stack height within the study area.
Kincaid, Indianapolis and Prairie Grass experiments	Kincaid – flat farmland with lakes Indianapolis – flat land, mixed industrial/commercial/urban. Although the model for ERF includes terrain effects, these are relatively minor (see section 6.2). Prairie Grass experiment – ground level release, not relevant to Facility study area.

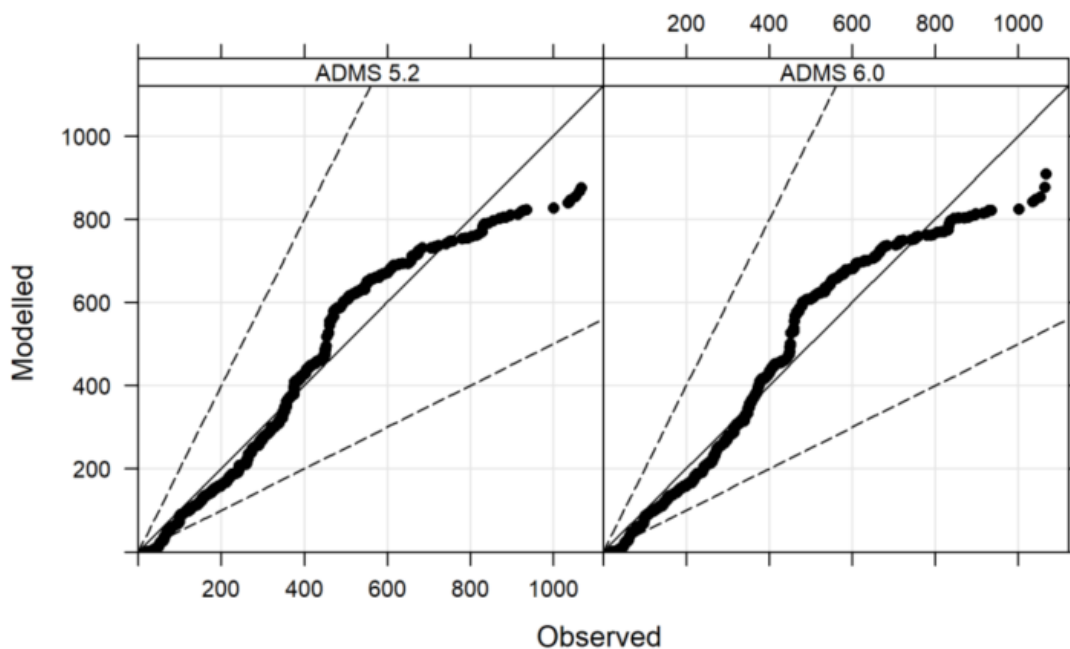
The validation studies include scatter plots, quantile-quantile plots, and a comparison between the observed and modelled maximum and robust highest concentration (Baldwin Power Station only).

- The scatter plots compare predicted and measured concentrations at a particular location at a particular time.
- The quantile-quantile plots compare the distribution of predicted and measured concentrations during the period having abandoned the (x,t) pairing – i.e. comparing the first highest concentration from the monitored with the first highest concentration predicted.
- The highest concentration is subject to extreme variations. Therefore, the robust highest concentration (RHC) is used due to its stability which is based on a tail exponential fit to the upper end of the distribution. The RHC is strongly related to the average and standard deviation.

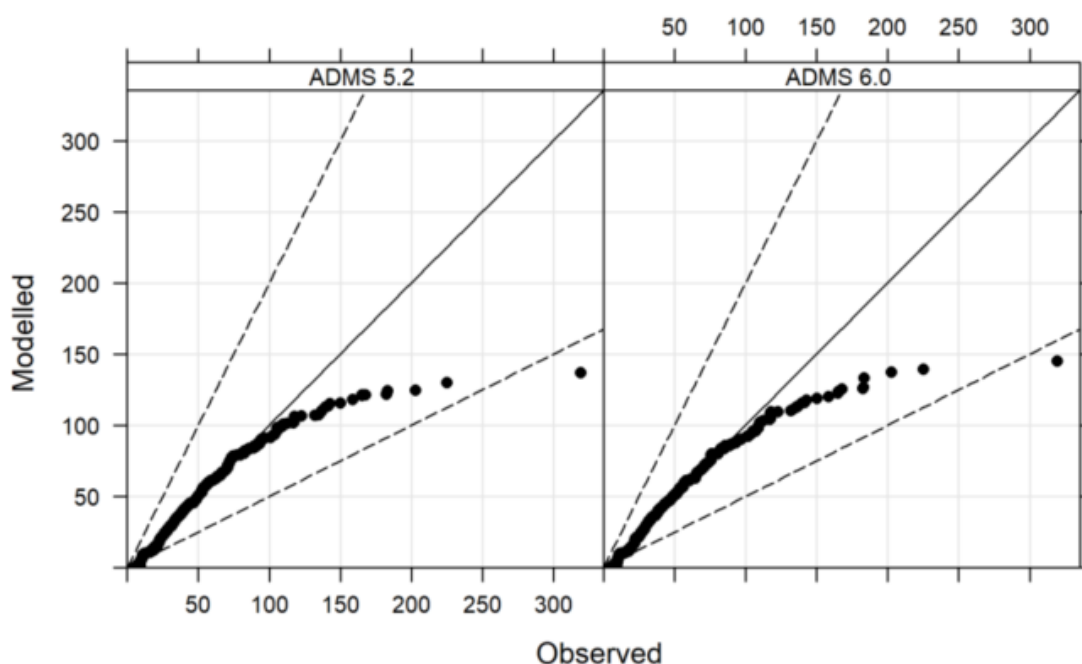
The most useful visual aid for evaluating model performance is the quantile-quantile plot which shows how the model performs across the full range of modelled and observed concentrations. The quantile-quantile plots for each validation study are shown in the following figures.

Quantile – Quantile Plot – Baldwin Power Station

Source: CERC, ADMS 6 Complex Terrain Validation Baldwin Power Plant, April 2023

Quantile – Quantile Plot – Indianapolis

Source: CERC, ADMS 6 Flat Terrain Validation Kincaid, Indianapolis and Prairie Grass, April 2023

Quantile – Quantile Plot – Kincaid

Source: CERC, ADMS 6 Flat Terrain Validation Kincaid, Indianapolis and Prairie Grass, April 2023

These plots show that at the most common (median) concentrations the modelled and observed concentrations are very similar, giving high confidence in annual mean concentrations. However, the maximum concentrations tended to be under-predicted in two out of the three studies (Baldwin and Kincaid), albeit these are based on a very small sample size.

For the Baldwin Power Plant validation is carried out against sulphur dioxide concentrations. In the validation document¹¹ CERC explains that there are issues with using sulphur dioxide as a tracer which include:

- The limitations of detection are usually of the order of $16 \mu\text{g}/\text{m}^3$, and concentrations below these are set to one-half of the limit. This leads to considerable inaccuracy when modelled concentrations are low.
- Sulphur dioxide is released from other sources. If estimates of these background concentrations are not available, then the model will underestimate concentrations, particularly long-term averages.

CERC does not report the modelled long-term or annual average concentration against the observed concentration and has only reported the RHC for the Baldwin Power Station study. This is reported for 1-hour, 3-hour and 24-hour averages. The ratio of mean to observed concentrations for the RHC varies from 0.67 to 0.71 across these averaging periods, indicating that the model may be under-estimating the very highest concentrations by up to 33%.

Taking the above into account, it is likely that annual mean concentrations are modelled with a high degree of accuracy. However, the extreme maximum concentrations are less certain, subject to up to 33% uncertainty based on the Baldwin validation study, and potentially over 50% based on the quantile-quantile plot for the Kincaid validation study.

¹¹ CERC, ADMS 5 Complex Terrain Validation Baldwin Power Plant, November 2016

7.2 Uncertainty

The validation documentation shows that the levels of uncertainty in the ADMS model with respect to the peak predicted concentrations are typically within 10% of the hourly and daily concentrations, with accuracy over long time frames expected to be at least as high as this.

The sensitivity analysis in section 6 shows that varying surface roughness and terrain parameters leads to changes in the peak results of up to around 80%. The large change of 80% is attributed to a constant surface roughness of 1.2 m across the site which is considered unrealistic given that upwind of the ERF's prevailing wind direction (south westerly) the area is mostly estuarine with a very low surface roughness, as such the variable surface roughness is representative and required.

Variations in weather data are more complex and feed into the inter-annual variability discussed below.

In order to allow for modelling uncertainty, this assessment includes a number of conservative assumptions. These are explained and quantified in this section.

7.2.1 Interannual variability

The detailed results tables presented in Appendices D and E include the breakdown of the peak concentration using each year of meteorological data. The maximum predicted impact over the 5-years of data has then been used as the basis of the assessment. Table 27 provides a breakdown of the range of the predicted impacts from the Varied ERF permit at the point of maximum impact for each averaging period.

Table 27: Interannual Variability

Averaging time	Impact from Varied ERF permit as percentage of maximum	
	Minimum	Average
Annual mean	77.2%	91.6%
Maximum 24-hour	85.3%	93.6%
Maximum 1-hour	76.3%	82.7%
99.79%ile 1-hour	87.6%	93.8%
99.73%ile 1-hour	85.2%	92.5%
99.9%ile 15-minute	93.5%	96.4%

For the point of maximum impact, the annual average over all five years of weather data is 91.6% of the highest year, and the minimum is 77.2% of the highest year. This suggests that using the peak year introduces a conservatism of around 8% compared to average values. There is similar inter-annual variability for shorter-term impacts which are reported as percentile values, where a 4-8% conservatism is introduced compared to the 5-year maximum.

7.2.2 Plant availability

The results are based on the assumption that the ERF would operate for 100% of the time. This is a very conservative assumption. The ERF will be off for periods of maintenance, with proposed availability likely to be around 98% (i.e. 8,585 hours).

7.2.3 Emission limits

The results are based on the assumption that the ERF will operate at the long-term ELVs for 100% of the time. However, the ERF currently operates at a margin below the ELVs stated in the EP.

7.2.4 Short term impacts

For short term impacts it has been assumed that the period when the ERF would need to operate at the short-term ELVs on both lines concurrently for an entire hour, during the worst-case weather conditions for dispersion, and the ERF would be operating at the worst-case flue gas conditions.

These are highly conservative assumptions, in particular regarding both lines operating at the short-term ELVs concurrently. In order to achieve the daily ELVs, the ERF is operated to achieve the daily ELV for each hour, with emissions only occasionally exceeding this level for short periods. If emissions close to the short-term ELVs do occur, these are most likely to only occur on one line at any one time. As such, short-term impacts for pollutants with short-term ELVs are likely to be overstated.

7.3 Overall effect on results

The conservative assumptions explained above mean that the overall impacts presented in this assessment will be overestimates.

1. At the point of maximum impact, annual mean impacts are overstated by around 2% due to plant availability, by around 8% when inter-annual variability is considered and by at least 10% when allowing for operation below the ELVs. This means that, overall, the annual mean impacts at the point of maximum impact in this assessment have inbuilt conservatism of at least 20%.
2. For short term impacts, selecting the worst-case weather conditions across all five years of weather data introduces conservatism of at least 4% at the point of maximum impact.
3. The validation documentation shows that the level of uncertainty in the model are on average within 10% of the hourly and daily concentrations, with accuracy over long time frames expected to be at least as high as this.

Therefore, it is considered that the results presented in this assessment are robust as the inbuilt conservatism is greater than uncertainty in the modelling.

8 Impact on Human Health

8.1 Screening criteria

NRW refers to the EA's air emissions risk assessment guidance for screening. 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 8.2.

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

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. If PCs 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 headroom¹², 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's document 'Guidance on assessing group 3 metals stack emissions from incinerators – V.4 June 2016' ('EA's metals guidance') has been used. The EA's metals guidance states that where the process contribution 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 process contribution 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.

8.2 Results

Detailed results tables are provided in the following appendices:

- Appendix D for the Permitted ERF;
- Appendix E for the Varied ERF permit; and

¹² Calculated as the AQAL minus twice the long-term background concentration.

- Appendix F for the change in impact associated with the proposed EP variation.

Results have been presented at the point of maximum ground level impact of emissions from the ERF and at receptor locations. Results are based on the following:

- Modelling domain size – 9.5 km x 9.5 km;
- Terrain and variable surface roughness included at a resolution of 128 x 128;
- Buildings – included;
- Stack height – 90 m;
- Five years of weather data 2020 to 2024 from Cardiff Airport meteorological recording station;
- Operation at the long term ELVs for the entire year;
- Operation at the short term ELVs assuming worst-case flue gas parameters for dispersion during the worst-case conditions for dispersion of emissions;
- Worst-case conversion of oxides of nitrogen to nitrogen dioxide;
- The entire dust emissions consist of either PM₁₀ or PM_{2.5};
- The entire VOC emissions are assumed to consist of benzene; and
- Cadmium and thallium are both released at the combined emission limit for cadmium and thallium.

Process contributions that cannot be screened out as ‘insignificant’ are highlighted. Where the process contribution cannot be screened out as ‘insignificant’, further analysis has been undertaken and results have been presented showing the impact at the identified receptor locations.

As shown in the detailed tables in Appendix F, for all pollutants and averaging periods, the change in impact due to the EP variation is screened out as ‘insignificant’. However, as shown in the detailed tables in Appendix E at the point of maximum impact of emissions the following impacts from the Varied ERF permit cannot be screened out as ‘insignificant’:

- Annual mean nitrogen dioxide impacts;
- Annual mean and daily mean VOCs (as benzene) impacts; and
- Annual mean cadmium impacts.

Further analysis of these impacts is presented below.

8.2.1 Further analysis – annual mean nitrogen dioxide

As shown in the detailed results tables, at the point of maximum impact the contribution from the Permitted ERF is 1.89% of the annual mean AQAL for nitrogen dioxide, and the contribution from the Varied ERF permit is 2.07% of the AQAL. The change in impact associated with the proposed EP variation is 0.18% of the AQAL. Whilst the change in impact can be screened out as ‘insignificant’ the contribution from the Varied ERF permit exceeds 1% of the AQAL.

Figure 8 of Appendix A shows the contour plot file of annual mean nitrogen dioxide impacts for the Permitted ERF and Varied ERF permit. As shown the area where impacts cannot be screened out as ‘insignificant’ is slightly greater for the Varied ERF permit. However, within this area there are no receptors where the annual mean AQAL applies – i.e. locations where members of the public may be regularly exposed, such as residential properties, schools, hospitals, and care homes. As such the nitrogen dioxide impact at all areas of relevant exposure to the annual mean AQAL can be screened out as ‘insignificant’. For completeness the contribution from the Permitted ERF and Varied ERF permit at each of the identified receptors is provided in the detailed results tables. As shown the maximum impact does not exceed 1% of the AQAL at any of the identified receptor locations.

The PEC is also presented in the detailed results tables. This assumes that the background concentration is the maximum across the modelling domain. As demonstrated in Table 7 background concentrations close to the Site are significantly lower. Using this conservative assumption relating to background concentrations the PEC associated with the Varied ERF permit is predicted to be 52.8% of the annual mean AQAL for nitrogen dioxide. Therefore, it can be concluded that for the Varied ERF permit there is little risk of the PEC exceeding the annual mean AQAL for nitrogen dioxide, and the impact can be considered 'not significant'.

The maximum PC for each of the receptors from the Permitted ERF and Varied ERF permit is presented in Appendix D and E respectively. As shown, the PC is not predicted to exceed 1% of the AQAL at any receptors, with a maximum of 0.5% at HR14. Therefore, it can be concluded that the impact of the Varied ERF permit can be screened out as 'insignificant' at all identified receptor locations.

A plot file of the impact from all sources is presented in Figure 8 of Appendix A. This shows the extent of annual mean impacts from the Varied ERF permit. This shows the impact of the Varied ERF permit with a greater than 1% process contribution will not affect areas classed as relevant exposure to the annual mean NO₂ objective.

8.2.2 Further analysis – annual mean benzene (as VOCs)

TOC represents a range of chemical species, typically referred to as 'volatile organic compounds' (VOCs). There is no single environmental assessment level set for VOCs. The EA guidance document "Air emissions risk assessment for your environmental permit"¹³ (the Air Emissions Guidance) states:

"If you release volatile organic compounds into the air you should provide details of all emissions. If you cannot identify what all the substances in them are, treat the unknowns as 100% benzene in your risk assessment. If you want to treat them as something else, you'll need to explain why."

Waste incinerator operators are not required to measure or report the speciation of emissions of VOCs; the only requirement is to monitor and report the concentration of TOC. Therefore, the impact of emissions of VOCs have been compared to the AQALs set for benzene.

As shown in the detailed results tables, at the point of maximum impact the contribution of emissions of TOCs from the Permitted ERF is 1.20% of the annual mean AQAL for benzene, and the contribution from the Varied ERF permit is 1.32% of the AQAL. The change in impact associated with the proposed EP variation is 0.12% of the AQAL. Whilst the change in impact can be screened out as 'insignificant' the contribution from the Varied ERF permit exceeds 1% of the AQAL.

Figure 9 of Appendix A shows the contour plot file of annual mean TOC impacts (as a % of the AQAL for benzene) for the Permitted ERF and Varied ERF permit. As shown the area where impacts cannot be screened out as 'insignificant' is slightly greater for the Varied ERF permit. However, within this area there are no receptors where the annual mean AQAL applies – i.e. locations where members of the public may be regularly exposed, such as residential properties, schools, hospitals, and care homes. As such the annual mean TOC impact at all areas of relevant exposure to the annual mean AQAL can be screened out as 'insignificant'. For completeness the contribution from the Permitted ERF and Varied ERF permit at each of the receptors is provided in the detailed results tables. As

¹³ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>

shown the maximum impact does not exceed 1% of the AQAL for benzene at any of the identified receptor locations.

The PEC is also presented in the detailed results tables. This assumes that the background concentration is the maximum across the modelling domain. As demonstrated in Table 7 background concentrations close to the Site are significantly lower. Using this conservative assumption relating to background concentrations the PEC associated with the Varied ERF permit is predicted to be 33.3% of the annual mean AQAL for benzene. Therefore, it can be concluded that for the Varied ERF permit there is little risk of the PEC exceeding the annual mean AQAL for benzene, and the impact can be considered 'not significant'.

8.2.3 Further analysis – annual mean cadmium

The EP includes a combined ELV for cadmium and thallium. There is only an AQAL for cadmium. The impact of emissions of cadmium and thallium combined has been compared to the AQAL for cadmium as a worst-case.

As shown in the detailed results tables, at the point of maximum impact the contribution of emissions from the Permitted ERF is 2.40% of the annual mean AQAL for cadmium, and the contribution from the Varied ERF permit is 2.63% of the AQAL. The change in impact associated with the proposed EP variation is 0.23% of the AQAL. Whilst the change in impact can be screened out as 'insignificant' the contribution from the Varied ERF permit exceeds 1% of the AQAL.

Figure 10 of Appendix A shows the contour plot file of annual mean cadmium and thallium impacts (as a % of the AQAL for cadmium) for the Permitted ERF and Varied ERF permit. As shown the area where impacts cannot be screened out as 'insignificant' is slightly greater for the Varied ERF permit. However, within this area there are no receptors where the annual mean AQAL applies – i.e. locations where members of the public may be regularly exposed, such as residential properties, schools, hospitals, and care homes. As such the annual mean cadmium and thallium impact at all areas of relevant exposure to the annual mean AQAL can be screened out as 'insignificant'. For completeness the contribution from the Permitted ERF and Varied ERF permit at each of the receptors is provided in the detailed results tables. As shown the maximum impact does not exceed 1% of the AQAL for cadmium at any of the identified receptor locations.

The PEC is also presented in the detailed results tables. In lieu of any local background monitoring of cadmium this assumes that the background concentration is the maximum monitored at an urban industrial site. Using this assumption the PEC associated with the Varied ERF permit is predicted to be 30.6% of the annual mean AQAL for cadmium.

This analysis assumes that cadmium is released at the combined ELV for cadmium and thallium. The Waste Incineration BREF shows that the average concentration recorded from UK plants equipped with bag filters (like the ERF) was $1.6 \mu\text{g}/\text{Nm}^3$ (or 3.2% of the ELV of $0.05 \text{ mg}/\text{Nm}^3$), the highest recorded concentration of cadmium and thallium was $14 \mu\text{g}/\text{Nm}^3$ (or 28% of the ELV of $0.05 \text{ mg}/\text{Nm}^3$) and only three lines recorded concentrations higher than $10 \mu\text{g}/\text{Nm}^3$ (or 20% of the ELV of $0.02 \text{ mg}/\text{Nm}^3$). Monitoring from the Permitted ERF has shown that in 2024 the maximum monitored concentration of cadmium and thallium was $0.0004 \text{ mg}/\text{Nm}^3$ which equates to 2% of the ELV for cadmium and thallium. As such it is likely that the impact of emissions of cadmium would be significantly lower than those calculated, and the impact of the Varied ERF permit would be screened out as 'insignificant'.

8.2.4 Further analysis – impact in AQMA

As detailed in section 4.1, there are two local AQMAs declared due to concern over annual mean nitrogen dioxide concentrations (Castle Street AQMA and Stephenson Square AQMA). The locations of the AQMAs are also shown on Figure 8 of Appendix A. As shown the contribution from the Varied ERF permit can be screened out as 'insignificant' within the AQMAs.

8.2.5 Heavy metals – at the point of maximum impact

The detailed results tables in appendices D and E detail the impact of emissions of metals from the Permitted ERF and Varied ERF permit.

If the PC is greater than 1% of the AQAL when it is assumed that each metal is emitted at the total metal ELV, further analysis has been undertaken. The EA's metals guidance details the maximum monitored concentrations of Group 3 metals emitted by Municipal Waste Incinerators and Waste Wood Co-Incinerators as a percentage of the ELV for Group 3 metals. The maximum monitored emission concentrations presented in the EA's analysis have been used as a conservative assumption.

As shown, if it is assumed that the entire emissions of metals consist of only one metal, the impact of the operation of the Varied ERF permit is generally less than 1% of the long term, with the exception of annual mean impacts of arsenic, chromium VI, manganese, and nickel. If it is assumed that the Varied ERF permit would perform no worse than the maximum monitored concentration from the EA's metals guidance, the impact of the Varied ERF permit would be below 1% of the long term AQAL for all pollutants with the exception of arsenic and nickel.

When considering the annual mean impact of emissions of arsenic the contribution from the Varied ERF permit would be 2.5% of the AQAL. The PEC would be 18.3% of the AQAL. This is well below the AQAL and therefore it can be concluded that there is no significant risk of exceeding the AQAL for arsenic.

When considering the annual mean impact of emissions of nickel the contribution from the Varied ERF permit would be 6.6% of the AQAL. The PEC would be 12.1% of the AQAL. This is well below the AQAL and therefore it can be concluded that there is no significant risk of exceeding the AQAL for nickel. This conservatively assumes that nickel is emitted at the maximum measured concentration from the EA's metals guidance. The EA explain that the two highest concentrations are outliers being 44% and 27% of the ELV of 0.5 mg/Nm³, the third highest concentration is 11% of the ELV of 0.5 mg/Nm³. When compared to the ELV of 0.3 mg/Nm³ which is the ELV for the ERF, the two highest concentrations are 73% and 45%, and the third highest concentration is 18% of the ELV. Therefore, it is likely that actual impact of nickel would be significantly lower.

When considering short term impacts the detailed results tables show that if it is assumed that the Varied ERF permit would perform no worse than maximum monitored concentration from the EA's metals guidance, the process contribution is below 10% of the short term AQAL for all pollutants for the Varied ERF permit.

This analysis has shown there is no risk of exceeding an AQAL for any metals either on a long-term or short-term basis as a result of emissions from the Varied ERF permit. This analysis conservatively assumes that the Varied ERF permit would continually operate. The preceding analysis has shown that when accounting for availability and likely emissions the impacts would be lower.

8.3 Change to ELV for TOCs:

As part of the EP variation application is proposed that the half-hourly ELV will be changed from 20 mg/Nm³ expressed as 100% of all half-hourly concentrations to 10 mg/Nm³ reported as the 97th percentile to align with current IED values and requirements of the Waste Incineration BREF. As set out in section 2.1 there are two AQALs set for benzene:

- an annual mean – 5 µg/m³; and
- a daily mean – 30 µg/m³.

There are no AQALs for benzene for averaging periods shorter than a day. As such the reduction in the ELV has not implications for the dispersion modelling. The ERF will be required to comply with the daily ELV regardless of the magnitude of any short-term spikes in TOC emissions. Therefore, the proposed variation to the EP would result in far fewer Schedule 5 Notifications being submitted to NRW, whilst providing the greater environmental protection owing to the reduced ELV.

9 Impact at Ecological Receptors

9.1 Screening

The EA's 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
- 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 EA's 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.

The EA's Air Emissions Guidance states further that to screen out impacts as 'insignificant' at local nature sites¹⁴:

- 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.

In accordance with the guidance, calculation of the PEC for local nature sites is not required. However, this has been calculated for completeness.

9.2 Daily mean Critical Level

As noted in Table 3 a higher daily mean Critical Level for oxides of nitrogen applies where sulphur dioxide and ozone are below their respective Critical Levels. There is no monitoring of sulphur dioxide within 15 km of ERF. However, background concentrations of sulphur dioxide are available on APIS. The APIS data shows that the maximum annual mean background concentration of sulphur dioxide at all ecological receptors within 15 km of ERF is 5.63 µg/m³, well below the most stringent Critical Level of 10 µg/m³.

According to the Defra report titled, "Air Pollution in the UK 2023 - Compliance Assessment Summary", an exceedance of the AO40 was recorded in Wales in 2023.

This analysis demonstrates that concentrations of ozone exceed the AOT40 Levels in the areas affected by emissions from ERF. As such, it is considered that the daily mean oxides of nitrogen Critical Level of 75 µg/m³ is applicable.

9.3 Methodology

9.3.1 Atmospheric emissions – Critical Levels

The impacts of emissions have been compared to the Critical Levels listed in Table 3. Further assessment has been undertaken where the process contribution 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

¹⁴ Ancient woodlands, local wildlife sites (SINCs in Wales) and national and local nature reserves.

sites, and where the process contribution of a particular pollutant is greater than 100% of the Critical Level for locally designated sites.

9.3.2 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 (CL_{maxS}), a minimum Critical Load for nitrogen (CL_{minN}) and a maximum Critical Load for nitrogen (CL_{maxN}). 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 each habitat feature identified in APIS and identified in the citation for the specific site. The map function tool has been used to identify the features and habitat specific Critical Loads. However, the APIS database does not include the local wildlife sites. As such an informed judgement based on likely habitats and the habitats considered in the previous assessment has been carried out to determine the most appropriate Critical Load for assessment purposes. The relevant Critical Loads are presented in Appendix C. The lowest Critical Load for each designated site has been used to ensure a robust assessment as an initial screening exercise.

9.3.3 Calculation methodology

9.3.3.1 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 average of the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site using the 5-years of weather data.
2. Calculate the dry deposition flux ($\mu\text{g}/\text{m}^2/\text{s}$) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 28.
3. Convert the dry deposition flux into units of $\text{kgN}/\text{ha}/\text{yr}$ using the conversion factors presented in Table 28.
4. Compare this result to the nitrogen deposition Critical Load.

Table 28: Deposition Factors

Pollutant	Deposition velocity (m/s)		Conversion factor ($\mu\text{g}/\text{m}^2/\text{s}$ to $\text{kg}/\text{ha}/\text{year}$)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

Source: AQTAG 6 (March 2014)

9.3.3.2 Acidification

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

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 9.3.3.1.
2. Apply the conversion factor for N outlined in Table 28 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 29: 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

Source: AQTAG (March 2014)

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.

The EA's air quality specialists (AQMAU) have confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. For the purpose of this assessment it has been assumed that wet deposition of HCl is double dry deposition.

The contribution from process emissions from ERF has been calculated using APIS formula:

Where $PEC\ N\ Deposition < CL_{min}N$:

$PC\ as\ \% \ of\ CL\ function = PC\ S\ deposition / CL_{max}S$

Where $PEC\ N\ Deposition > CL_{min}N$:

$PC\ as\ \% \ of\ CL\ function = (PC\ S + N\ deposition) / CL_{max}N$

9.4 Results

Detailed results tables are provided in the following appendices:

- Appendix D for the Permitted ERF;
- Appendix E for the Varied ERF permit; and
- Appendix F for the change in impact associated with the proposed EP variation.

Results are presented as the maximum predicted concentration at each ecological receptor based on the following:

- Surface roughness and terrain resolution 128 x 128;
- Buildings – included;
- Stack height – 90 m;
- Five years of weather data 2020 to 2024 from Cardiff Airport meteorological recording station;
- Operation at the daily-mean ELVs for the entire year, including ammonia at the daily mean ELV of 15 mg/Nm³;
- EA's worst case conversion of NO_x to nitrogen dioxide;
- The nitrogen deposition impacts include the contribution from nitrogen dioxide and ammonia emissions;
- The acid deposition impacts include the contribution from nitrogen dioxide, ammonia, sulphur dioxide and hydrogen chloride;
- Wet deposition of HCl has been included in the acid S calculation as double dry deposition; and
- It has been assumed the most sensitive habitat is present at the point of maximum impact of emissions in each site.

9.4.1 Impacts at Statutory Designated Sites

As shown in Appendix F, the change in impact is less than 1% of the long-term Critical Levels and Critical Loads and less than 10% of the short-term Critical Levels and can be screened out as 'insignificant'. However, as shown in the detailed results tables in Appendix E the impact of the Varied ERF permit cannot be screened out as 'insignificant' at the following sites:

- Severn Estuary SAC, SPA, Ramsar, and SSSI; and
- Cwm Cydfin, Leckwith SSSI.

9.4.1.1 Severn Estuary

The Severn Estuary is designated as a SAC, SPA, Ramsar and SSSI. The extents of these designations are slightly different. The impact at the Severn Estuary has been calculated for the point of maximum impact within the site by post processing the gridded 9.5 km x 9.5 km output from the dispersion model.

The change in impact associated with the proposed EP variation can be screened out as 'insignificant'. However, the following impacts associated with the Varied ERF permit cannot be screened out as 'insignificant':

- Annual mean impacts of oxides of nitrogen, sulphur dioxide and ammonia;
- Daily mean impacts of oxides of nitrogen; and
- Nitrogen deposition impacts.

APIS does not identify that lichens or bryophytes are integral for the habitat but does identify that a Critical Level of 1 µg/m³ or 3 µg/m³ would be appropriate. As such the most stringent Critical Level has been applied.

At the point of maximum impact within the Severn Estuary the annual mean oxides of nitrogen, sulphur and ammonia impacts associated with the operation of the ERF with the proposed increase in capacity are 3.9%, 2.6% and 9.8% of the respective Critical Levels. This conservatively assumes

that the point of maximum impact there are habitats present which would be sensitive to emissions and the lower Critical Level applies. The contour plot files are presented in Figure 11 to Figure 15 of Appendix A. In addition, the area of saltmarsh habitats has been identified.

As shown, when considering the impact in relation to the Critical Levels for annual mean oxides of nitrogen ($30 \mu\text{g}/\text{m}^3$) and sulphur dioxide ($10 \mu\text{g}/\text{m}^3$) the process contribution from the Permitted ERF and Varied ERF permit is less than 1% and can be screened out as 'insignificant'.

APIS identifies the annual mean Critical Level for ammonia at the Severn Estuary to be $1\text{--}3 \mu\text{g}/\text{m}^3$. When considering the impact in relation to the lower Critical Level the process contribution from the Permitted ERF and Varied ERF permit exceeds 1% at the saltmarsh habitats. However, when considering the impact in relation to the Critical Level of $3 \mu\text{g}/\text{m}^3$ the process contribution from the Permitted ERF and Varied ERF permit can be screened out as 'insignificant'.

The dispersion modelling conservatively assumes emissions of ammonia would be at the ELV set in the EP – i.e. at $15 \text{ mg}/\text{Nm}^3$. Prior to the transposition of the WI BREF the EP did not contain an ELV for ammonia. Analysis of the monitoring data presented in the annual compliance reports has shown that daily mean ammonia emissions have been significantly below the daily mean ELV with the highest daily mean concentration approximately $7 \text{ mg}/\text{Nm}^3$, and on a longer term basis the monthly daily mean has been significantly lower (less than $3 \text{ mg}/\text{Nm}^3$). Therefore, it is anticipated that the likely impact of the Varied ERF permit would be lower than that consented by NRW for the Permitted ERF and is likely that actual impacts of the Varied ERF permit would be 'insignificant'.

At the point of maximum impact within the Severn Estuary the daily mean oxides of nitrogen impact associated with the operation of the ERF with the proposed increase in capacity is 11.18% of the Critical Level. This conservatively assumes that the point of maximum impact there are habitats present which would be sensitive to emissions. The contour plot file is presented in Figure 16 of Appendix A. In addition, the area of saltmarsh habitats has been identified. As shown, the area where the impact from the Varied ERF permit is greater than 10% of the daily mean oxides of nitrogen Critical Level is not close to the area of saltmarsh habitats. Therefore, the daily mean impact of emissions of oxides of nitrogen from the Varied ERF permit can be screened out as 'insignificant' with reference to the daily mean Critical Level at areas of sensitive habitats.

At the point of maximum impact within the Severn Estuary the nitrogen deposition impacts associated with the operation of the ERF with the proposed increase in capacity is 5.78% of the most sensitive Critical Load identified in APIS across the designated site – i.e. Atlantic upper-mid and mid-low saltmarshes – $10 \text{ kgN}/\text{ha}/\text{yr}$. The contour plot file presented in Figure 10 of Appendix A shows that the predicted impact at the saltmarsh habitats is less than 1% for the Permitted ERF, but this just exceed 1% for the Varied ERF permit over a very small portion of the saltmarsh habitat. APIS provides a Critical Load range of $10\text{--}20 \text{ kgN}/\text{ha}/\text{yr}$ and states:

"It is recommended that this is the relevant critical load for most of saltmarsh but the lower level of $10 \text{ kgN}/\text{ha}/\text{yr}$ should be applied to the more densely vegetated upper marsh (e.g. EUNIS class MA223, MA224) and to areas of marsh subjected to direct run-off from adjacent catchments (NRW recommendation). For pioneer saltmarsh (MA225) use the higher $20\text{--}30 \text{ kg N}/\text{ha}/\text{yr}$ critical load."

From a review of aerial mapping it can be seen that this area identified as saltmarsh is regularly inundated by tidal water, and as such it is considered that this is pioneer saltmarsh. Therefore, the nitrogen deposition Critical Load for this section of the habitat is $20 \text{ kgN}/\text{ha}/\text{yr}$. As such the impact of nitrogen deposition from the Permitted ERF and Varied ERF permit can be screened out as 'insignificant' taking into account the spatial distribution of habitats.

The above nitrogen deposition analysis is based on ammonia modelling that conservatively assumes the ELV set in the EP – i.e. at $15 \text{ mg}/\text{Nm}^3$. Prior to the transposition of the WI BREF the EP did not

contain an ELV for ammonia. Analysis of the monitoring data presented in the annual compliance reports has shown that daily mean ammonia emissions have been significantly below the daily mean ELV with the highest daily mean concentration approximately 7 mg/Nm³, and on a longer term basis the monthly daily mean has been significantly lower (less than 3 mg/Nm³). Therefore, the impact of nitrogen deposition would be significantly lower than that predicted.

9.4.1.2 Cwm Cydfin, Leckwith

Cwm Cydfin, Leckwith is designated as a SSSI. This is located 3.9 km to the west of the ERF. This site was not assessed in the 2014 Air Quality Assessment as a different screening distance of 2 km for SSSIs was used.

The change in impact associated with the proposed EP variation can be screened out as 'insignificant'. However, the following impacts associated with the Varied ERF permit cannot be screened out as 'insignificant':

- Annual mean impacts of ammonia;
- Nitrogen deposition impacts; and
- Acid deposition impacts.

APIS identifies that lichens and bryophytes are integral for the habitat. As such the most stringent Critical Level (1 µg/m³) has been applied.

The annual mean ammonia impact associated with the operation of the ERF with the proposed increase in capacity is 1.34% of the Critical Level. The annual mean ammonia impact associated with the Permitted ERF is 1.17% of the Critical Level. The proposed EP variation would result in an increase of 0.17% of the Critical Level. Neither the impact of the Varied ERF permit or Permitted ERF can be screened out as 'insignificant'. However, the change associated with the EP variation can be screened out as 'insignificant'.

APIS identifies that the Critical Load for nitrogen deposition is 10-15 kgN/ha/yr. The lower end of the range has been used in the first instance.

The nitrogen deposition impact associated with the operation of the ERF with the proposed increase in capacity is 1.21% of the lower Critical Load for broadleaved and deciduous woodland (10 kgN/ha/yr). The nitrogen deposition impact associated with the Permitted ERF is 1.07% of the lower Critical Load. The proposed EP variation would result in an increase of 0.14% of the Critical Load. Neither the impact of the Varied ERF permit or Permitted ERF can be screened out as 'insignificant'. However, the change associated with the EP variation can be screened out as 'insignificant'. The nutrient deposition impact as a percentage of the lower Critical Load across the site can be seen in Figure 18 of Appendix A. When considering the impact against the upper end of the Critical Load the impact of the Permitted ERF and Varied ERF permit can be screened out as 'insignificant'.

APIS identifies that the minCLmax N for acid deposition is 1.744 keq/ha/yr and the maxCLmax N is 11.161 keq/ha/yr. The lower end of the range has been used in the first instance.

The acid deposition impacts associated with the operation of the ERF with the proposed increase in capacity is 1.30% of the lower Critical Load for broadleaved and coniferous woodland (1.744 keq/ha/yr). The acid deposition impact associated with the Permitted ERF is 1.15% of the lower Critical Load. The proposed EP variation would result in an increase of 0.15% of the lower Critical Load. Neither the impact of the Varied ERF permit or Permitted ERF can be screened out as 'insignificant'. However, the change associated with the EP variation can be screened out as

‘insignificant’. Acid deposition variations across the Leckwith SSSI are presented in Figure 19 of Appendix A. When considering the impact in relation to the upper Critical Load the impact of the Permitted ERF and Varied ERF permit can be screened out as ‘insignificant’.

This analysis conservatively assumes that the emissions of ammonia are at the ELV set in the EP – i.e. at 15 mg/Nm³. As explained in section 9.4.1.1, it is likely that emissions of ammonia would be significantly lower than used in the assessment and impacts of ammonia, nitrogen and acid deposition would be significantly lower than presented in this assessment.

Further analysis has been carried out to determine the ammonia emissions required to have an impact no worse than the Permitted ERF operating at the existing ELV at Cwm Cydfin, Leckwith. This has shown that with ammonia emissions of 14 mg/Nm³, the ammonia and nitrogen deposition impact of the Varied ERF permit at this site would be no worse than the Permitted ERF. A further reduction in ammonia emissions to 9.5 mg/Nm³ would be required for the acid deposition impact of the Varied ERF permit to be no worse than the Permitted ERF. The review of monitoring data has shown that actual emissions are significantly lower than this. Therefore, it is anticipated that the likely impact of the Varied ERF permit would be lower than that consented by NRW for the Permitted ERF and is likely that actual impacts of the Varied ERF permit would be ‘insignificant’ at Cwm Cydfin, Leckwith.

9.4.2 Impacts at Non-Statutory Designated Sites

As shown in Appendix F, the change in impact associated with the proposed EP variation is less than 1% of the long-term Critical Levels and Loads and less than 10% of the short-term Critical Levels. Further to this, the total contribution from the Permitted ERF and Varied ERF permit has been compared to the Critical Level and habitat specific Critical Loads as detailed in Appendix D and E. The process contribution from the Permitted and Varied ERF permit can be screened out as ‘insignificant’ as it is less than 100% of the relevant Critical Levels and Critical Loads.

10 Conclusions

This Dispersion Modelling Assessment has been undertaken to support an application for a variation to the EP for ERF. As this is a variation to an existing permitted and operational process, comparison has been made with the impact of the Permitted ERF and the total impact of the ERF with the proposed increase in capacity. To ensure that a direct comparison is being made between the Proposed and Permitted ERF dispersion modelling has been carried out for both operational scenarios. This has been undertaken based on the assumption that for both scenarios the ERF will operate continually at the emission limits prescribed in the existing EP, except for the proposed reduction in half hourly ELV for TOC from 20 to 10 mg/Nm³.

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.

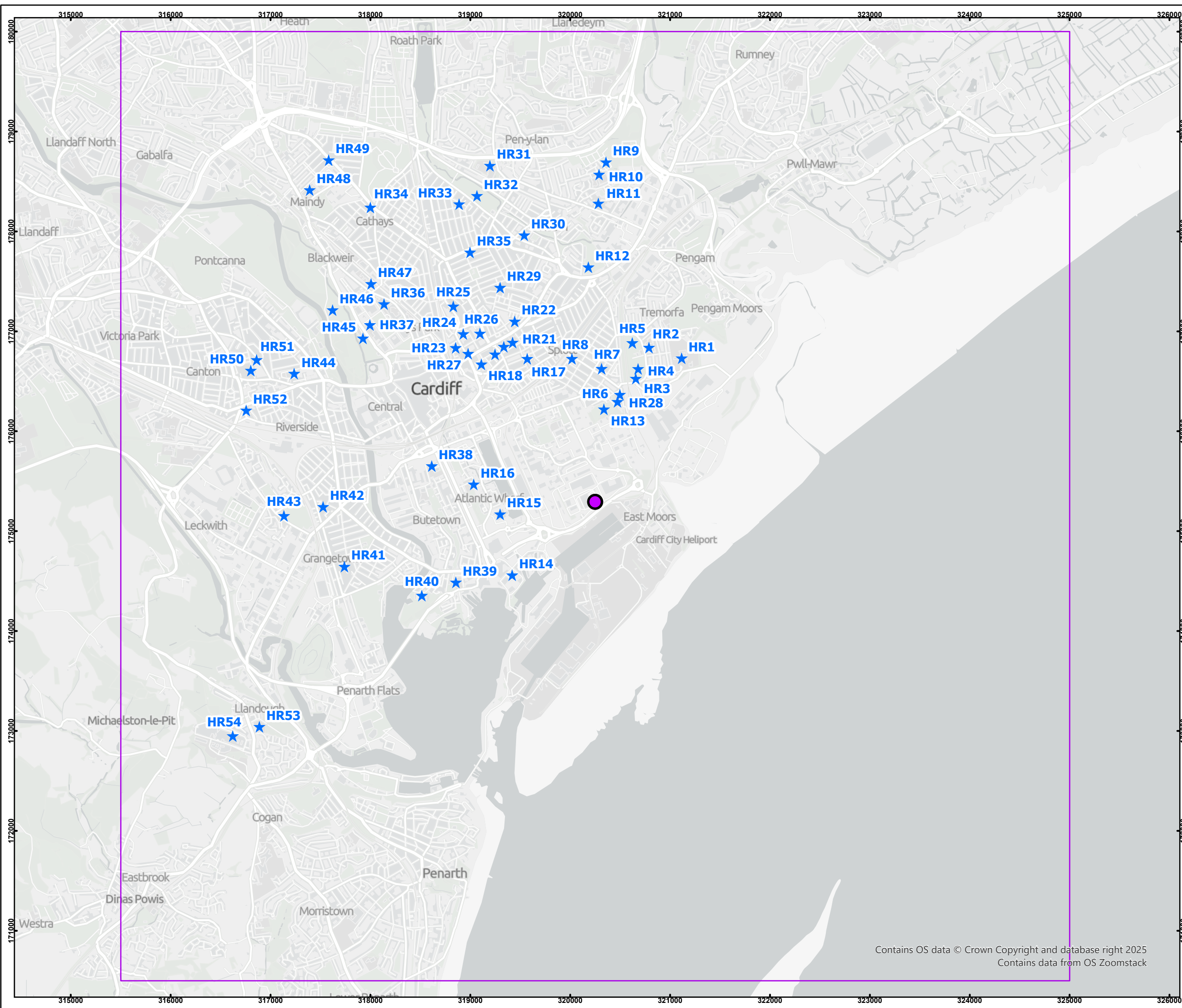
1. In relation to the change in the increase in waste throughput and the impacts on human health:
 - a. The operation of ERF operating with the proposed increase in waste throughput will not cause a breach of any AQAL.
 - b. The change in impact from the Permitted ERF at the point of maximum impact can be screened out as 'insignificant' as it is less than 1% of the long term AQALs and 10% of the short term AQALs.
 - c. The total impact of the Varied ERF permit can be screened out as 'insignificant' AQALs in areas relevant to human health exposure.
 - d. In relation to the change in the half-hourly TOC ELV, the proposed change would result in far fewer Schedule 5 Notifications being submitted to NRW, whilst providing the greater environmental protection owing to the reduced ELV.
2. In relation to the change in the increase in waste throughput and impacts at ecologically sensitive sites:
 - a. At all non-statutory designated sites the contribution from the Permitted and Varied ERF permit can be screened out as 'insignificant' as the contribution is less than 100% of the relevant Critical Level and Critical Loads.
 - b. At all identified statutory European and UK designated ecological receptors, the change in impact from the Permitted ERF can be screened out as 'insignificant' as it is less than 1% of the long term AQALs and 10% of the short term AQALs. However, the total impact of ammonia, nutrient nitrogen and acid deposition from the Varied ERF permit cannot be screened out as 'insignificant' at two designated sites:
 - i. The Severn Estuary is designated as a SAC, SPA, RAMSAR and SSSI. The change in impact can be screened out as 'insignificant' at all areas of relevant habitats within the ecological site when taking into account the spatial distribution of habitats. However, the impact of the Permitted and Varied ERF permit cannot be screened out as 'insignificant' for ammonia. The dispersion modelling conservatively assumes ammonia emissions are at the ELV in the existing EP of 15 mg/Nm³. However, a review of the operational emissions data has shown that daily mean ammonia emissions have been significantly lower than this (approximately 46% of the daily mean ELV), and the monthly daily mean has been even lower (approximately 20% of the daily mean ELV). As such it is anticipated that the likely impact of the Varied ERF permit would be lower than that consented by NRW for the Permitted ERF and is likely that actual impacts of the Varied ERF permit would be 'insignificant'.

- ii. At Cwm Cydfin, Leckwith SSSI the change in impact can be screened out as 'insignificant'. However, the impact of the Permitted and Varied ERF permit cannot be screened out as 'insignificant' as the impact of ammonia, nutrient nitrogen and acid deposition impacts exceed 1% of the relevant Critical Level and Critical Loads. This conservatively assumes that emissions of ammonia are at the ELV stated in the existing EP (15 mg/Nm³). A review of the operational emissions data has shown that ammonia emissions have been significantly lower than this. As such it is anticipated that the likely impact of the Varied ERF permit would be lower than that consented by NRW for the Permitted ERF and is likely that actual impacts of the Varied ERF permit would be 'insignificant'.

In summary, the assessment has shown that the change in air quality impact associated with proposed EP variation would be 'insignificant'. In addition, the total impact of ERF operating as proposed would have an acceptable impact on local air quality, ecological receptors, the general population or the local community. As such there should be no air quality constraint in granting the proposed variation to the existing EP.

Appendices

A Figures



Legend

- Model Grid Extents
- Human Sensitive Receptors
- ERF Stacks

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 1. Human Health Receptors

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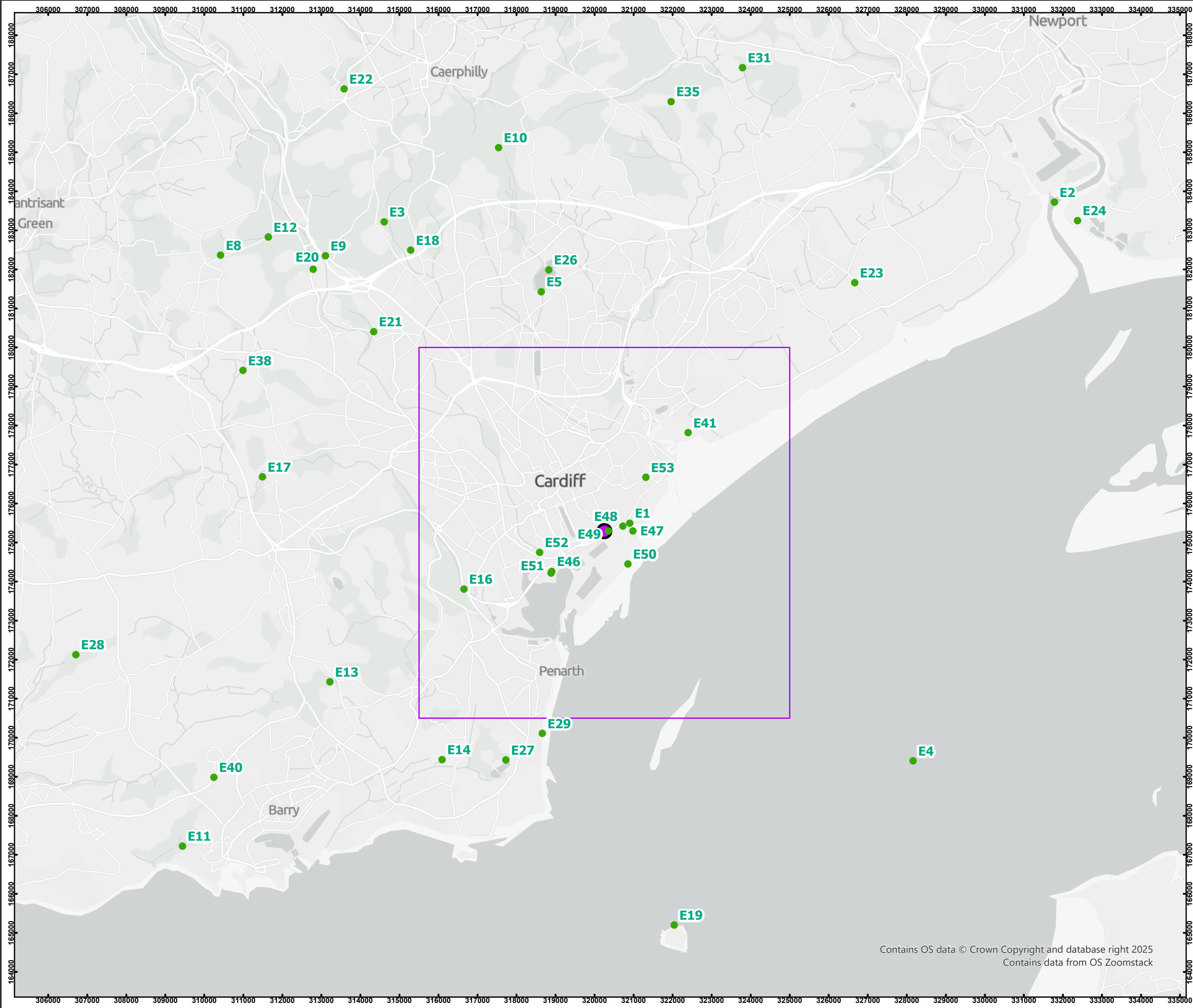
km

Scale: 1:35,000

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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	
Figure 2. Ecological Receptors	
Drawn by: RCB	Date: 23/10/2025
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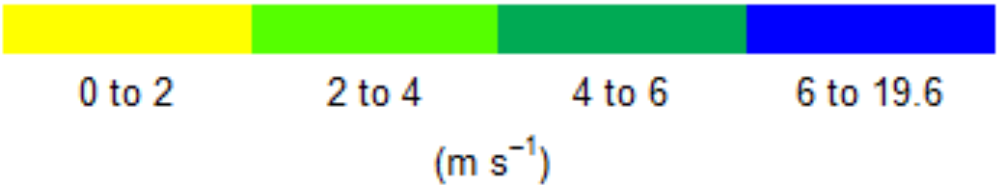
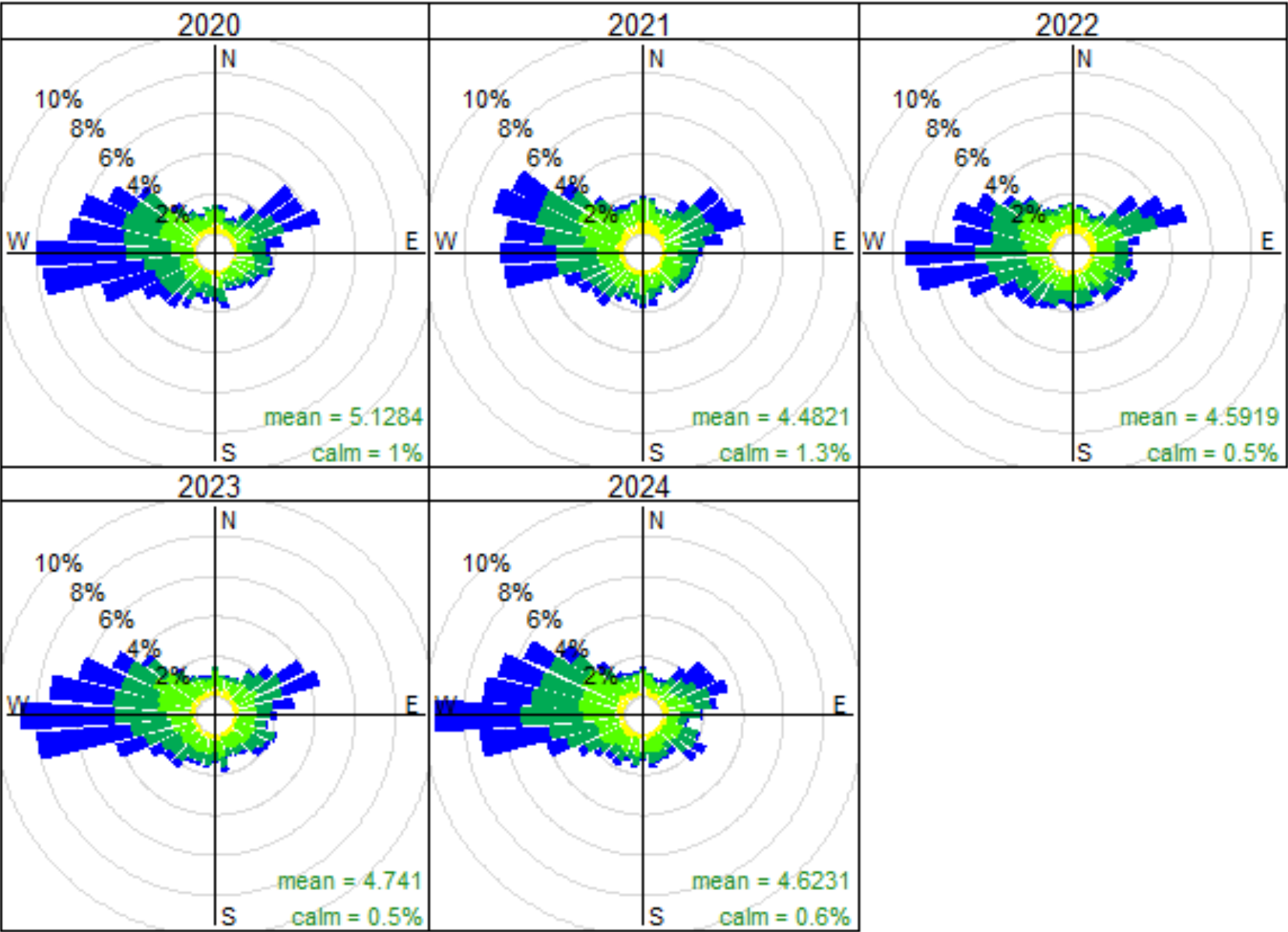
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Frequency of counts by wind direction (%)

Notes:
Wind rose data from Cardiff Airport.

Client: Viridor Trident Park Ltd
Site: Cardiff Energy Recovery Facility
Project: 3605
Title:

Figure 4. Wind Rose

Drawn by: RCB Date: 23/10/2025

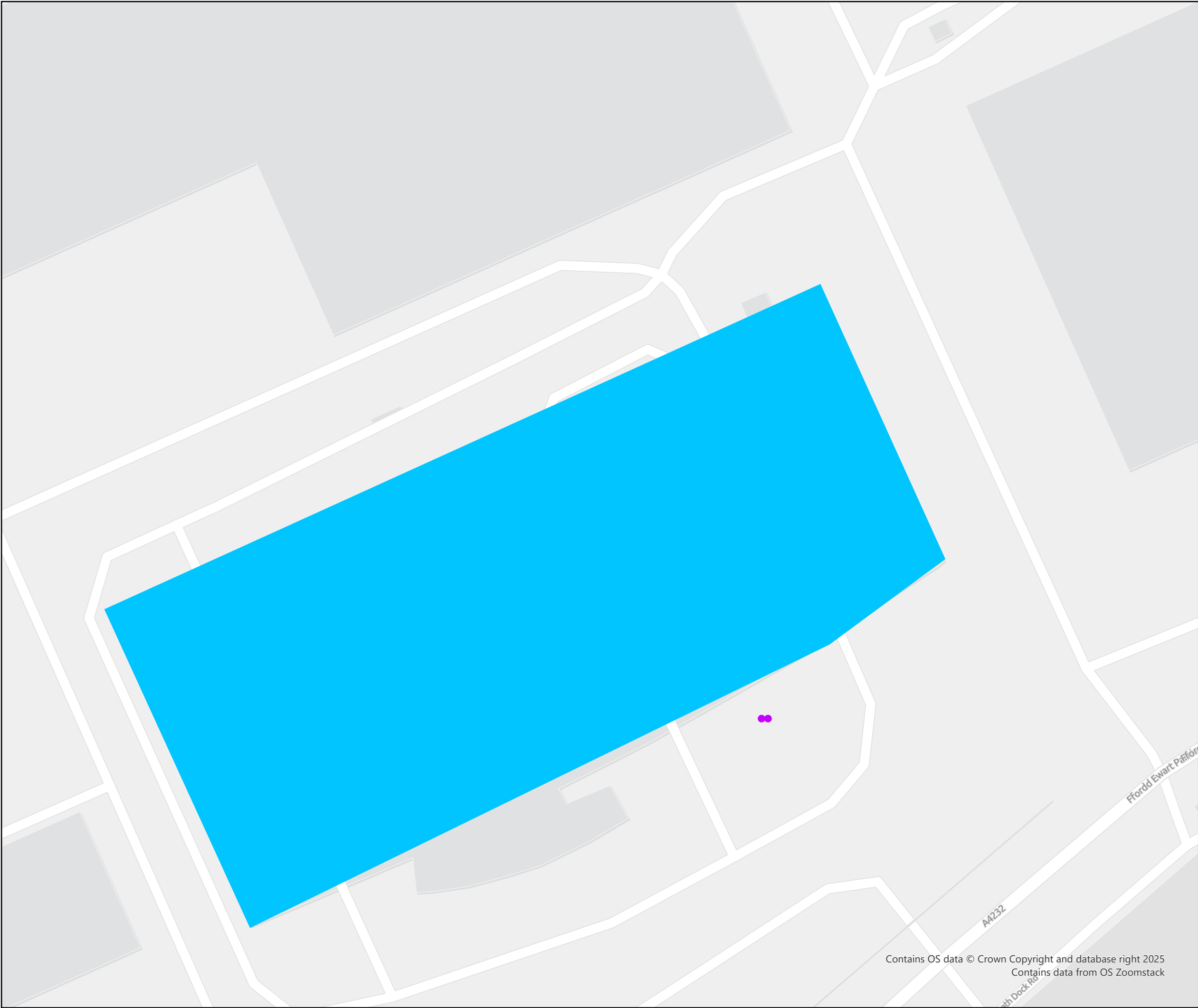
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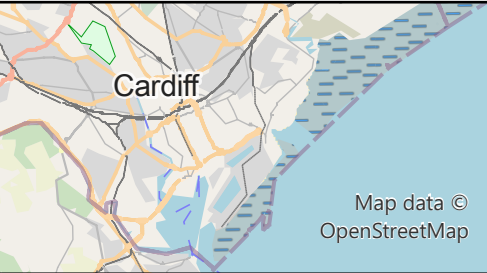
Legend

- ERF Stacks
- Building

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

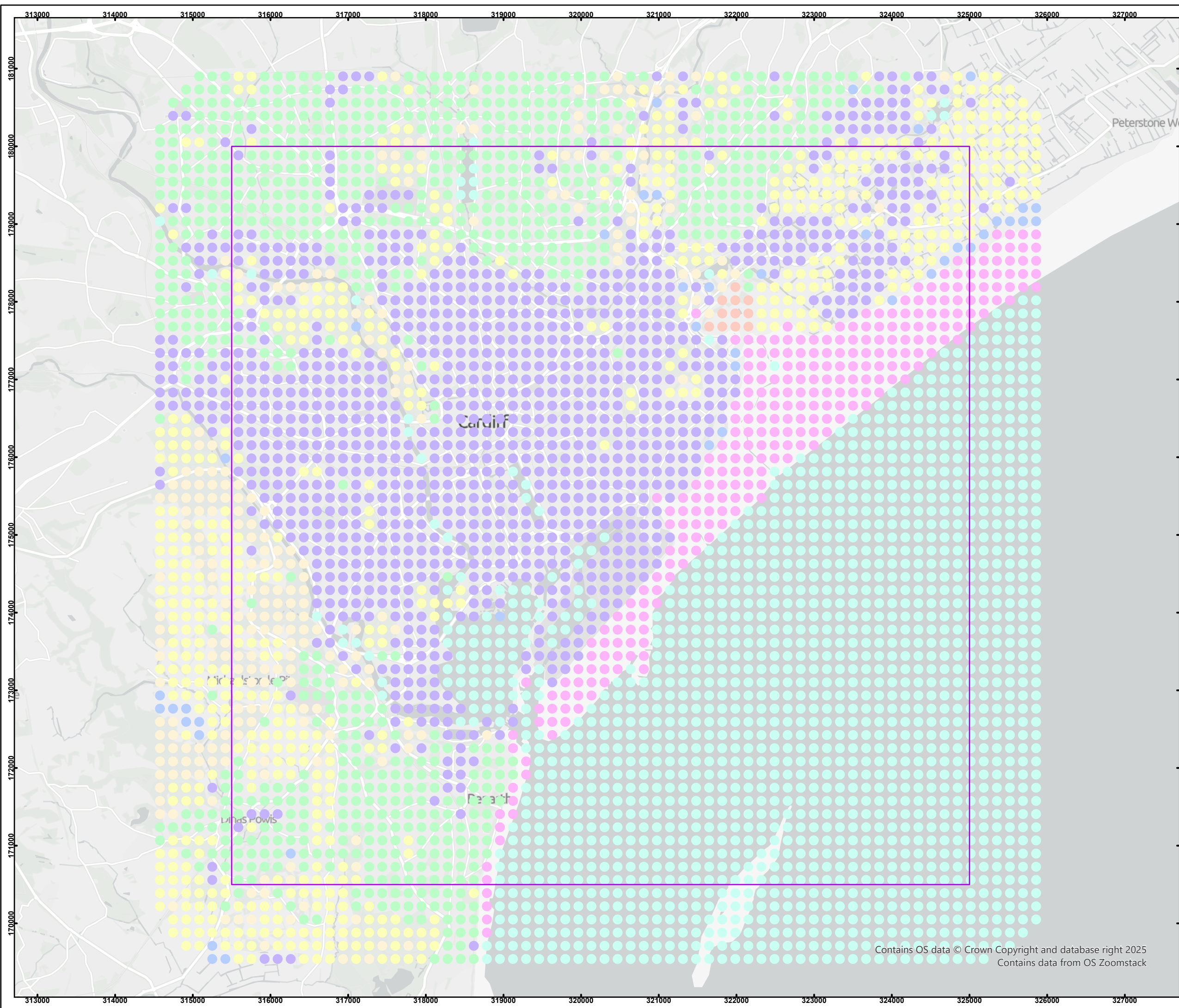
Figure 5. Buildings

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Legend

Model Grid Extents

Surface roughness (m)

0.0001

0.0005

0.005

0.03

0.05

0.5

0.75

1.2

Figure 6. Surface Roughness

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ntrisant

Cardiff

Penarth

Barry

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00.450.91.8

km

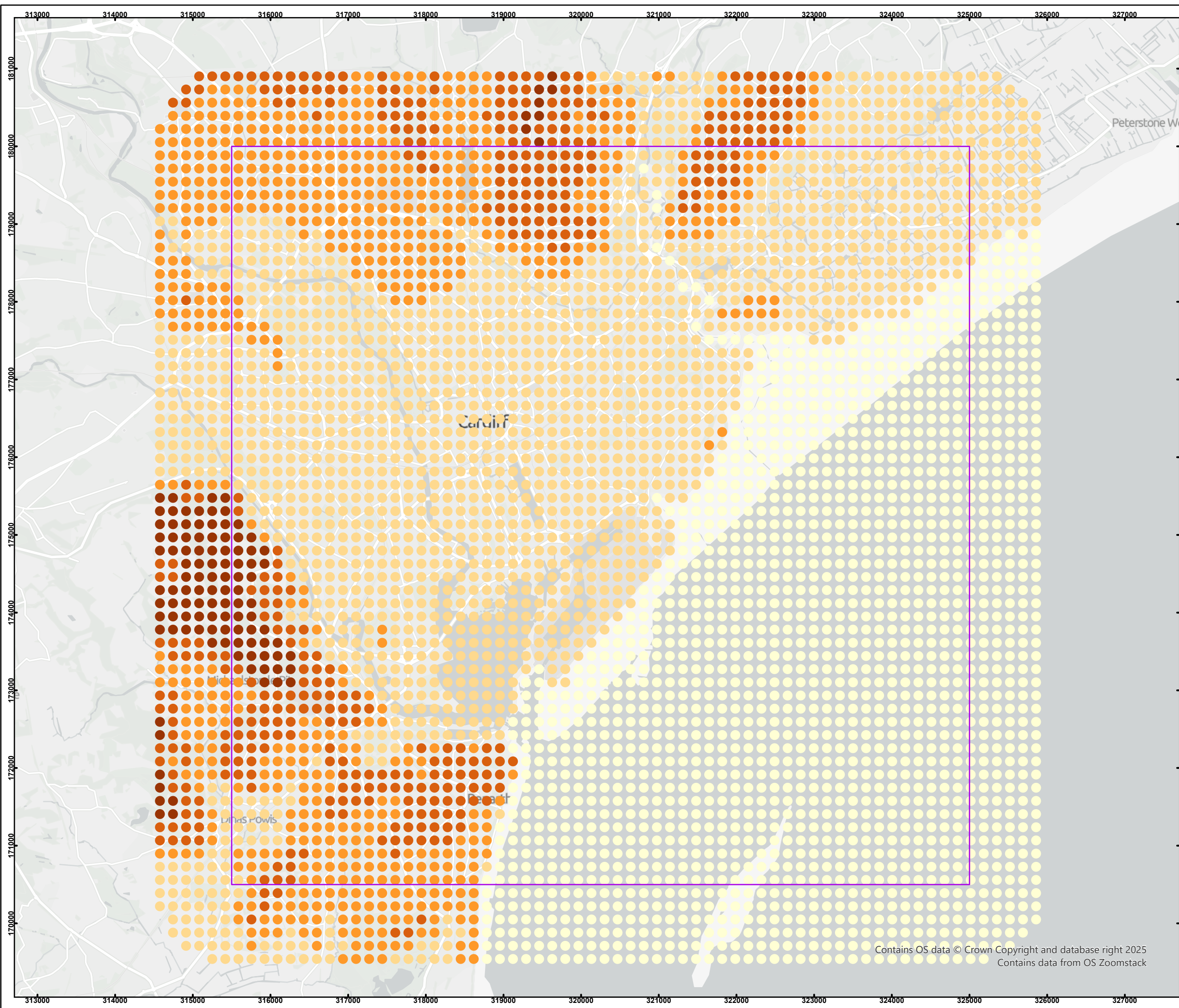
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Legend

Model Grid Extents

Terrain (m)

-3.9 - 3.0

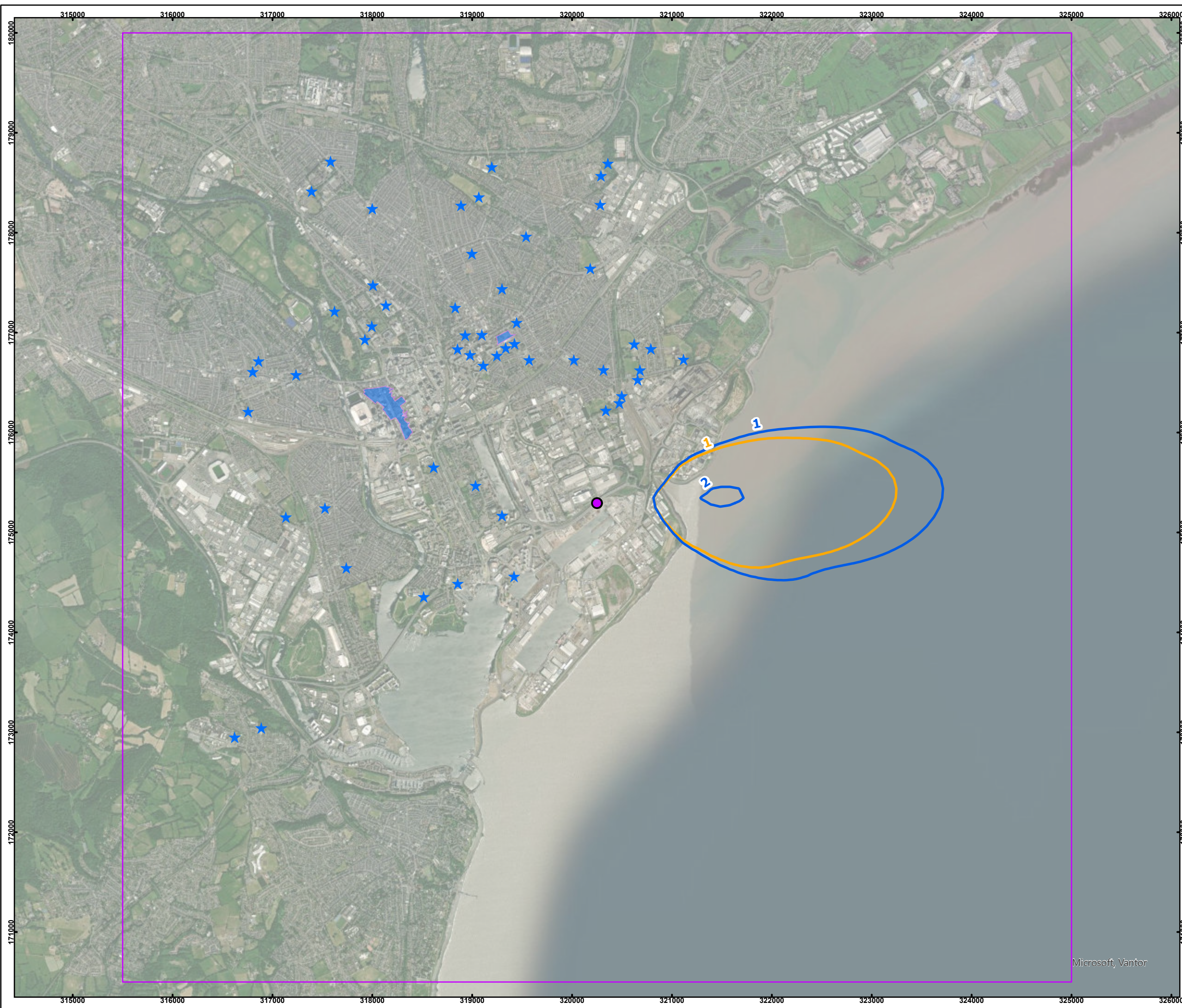
3.1 - 19.1

19.2 - 37.5

37.6 - 62.6

62.7 - 112.5

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	
Figure 7. Terrain	
Drawn by: RCB	Date: 23/10/2025
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00.450.91.8 km Scale: 1:45,000	
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Legend

- Model Grid Extents
- AQMAs
- ERF Stacks
- Human Receptors
- Varied ERF permit
- Permitted ERF

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of AQAL.
Assumes 70% NO_x to NO₂ conversion rate.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 8. Annual Mean Nitrogen Dioxide

Drawn by: RCB	Date: 14/11/2025
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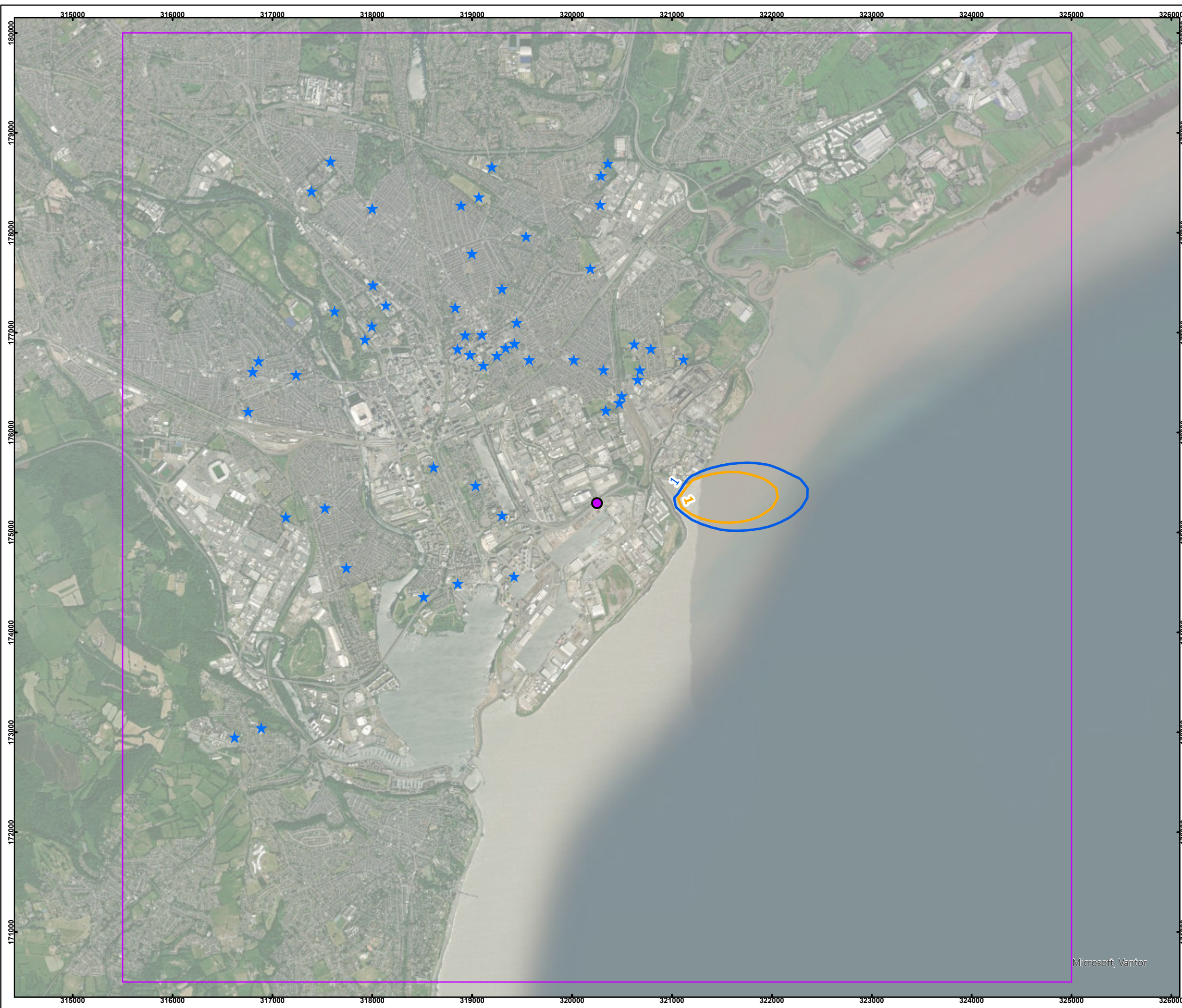
Map data © OpenStreetMap

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km

Scale: 1:35,000

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Legend

- Model Grid Extents
- ERF Stacks
- Human receptors
- Varied ERF permit
- Permitted ERF

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of AQAL for benzene.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 9. Annual Mean Benzene

Drawn by: RCB	Date: 14/11/2025
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Map data © OpenStreetMap

00.350.71.4

km

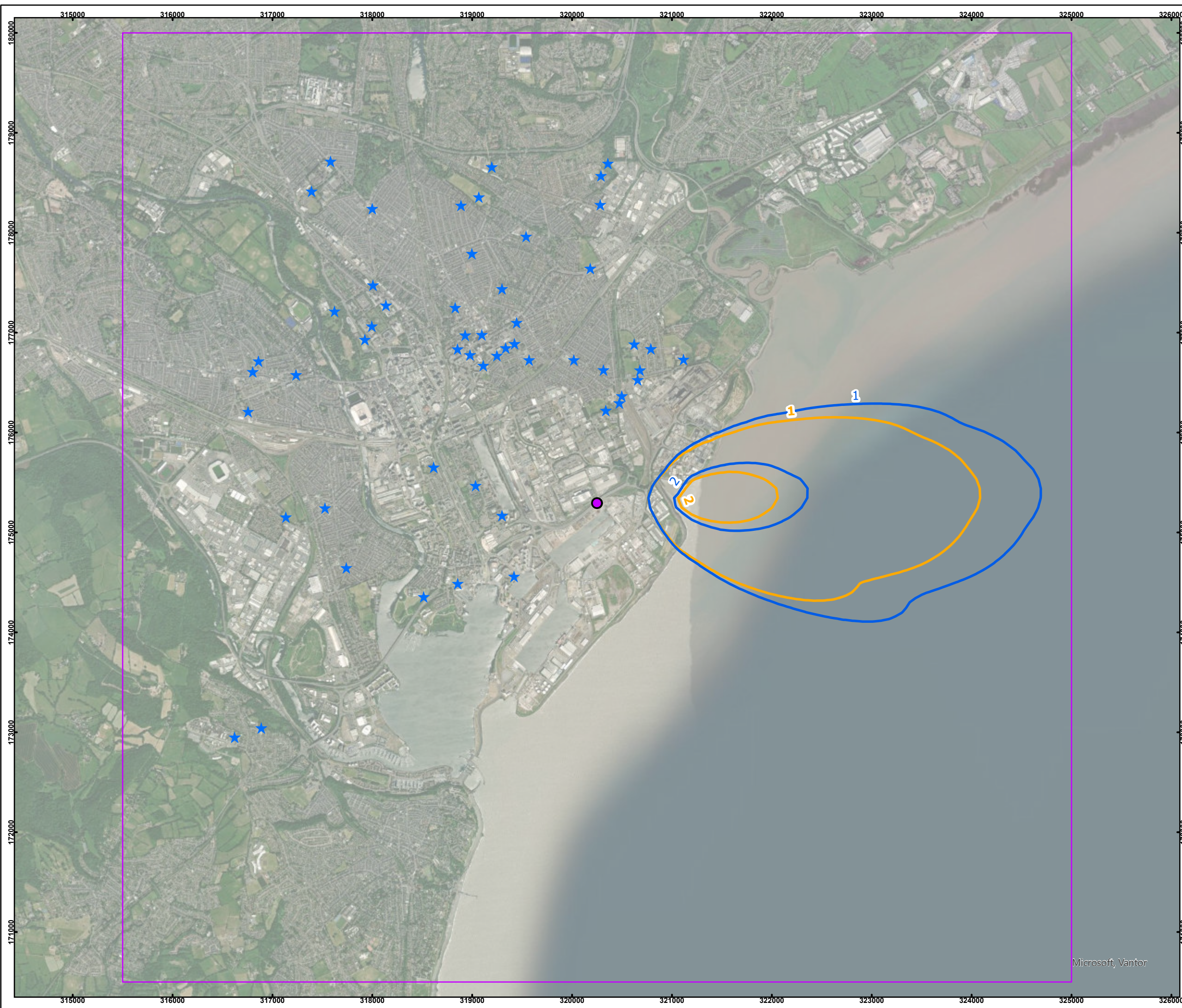
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Scale: 1:35,000

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Microsoft, Vantor



Legend

- Model Grid Extents
- ERF Stacks
- Human Receptors
- Varied ERF permit
- Permitted ERF

Notes:

All impacts presented as a % of AQAL.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 10. Annual Mean Cadmium

Drawn by: RCB	Date: 14/11/2025
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0 0.35 0.7 1.4 km

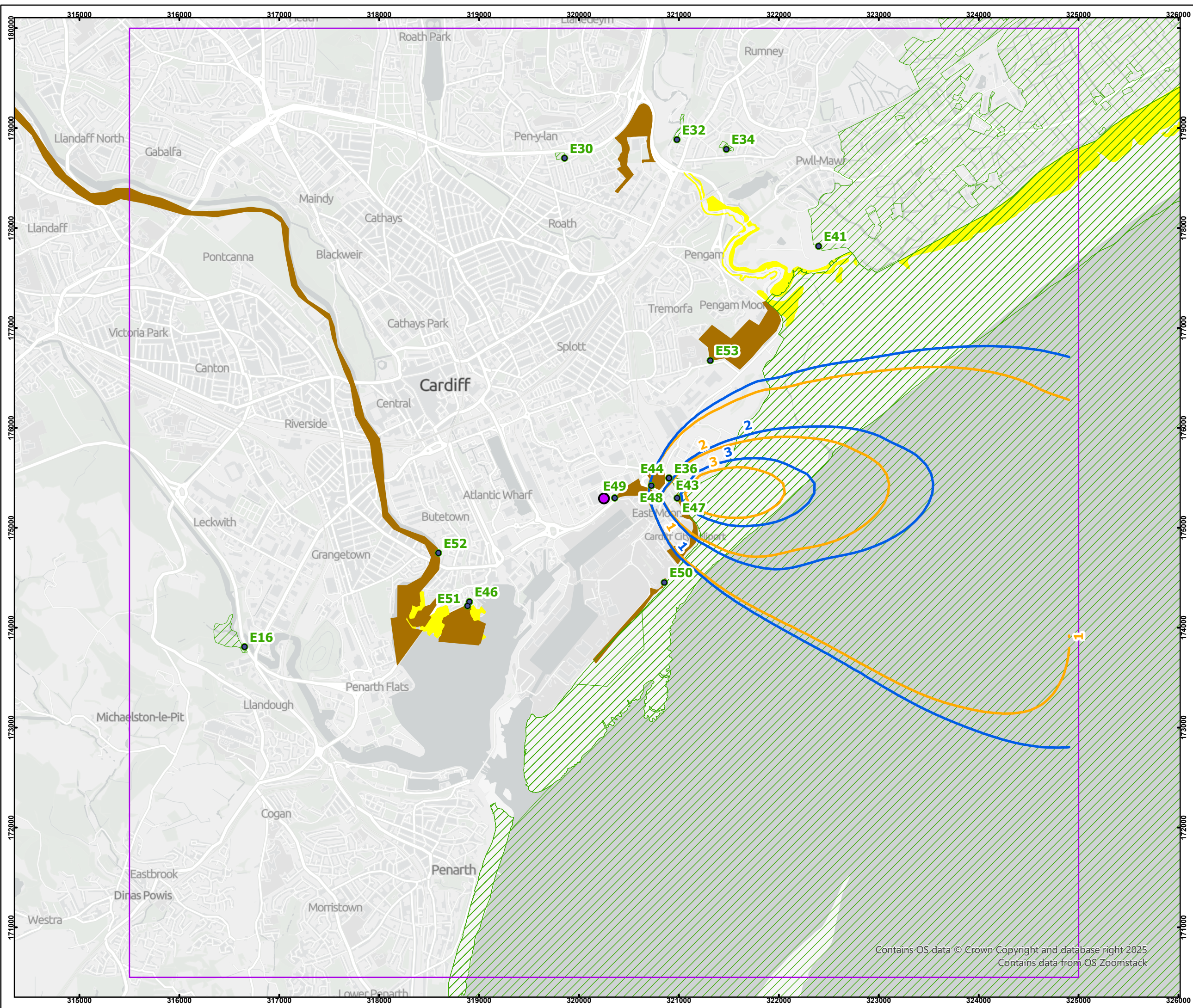
Scale: 1:35,000

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Legend

- Ecological receptors
- TridentPark_EcologicalRece
- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of the Critical Level.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 11. Annual Mean Oxides of Nitrogen

Drawn by: RCB	Date: 14/11/2025
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km

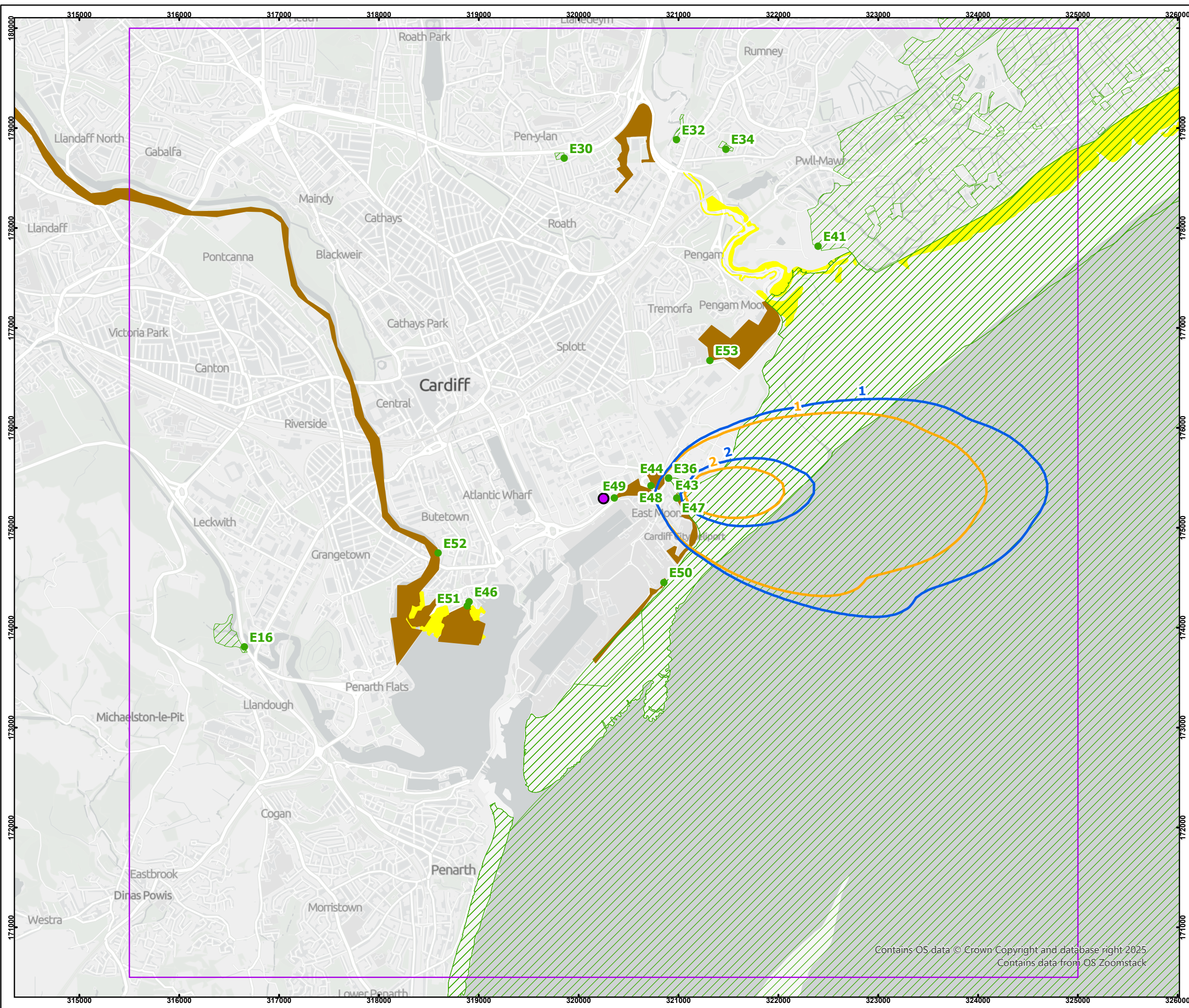
Scale: 1:35,000

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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF Permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of the 10 µg/m³ Critical Level.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 12. Annual Mean Sulphur Dioxide - lower Critical Level

Drawn by: RCB	Date: 14/11/2025
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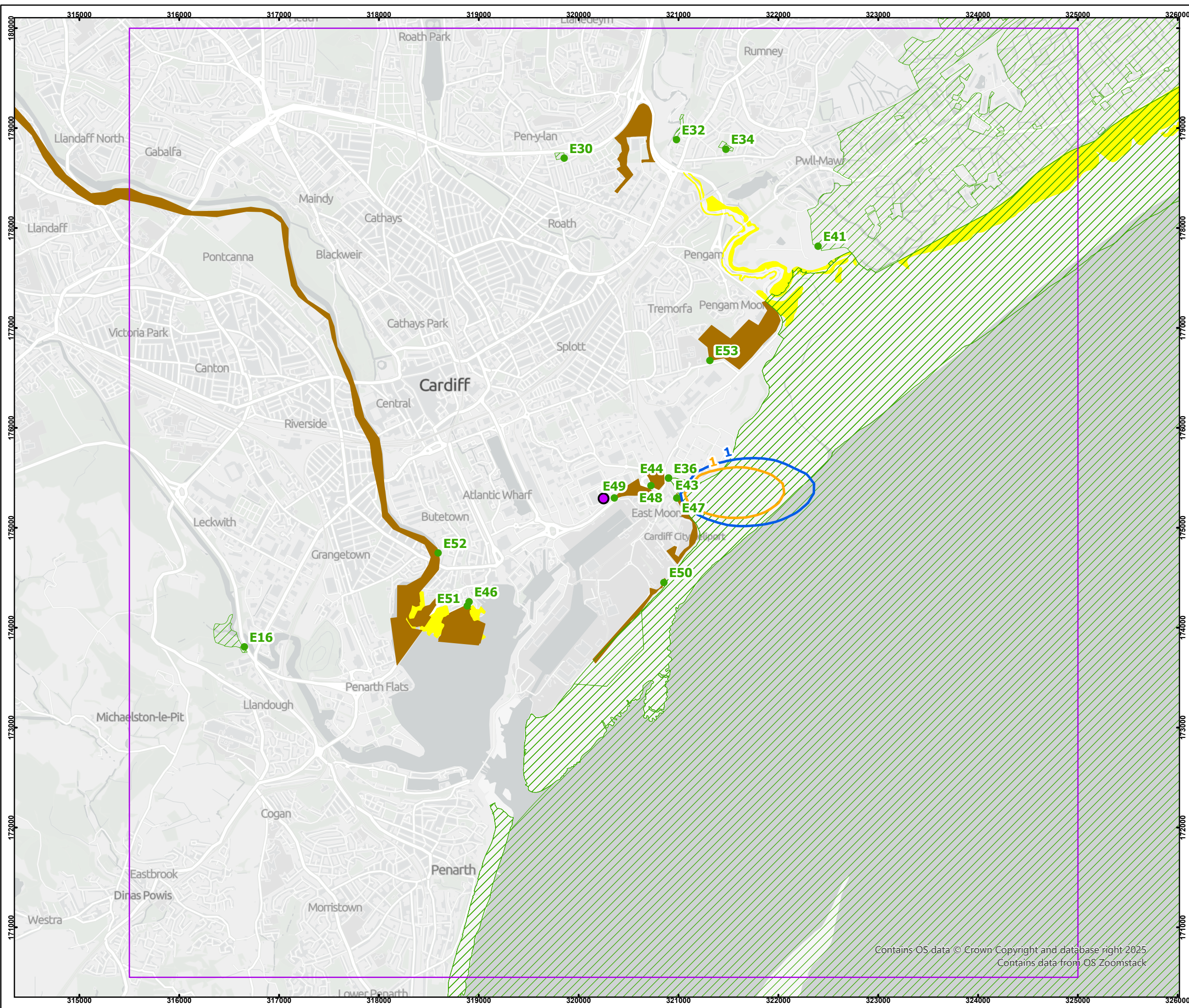
km

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Legend

Model Grid Extents

Ecological Receptors

ERF Stacks

Varied ERF Permit

Permitted ERF

Statutory Designated Sites

Non-Statutory Designated Sites

Coastal Saltmarsh Priority Habitat

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of the 20 µg/m³ Critical Level.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 13. Annual Mean Sulphur Dioxide - normal Critical Level

Drawn by: RCB	Date: 14/11/2025
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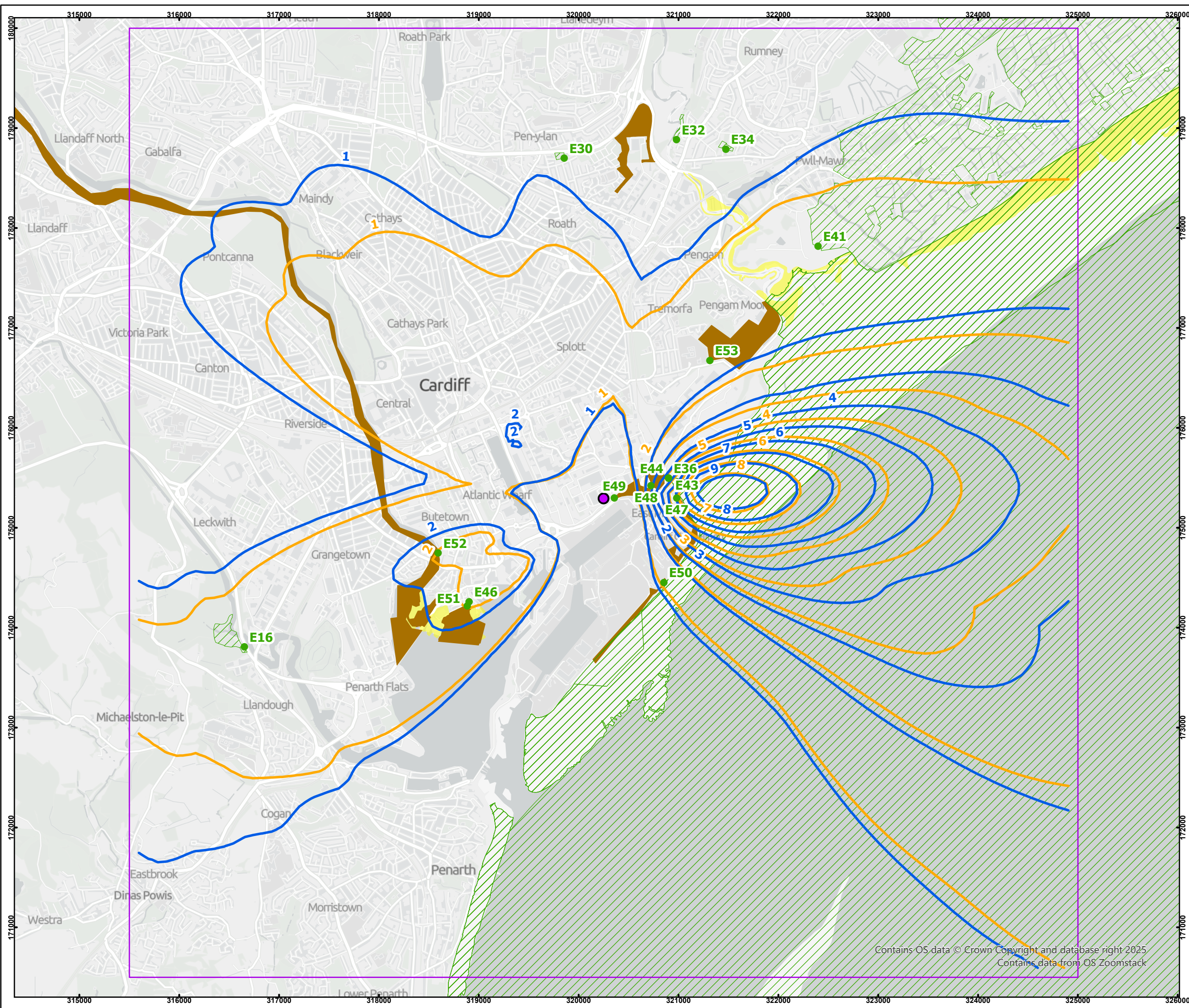
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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF Permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of the 1 µg/m3 Critical Level.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 14. Annual Mean Ammonia - lower Critical Level

Drawn by: RCB Date: 14/11/2025

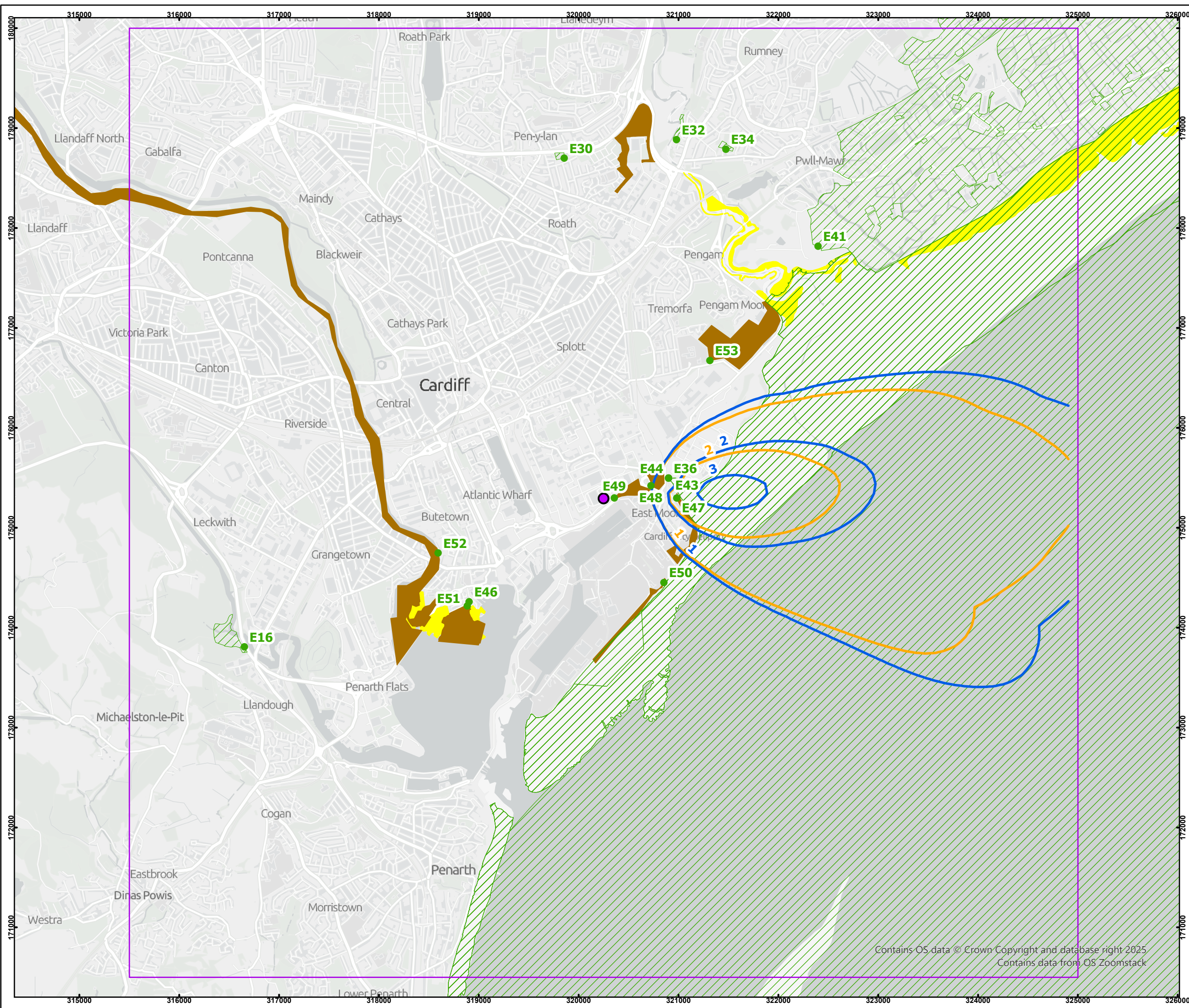
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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of the 3 µg/m3 Critical Level.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 15. Annual Mean Ammonia - normal Critical Level

Drawn by: RCB Date: 14/11/2025

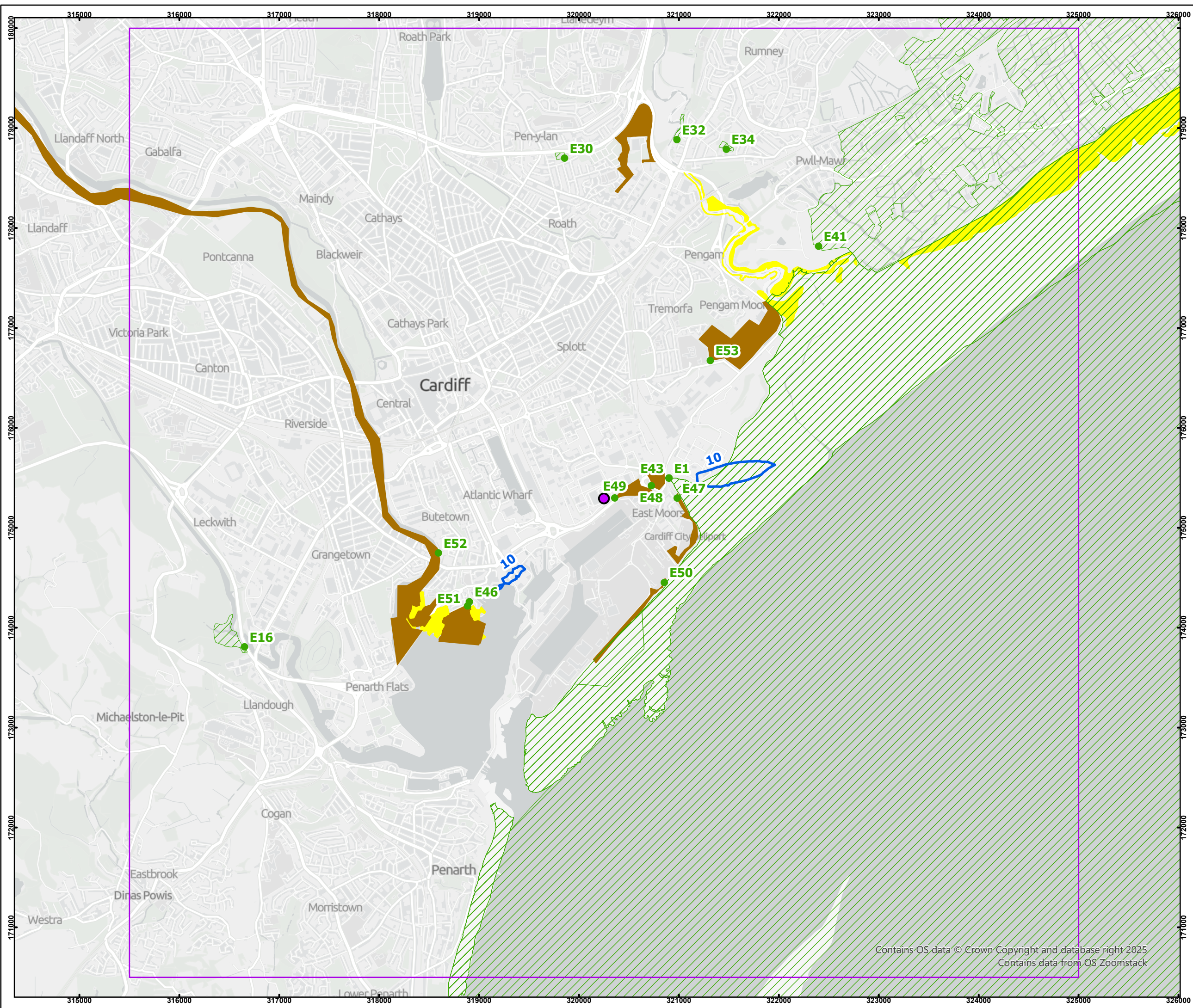
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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:
Maximum process contribution using 5-years of weather data.
All impacts presented as a % of the 75 µg/m³ Critical Level.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 16. Daily Mean Oxides of Nitrogen

Drawn by: RCB	Date: 14/11/2025
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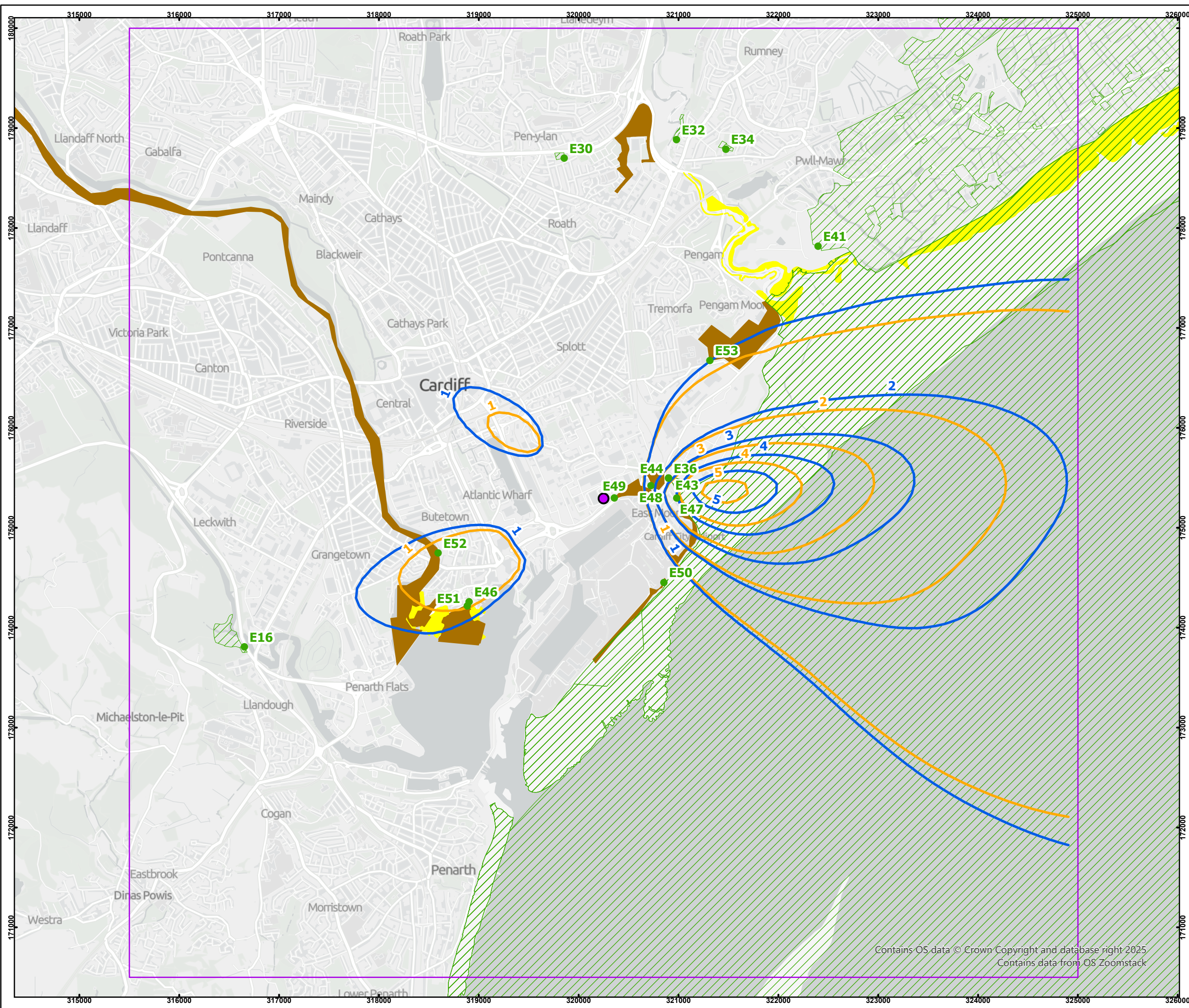
km

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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:

Average of 5-years weather data.
Grassland deposition velocity.
All impacts presented as a % of the Critical Load of 10kgN/ha/yr.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 17. Nitrogen Deposition - Grassland

Drawn by: RCB	Date: 14/11/2025
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Map data © OpenStreetMap

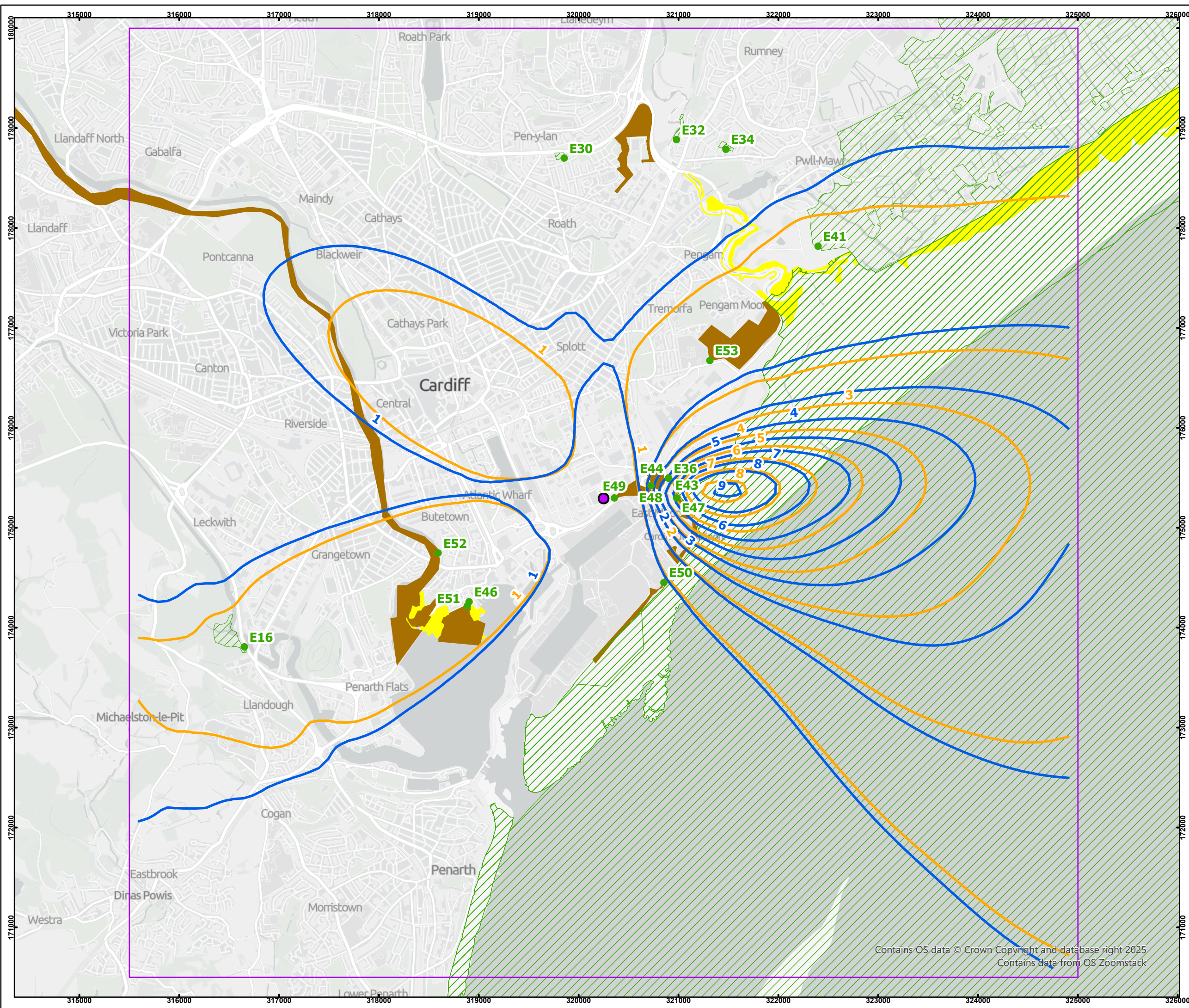
0 0.35 0.7 1.4 km

Scale: 1:35,000

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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:

Average of 5-years weather data.
Woodland deposition velocity.
All impacts presented as a % of the Critical Load of 10kgN/ha/yr.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 18. Nitrogen Deposition - Woodland

Drawn by: RCB	Date: 14/11/2025
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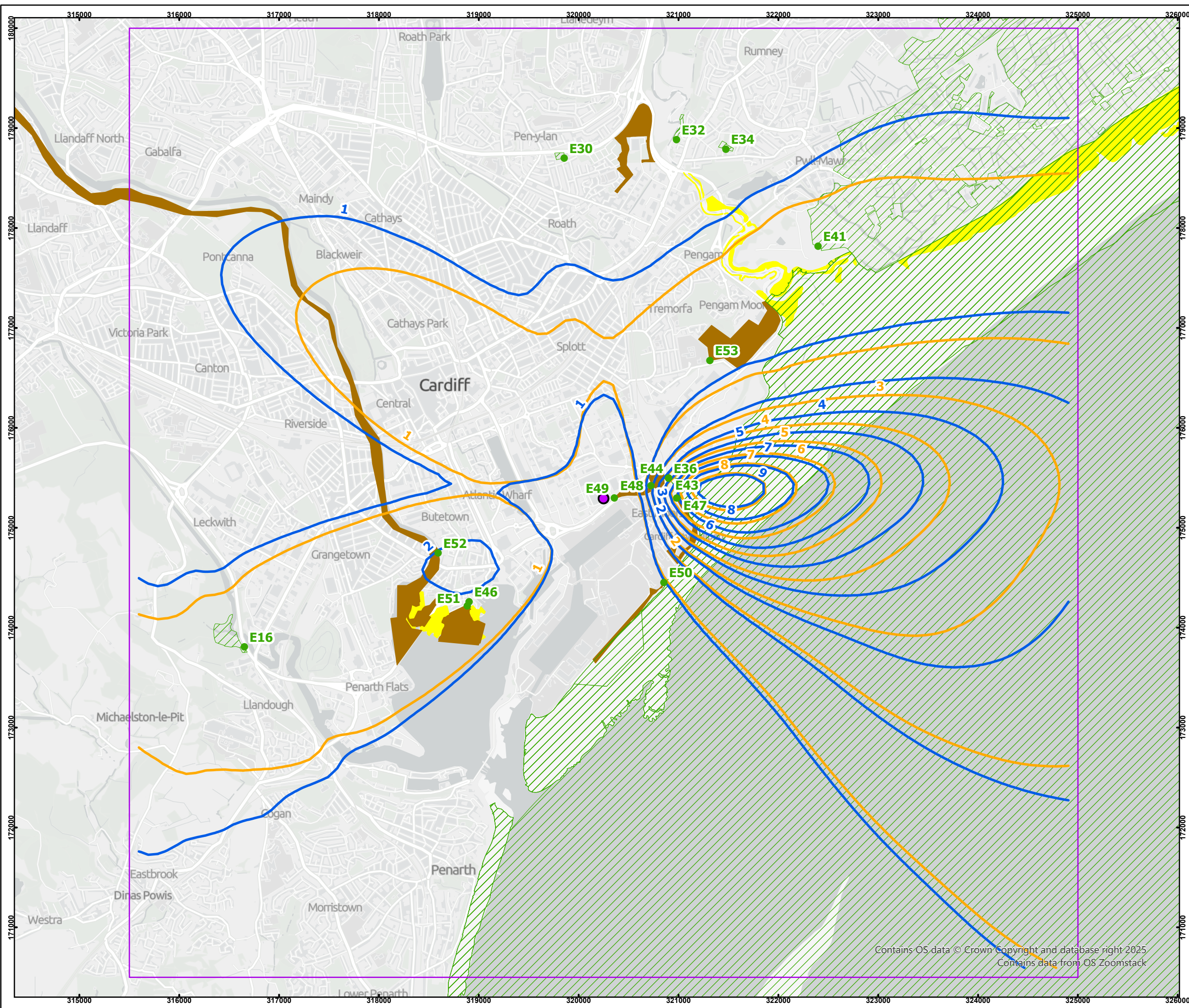
0 0.35 0.7 1.4 km

Scale: 1:35,000

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Legend

- Model Grid Extents
- Ecological Receptors
- ERF Stacks
- Varied ERF permit
- Permitted ERF
- Statutory Designated Sites
- Non-Statutory Designated Sites
- Coastal Saltmarsh Priority Habitat

Notes:
Average of 5-years weather data.
Woodland deposition velocity.
All impacts presented as a % of the Critical Load of 1.744keq/ha/yr.

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 19. Acid Deposition - Woodland

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0 0.35 0.7 1.4 km
Scale: 1:35,000

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B Diffusion tube monitoring within 3 km of ERF

Table 30 provides a summary of the annual mean nitrogen dioxide diffusion tube monitoring from within 3 km of ERF.

Table 30: Diffusion tube monitoring data

Site ID	2023 mapped bg (µg/m³)	Annual mean concentration (µg/m³)				
		2019	2020	2021	2022	2023
Roadside and kerbside sites						
258	14.3			29.4	29.5	26.7
58	15.5	41.2	30	30.8	31	30.7
81	16.6	34.4	27.2	29.3	27	24.5
259	14.8				26.1	20.5
126	15.5	33.3	22.3	24	25.3	25.6
128	14.3	29.8	25	25	27.2	26.9
131	16.6	35.7	28.8	26.7	26	24.8
143	17.6	35.6	23.5	25.7	25.7	25.4
144	17.6	33.9	25	26.4	27.9	27.6
147	14.3	26.9	20.5	23.8	24.3	22
148	14.3	25.6	21.3	23.9	24	20.7
149	14.3	30.1	26.8	25.9	27.1	26.2
159	14.6	32.2	26.4	27.4	28.7	26.7
179	17.6	33.1	32.4	37.6	31.7	36
183	17.6	30.9	23.5	23.7	25.9	22.2
184	17.6	40.5	28.3	27.5	28.3	24.7
186	17.6	42.7	23.1	24.5	31.6	30.8
187	15.5	43.9	25.7	26.1	31.5	27.6
188	17.6	43.7	32.5	26.8	28.5	26.7
191	16.0	27.9	22.5	24.3	25.4	23.2
195	14.6	31.2	24.2	24.6	25	22.1
198	16.6	33.5	25.7	28.7	28.3	26.3
199	16.0	25	20.7	20.1	20.1	19
201	15.5	28.9	22.1	24	27	23.1
202	15.5	27.6	23.3	24.5	26.3	22.9
204	15.5	22.1	18.7	20.1	20.9	20.3
254	15.5			27.7	30.2	26.6
220	17.6	38.4	27.9	30.4	31.3	28

Site ID	2023 mapped bg (µg/m³)	Annual mean concentration (µg/m³)				
		2019	2020	2021	2022	2023
221	16.0		30.4	26.9	33.8	30.2
190	16.0	23.4	20.7	20.1	21.1	19.8
263	13.5				14.4	16.2
TRO-019	20.3			14.5	14.5	13.1
TRO-020	17.3			14.7	15.3	12.5
TRO-021	17.3			17.2	16.5	13.6
TRO-022	16.6			19.3	19.9	17.5
TRO-023	16.6			19.5	19.2	17.3
TRO-024	16.6			29.6	32.4	26.2
TRO-025	16.0			15.3	15.5	15.2
TRO-026	16.0			14.8	16	13.1
TRO-027	16.0			16.4	18.5	15.6
TRO-058	12.8					14
TRO-059	12.8					13.3
TRO-060	12.8					13.9

Source: Cardiff Council 2024 Air Quality Progress Report

C Background concentrations at ecological receptors

Table 31: APIS Data for Ecological Sites

ID	Site	Maximum concentration (µg/m3)		
		Oxides of nitrogen	Sulphur dioxide	Ammonia
Annual mean Critical Level		30	10 / 20	1 / 3
E1	Severn Estuary (Wales)	25.0	5.6	1.7
E2	River Usk / Afon Wysg	23.5	5.3	1.6
E3	Cardiff Beech Woods	16.1	2.5	1.0
E4	Severn Estuary (England)	25.0	5.6	1.7
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / Llanishen and Lisvane Reservoir Embankments	15.3	3.3	1.2
E6	Barry Island	9.8	1.9	0.9
E7	Brofiscin Quarry, Groes Faen	9.8	1.9	0.9
E8	Caeau Blaen-bielly	9.4	1.9	0.9
E9	Castell Coch Woodlands and Road Section	13.6	2.5	1.0
E10	Cefn Onn	10.1	2.0	0.9
E11	Cliff Wood - Golden Stairs	8.7	1.9	1.0
E12	Coed y Bedw	10.0	1.8	0.9
E13	Coedydd y Barri / Barry Woodlands	9.6	1.7	1.1
E14	Cog Moors	10.7	1.9	1.1
E15	Cwarrau Ton Mawr a Ffynnon Taf - Ton Mawr and Taffs Well Quarries	16.0	2.3	1.0
E16	Cwm Cydfin, Leckwith	17.2	3.3	1.1
E17	Ely Valley	13.0	2.0	1.0
E18	Fforestganol a Chwm Nofydd	15.9	2.5	1.1
E19	Flat Holm	25.0	5.6	1.7
E20	Garth Wood	16.1	2.5	1.0
E21	Glamorgan Canal / Long Wood	19.2	2.8	1.1
E22	Gwaun Gledyr	14.3	2.6	0.9
E23	Gwent Levels - St. Brides	16.7	3.1	1.6
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	11.0	1.9	1.5
E25	Hayes Point to Bendrick Rock	12.8	2.4	1.2
E26	Lisvane Reservoir	15.2	3.1	1.2
E27	Llynnoedd Cosmeston / Cosmeston Lakes	8.9	1.6	1.1
E28	Nant Whitton Woodlands	7.4	1.4	1.1

ID	Site	Maximum concentration (µg/m3)		
		Oxides of nitrogen	Sulphur dioxide	Ammonia
E29	Penarth Coast	10.4	2.1	1.2
E30	Penylan Quarry	21.0	4.2	1.2
E31	Plas Machen Wood	10.1	1.8	1.0
E32	Rhymney River Section	20.9	3.7	1.2
E34	Rumney Quarry	18.4	3.5	1.2
E35	Ruperra Castle and Woodlands	9.9	1.9	1.0
E37	Sully Island	8.1	1.4	1.2
E38	Ty Du Moor	11.6	1.6	1.0
E39	Wern Ddu Claypits	10.2	2.1	0.9
E40	Fferm Walters	11.3	2.5	1.1
E41	Gwent Levels - Rumney and Peterstone	17.5	3.5	1.4
E46	Cardiff Bay Wetland and Hamadryad Park	19.4	3.4	1.1
E47	Cardiff Heliport Fields	25.0	5.6	1.1
E48	Tidal Sidings	25.0	5.6	1.1
E49	Ocean Park South	25.0	5.6	1.1
E50	Beach Sidings	19.5	3.8	1.1
E51	Cardiff Bay Wetland Reserve	19.4	3.4	1.1
E52	River Taff	19.4	3.4	1.1
E53	Pengam Moors	19.1	3.5	1.1

Source: APIS

Table 32: APIS Data for Ecological Sites - Deposition

ID	Site	N deposition (kgN/ha/yr)		Acid deposition (keq/ha/yr)	
		Grassland	Woodland	Grassland	Woodland
E1	Severn Estuary (Wales)	14.2	26.0	1.1	1.9
E2	River Usk / Afon Wysg	21.6	33.0	1.6	2.5
E3	Cardiff Beech Woods	13.4	23.3	1.1	1.9
E4	Severn Estuary (England)	14.2	26.0	1.1	1.9
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / Llanishen and Lisvane Reservoir Embankments	13.3	23.5	1.2	2.0
E6	Barry Island	9.7	18.5	0.8	1.4
E7	Brofiscin Quarry, Groes Faen	12.1	21.4	1.0	1.7
E8	Caeau Blaen-bielly	12.7	22.3	1.1	1.8
E9	Castell Coch Woodlands and Road Section	13.3	23.1	1.1	1.9

ID	Site	N deposition (kgN/ha/yr)		Acid deposition (keq/ha/yr)	
		Grassland	Woodland	Grassland	Woodland
E10	Cefn Onn	13.2	23.0	1.1	1.9
E11	Cliff Wood - Golden Stairs	9.7	18.4	0.8	1.4
E12	Coed y Bedw	12.9	22.6	1.1	1.8
E13	Coedydd y Barri / Barry Woodlands	11.1	20.5	0.9	1.6
E14	Cog Moors	10.5	19.8	0.9	1.6
E15	Cwarrau Ton Mawr a Ffynnon Taf - Ton Mawr and Taffs Well Quarries	13.0	22.8	1.1	1.9
E16	Cwm Cydfin, Leckwith	12.1	22.0	1.1	1.8
E17	Ely Valley	11.9	21.2	1.0	1.7
E18	Fforestganol a Chwm Nofydd	13.4	23.3	1.1	1.9
E19	Flat Holm	21.6	33.0	1.6	2.5
E20	Garth Wood	13.3	23.1	1.1	1.9
E21	Glamorgan Canal / Long Wood	12.9	22.9	1.1	1.9
E22	Gwaun Gledyr	14.3	24.1	1.2	1.9
E23	Gwent Levels - St. Brides	13.4	24.3	1.1	1.9
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	12.9	23.9	1.0	1.8
E25	Hayes Point to Bendrick Rock	9.8	18.7	0.8	1.4
E26	Lisvane Reservoir	13.3	23.5	1.2	2.0
E27	Llynnoedd Cosmeston / Cosmeston Lakes	10.5	19.9	0.8	1.5
E28	Nant Whitton Woodlands	11.2	20.7	0.9	1.6
E29	Penarth Coast	10.6	19.9	0.9	1.6
E30	Penylan Quarry	12.8	23.1	1.2	2.0
E31	Plas Machen Wood	13.3	23.3	1.1	1.9
E32	Rhymney River Section	12.5	22.6	1.1	1.8
E34	Rumney Quarry	12.1	22.1	1.1	1.8
E35	Ruperra Castle and Woodlands	13.2	23.2	1.1	1.9
E37	Sully Island	10.0	19.0	0.8	1.5
E38	Ty Du Moor	11.9	21.4	1.0	1.7
E39	Wern Ddu Claypits	13.3	23.1	1.1	1.9
E40	Fferm Walters	10.4	19.4	0.8	1.5
E41	Gwent Levels - Rumney and Peterstone	12.8	23.2	1.1	1.8
E46	Cardiff Bay Wetland and Hamadryad Park	11.9	21.7	1.1	1.9
E47	Cardiff Heliport Fields	11.6	21.3	1.1	1.9
E48	Tidal Sidings	11.6	21.3	1.1	1.9
E49	Ocean Park South	11.6	21.3	1.1	1.9
E50	Beach Sidings	11.2	20.7	1.1	1.8

ID	Site	N deposition (kgN/ha/yr)		Acid deposition (keq/ha/yr)	
		Grassland	Woodland	Grassland	Woodland
E51	Cardiff Bay Wetland Reserve	11.9	21.7	1.1	1.9
E52	River Taff	11.9	21.7	1.1	1.9
E53	Pengam Moors	11.5	21.3	1.1	1.9

Source: APIS

The concentrations presented in Table 31 and deposition rates presented in Table 32 are grid square averaged values provided as a rolling 3-year mean as set out in APIS. The APIS website explains that the use of a 3-year mean has been demonstrated to be a suitable time period to smooth out some of the inter-annual variations in deposition which occur due to the natural variability in annual weather patterns.

D Permitted ERF – Detailed Results

Continual operation at daily ELV

					Contribution to Ground Level Concentration at Point of Greatest Impact								
Pollutant	Quantity	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	20.3	0.7	0.6	0.6	0.8	0.8	0.8	1.9%	21.1	52.64%
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	40.6	5.1	5.5	5.4	5.1	5.7	5.7	2.9%	46.3	23.16%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	10.4	1.4	1.1	1.3	1.4	1.2	1.4	1.1%	11.8	9.45%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	10.4	3.1	3.4	3.4	3.1	3.6	3.6	1.0%	14.0	4.00%
Sulphur dioxide	99.9th %ile of 15 min. means	µg/m³	266	10.4	4.0	4.0	4.0	3.9	4.1	4.1	1.5%	14.5	5.46%
Particulates (PM10)	Annual mean	µg/m³	40	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.07%	13.2	33.07%
Particulates (PM10)	90.4th %ile of daily means	µg/m³	50	26.4	0.1	0.1	0.1	0.1	0.1	0.1	0.2%	26.5	52.99%
Particulates (PM2.5)	Annual mean	µg/m³	20	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.15%	7.2	36.15%
Particulates (PM2.5)	Annual mean - 2040 target	µg/m³	10	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	7.2	72.30%
Carbon monoxide	8 hour running mean	µg/m³	10,000	0.6	3.6	4.0	4.0	3.4	4.1	4.1	0.04%	4.7	0.05%
Carbon monoxide	Hourly mean	µg/m³	30,000	0.6	9.3	8.0	9.7	7.6	7.3	9.7	0.03%	10.3	0.03%
Hydrogen chloride	Hourly mean	µg/m³	750	1.6	1.5	1.3	1.5	1.2	1.2	1.5	0.2%	3.1	0.42%
Hydrogen fluoride	Annual mean	ng/m³	16,000	2,400.0	5.7	4.6	5.2	6.0	6.0	6.0	0.04%	2,406.0	15.04%
Hydrogen fluoride	Hourly mean	ng/m³	160,000	4,800.0	187.0	160.6	193.7	152.1	146.8	193.7	0.12%	4,993.7	3.12%
Ammonia	Annual mean	µg/m³	180	1.4	0.1	0.1	0.1	0.1	0.1	0.1	0.05%	1.5	0.83%
Ammonia	Hourly mean	µg/m³	2,500	2.8	2.8	2.4	2.9	2.3	2.2	2.9	0.12%	5.7	0.23%
VOCs (as benzene)	Annual mean	ng/m³	5,000	1,600.0	56.7	46.3	51.5	60.0	59.9	60.0	1.2%	1,660.0	33.20%
VOCs (as benzene)	Daily mean	ng/m³	30,000	3,200.0	399.9	349.4	398.8	407.6	355.4	407.6	1.4%	3,607.6	12.03%
Mercury	Daily mean	ng/m³	60	32.0	0.8	0.7	0.8	0.8	0.7	0.8	1.4%	32.8	54.69%
Mercury	Hourly mean	ng/m³	600	32.0	3.7	3.2	3.9	3.0	2.9	3.9	0.6%	35.9	5.98%
Cadmium	Annual mean	ng/m³	5	1.4	0.11	0.09	0.10	0.12	0.12	0.12	2.40%	1.5	30.40%
Cadmium	Daily mean	ng/m³	30	2.8	0.8	0.7	0.8	0.8	0.7	0.8	2.7%	3.6	12.05%
PaHs	Annual mean	pg/m³	250	200.0	1.1	0.9	1.0	1.2	1.2	1.2	0.5%	201.2	80.48%
Dioxins and Furans	Annual mean	fg/m³	-	33.0	0.3	0.3	0.3	0.4	0.4	0.4	-	33.4	-
PCBs	Annual mean	ng/m³	200	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.015%	0.2	0.08%
PCBs	Hourly mean	ng/m³	6,000	0.3	0.9	0.8	1.0	0.8	0.7	1.0	0.02%	1.2	0.02%

Note:

Assumes continual operation of the ERF at the daily mean ELVs

Continual operation at half-hourly ELV

					Contribution to Ground Level Concentration at Point of Greatest Impact								
Pollutant	Quantity	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	40.6	11.4	12.3	12.0	11.4	12.7	12.7	6.4%	53.3	26.66%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	10.4	15.6	16.8	16.9	15.6	17.9	17.9	5.1%	28.3	8.10%
Sulphur dioxide	99.9th %ile of 15 min. means	µg/m³	266	10.4	19.8	20.2	20.0	19.4	20.6	20.6	7.7%	31.0	11.65%
Carbon monoxide	8 hour running mean	µg/m³	10,000	0.6	10.8	12.1	12.0	10.3	12.2	12.2	0.12%	12.8	0.13%
Carbon monoxide	Hourly mean	µg/m³	30,000	0.6	28.0	24.1	29.1	22.8	22.0	29.1	0.10%	29.7	0.10%
Hydrogen chloride	Hourly mean	µg/m³	750	1.6	11.2	9.6	11.6	9.1	8.8	11.6	1.5%	13.2	1.76%
Hydrogen fluoride	Hourly mean	ng/m³	160,000	4,800	747.3	641.8	774.4	607.8	586.9	774.4	0.5%	5,574.4	3.48%

Note:

Assumes continual operation of the ERF at the half-hourly mean ELVs

Risk Assessment - Annual Mean

Metal	AQAL (ng/m³)	Background Concentration (ng/m³)	Assuming each metal emitted at 100% of the group ELV				Metal (as % of ELV)	Each metal emitted at the maximum concentration from the EA metals			
			PC		PEC			PC		PEC	
			ng/m³	as % of AQAL	ng/m³	as % of AQAL		ng/m³	as % of AQAL	ng/m³	as % of AQAL
Arsenic	6	0.95	1.80	29.98%	2.75	45.82%	8.3%	0.15	2.50%	1.10	18.33%
Antimony	5,000	1.30	1.80	0.04%	3.10	0.06%	3.8%	0.07	0.001%	1.37	0.03%
Chromium	-	6.10	1.80	-	7.90	-	30.7%	0.55	-	6.65	-
Chromium (VI)	0	1.22	1.80	719.58%	3.02	1207.58%	0.043%	0.0008	0.31%	1.22	488.31%
Cobalt	-	5.50	1.80	-	7.30	-	1.9%	0.03	-	5.53	-
Copper	-	15.00	1.80	-	16.80	-	9.7%	0.17	-	15.17	-
Lead	250	23.00	1.80	0.72%	24.80	9.92%	16.8%	0.30	0.12%	23.30	9.32%
Manganese	150	100.00	1.80	1.20%	101.80	67.87%	20.0%	0.36	0.24%	100.36	66.91%
Nickel	20	1.10	1.80	8.99%	2.90	14.49%	73.3%	1.32	6.60%	2.42	12.10%
Vanadium	-	13.00	1.80	-	14.80	-	2.0%	0.04	-	13.04	-

Risk Assessment - Short-term daily mean

Metal	AQAL (ng/m³)	Background Concentration (ng/m³)	Assuming each metal emitted at 100% of the group ELV				Metal (as % of ELV)	Each metal emitted at the maximum concentration from the EA metals			
			PC		PEC			PC		PEC	
			ng/m³	as % of AQAL	ng/m³	as % of AQAL		ng/m³	as % of AQAL	ng/m³	as % of AQAL
Arsenic	-	1.90	12.23	-	14.13	-	8.3%	1.02	-	2.92	-
Antimony	-	2.60	12.23	-	14.83	-	3.8%	0.47	-	3.07	-
Chromium	2,000	12.20	12.23	0.61%	24.43	1.22%	30.7%	3.75	0.19%	15.95	0.80%
Chromium (VI)	-	2.44	12.23	-	14.67	-	0.0%	0.005	-	2.45	-
Cobalt	-	11.00	12.23	-	23.23	-	1.9%	0.23	-	11.23	-
Copper	50	30.00	12.23	24.46%	42.23	84.46%	9.7%	1.18	2.36%	31.18	62.36%
Lead	-	46.00	12.23	-	58.23	-	16.8%	2.05	-	48.05	-
Manganese	-	200.00	12.23	-	212.23	-	20.0%	2.45	-	202.45	-
Nickel	-	3.00	12.23	-	15.23	-	73.3%	8.97	-	11.97	-
Vanadium	1,000	26.00	12.23	1.22%	38.23	3.82%	2.0%	0.24	0.02%	26.24	2.62%

Risk Assessment - Short-term hourly mean

Metal	AQAL (ng/m³)	Background Concentration (ng/m³)	Assuming each metal emitted at 100% of the group ELV				Metal (as % of ELV)	Each metal emitted at the maximum concentration from the EA metals			
			PC		PEC			PC		PEC	
			ng/m³	as % of AQAL	ng/m³	as % of AQAL		ng/m³	as % of AQAL	ng/m³	as % of AQAL
Arsenic	-	1.90	58.12	-	60.02	-	8.3%	4.84	-	6.74	-
Antimony	150,000	2.60	58.12	0.04%	60.72	0.04%	3.8%	2.23	0.001%	4.83	0.003%
Chromium	-	12.20	58.12	-	70.32	-	30.7%	17.82	-	30.02	-
Chromium (VI)	-	2.44	58.12	-	60.56	-	0.0%	0.03	-	2.47	-
Cobalt	-	11.00	58.12	-	69.12	-	1.9%	1.08	-	12.08	-
Copper	-	30.00	58.12	-	88.12	-	9.7%	5.62	-	35.62	-
Lead	-	46.00	58.12	-	104.12	-	16.8%	9.75	-	55.75	-
Manganese	1,500,000	200.00	58.12	0.0039%	258.12	0.017%	20.0%	11.62	0.0008%	211.62	0.014%
Nickel	700	3.00	58.12	8.30%	61.12	8.73%	73.3%	42.62	6.09%	45.62	6.52%
Vanadium	-	26.00	58.12	-	84.12	-	2.0%	1.16	-	27.16	-

Annual mean nitrogen dioxide

ID	Receptor	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
HR1	Willows High School	µg/m³	40	20.3	0.11	0.11	0.12	0.10	0.10	0.12	0.3%	20.4	51.0%
HR2	Baden Powell County Primary School	µg/m³	40	20.3	0.08	0.09	0.09	0.09	0.09	0.09	0.2%	20.4	51.0%
HR3	Splott Health centre	µg/m³	40	20.3	0.09	0.09	0.09	0.09	0.09	0.09	0.2%	20.4	51.0%
HR4	Splott Rec South	µg/m³	40	20.3	0.09	0.09	0.09	0.09	0.09	0.09	0.2%	20.4	51.0%
HR5	Splott Rec North	µg/m³	40	20.3	0.08	0.08	0.09	0.09	0.08	0.09	0.2%	20.4	51.0%
HR6	Moorland Primary School #1	µg/m³	40	20.3	0.08	0.07	0.08	0.09	0.08	0.09	0.2%	20.4	51.0%
HR7	College building	µg/m³	40	20.3	0.07	0.06	0.09	0.09	0.08	0.09	0.2%	20.4	51.0%
HR8	Library	µg/m³	40	20.3	0.07	0.06	0.10	0.08	0.08	0.10	0.3%	20.4	51.0%
HR9	Allotments	µg/m³	40	20.3	0.05	0.05	0.07	0.06	0.06	0.07	0.2%	20.4	50.9%
HR10	Howardian Centre	µg/m³	40	20.3	0.05	0.05	0.07	0.06	0.06	0.07	0.2%	20.4	50.9%
HR11	University of Wales Institute	µg/m³	40	20.3	0.06	0.05	0.07	0.06	0.06	0.07	0.2%	20.4	50.9%
HR12	St Peters Rec	µg/m³	40	20.3	0.06	0.06	0.08	0.07	0.07	0.08	0.2%	20.4	51.0%
HR13	Moorland park	µg/m³	40	20.3	0.07	0.06	0.08	0.08	0.07	0.08	0.2%	20.4	51.0%
HR14	National Assembly	µg/m³	40	20.3	0.18	0.14	0.11	0.09	0.12	0.18	0.4%	20.5	51.2%
HR15	County Hall	µg/m³	40	20.3	0.09	0.09	0.10	0.12	0.05	0.12	0.3%	20.4	51.0%
HR16	St Cuthbert's RC Primary School	µg/m³	40	20.3	0.09	0.08	0.09	0.08	0.05	0.09	0.2%	20.4	51.0%
HR17	Adamstown County Primary School	µg/m³	40	20.3	0.07	0.07	0.11	0.09	0.08	0.11	0.3%	20.4	51.0%
HR18	College	µg/m³	40	20.3	0.09	0.10	0.13	0.10	0.10	0.13	0.3%	20.4	51.1%
HR19	Cardiff Royal Infirmary #1	µg/m³	40	20.3	0.08	0.09	0.12	0.09	0.09	0.12	0.3%	20.4	51.0%
HR20	Cardiff Royal Infirmary #2	µg/m³	40	20.3	0.07	0.08	0.11	0.09	0.08	0.11	0.3%	20.4	51.0%
HR21	Cardiff Royal Infirmary #3	µg/m³	40	20.3	0.07	0.07	0.10	0.08	0.07	0.10	0.3%	20.4	51.0%
HR22	St Peter's RC Primary School	µg/m³	40	20.3	0.06	0.07	0.10	0.08	0.07	0.10	0.2%	20.4	51.0%
HR23	School building	µg/m³	40	20.3	0.09	0.09	0.12	0.09	0.10	0.12	0.3%	20.4	51.0%
HR24	School building	µg/m³	40	20.3	0.08	0.09	0.11	0.09	0.09	0.11	0.3%	20.4	51.0%
HR25	College building	µg/m³	40	20.3	0.07	0.08	0.10	0.08	0.08	0.10	0.3%	20.4	51.0%
HR26	College building	µg/m³	40	20.3	0.07	0.08	0.11	0.08	0.08	0.11	0.3%	20.4	51.0%
HR27	College building	µg/m³	40	20.3	0.09	0.10	0.12	0.09	0.10	0.12	0.3%	20.4	51.1%
HR28	Moorland Primary School #2	µg/m³	40	20.3	0.08	0.08	0.09	0.09	0.08	0.09	0.2%	20.4	51.0%
HR29	St Anne's Church in Wales Infant	µg/m³	40	20.3	0.06	0.06	0.09	0.07	0.06	0.09	0.2%	20.4	51.0%
HR30	Marlborough Junior School	µg/m³	40	20.3	0.05	0.05	0.08	0.07	0.06	0.08	0.2%	20.4	51.0%
HR31	College building	µg/m³	40	20.3	0.05	0.05	0.07	0.06	0.05	0.07	0.2%	20.4	50.9%
HR32	Roath Park Recreation ground	µg/m³	40	20.3	0.05	0.05	0.07	0.06	0.05	0.07	0.2%	20.4	50.9%
HR33	Roath Park Primary School	µg/m³	40	20.3	0.04	0.05	0.07	0.06	0.05	0.07	0.2%	20.4	50.9%
HR34	School building	µg/m³	40	20.3	0.05	0.06	0.08	0.06	0.06	0.08	0.2%	20.4	50.9%
HR35	School building	µg/m³	40	20.3	0.05	0.06	0.08	0.06	0.06	0.08	0.2%	20.4	50.9%
HR36	University of Wales Cardiff	µg/m³	40	20.3	0.07	0.08	0.10	0.08	0.09	0.10	0.2%	20.4	51.0%
HR37	Cathays Park	µg/m³	40	20.3	0.08	0.08	0.10	0.08	0.10	0.10	0.3%	20.4	51.0%
HR38	Virgin Church in Wales Primary School	µg/m³	40	20.3	0.09	0.08	0.09	0.08	0.05	0.09	0.2%	20.4	51.0%
HR39	Mountstuart Primary School	µg/m³	40	20.3	0.17	0.15	0.14	0.15	0.12	0.17	0.4%	20.5	51.2%
HR40	Royal Hamadryad Hospital	µg/m³	40	20.3	0.15	0.14	0.14	0.14	0.11	0.15	0.4%	20.5	51.1%
HR41	St Pauls Primary School	µg/m³	40	20.3	0.11	0.11	0.11	0.12	0.07	0.12	0.3%	20.4	51.1%
HR42	St Patricks RC Primary School	µg/m³	40	20.3	0.06	0.06	0.06	0.07	0.05	0.07	0.2%	20.4	50.9%
HR43	Ninian Park Primary School	µg/m³	40	20.3	0.06	0.06	0.06	0.06	0.05	0.06	0.2%	20.4	50.9%
HR44	St Davids Hospital	µg/m³	40	20.3	0.07	0.07	0.09	0.07	0.07	0.09	0.2%	20.4	51.0%
HR45	Castle Mews – College	µg/m³	40	20.3	0.08	0.08	0.10	0.08	0.10	0.10	0.3%	20.4	51.0%
HR46	Nursery – plants	µg/m³	40	20.3	0.07	0.07	0.09	0.08	0.09	0.09	0.2%	20.4	51.0%
HR47	Uni library	µg/m³	40	20.3	0.07	0.08	0.09	0.08	0.09	0.09	0.2%	20.4	51.0%

HR48	Ysgol Mynydd Bychan School #1	µg/m³	40	20.3	0.05	0.06	0.07	0.06	0.06	0.07	0.2%	20.4	50.9%
HR49	Ysgol Mynydd Bychan School #2	µg/m³	40	20.3	0.04	0.06	0.07	0.06	0.05	0.07	0.2%	20.4	50.9%
HR50	Severn County Junior School	µg/m³	40	20.3	0.06	0.06	0.08	0.06	0.06	0.08	0.2%	20.4	50.9%
HR51	St Marys Catholic Primary School	µg/m³	40	20.3	0.07	0.06	0.08	0.06	0.06	0.08	0.2%	20.4	51.0%
HR52	Kitchener County Primary School	µg/m³	40	20.3	0.05	0.05	0.06	0.05	0.04	0.06	0.2%	20.4	50.9%
HR53	Llandough Primary School	µg/m³	40	20.3	0.09	0.09	0.09	0.08	0.08	0.09	0.2%	20.4	51.0%
HR54	Llandough Hospital N.H.S Trust	µg/m³	40	20.3	0.09	0.09	0.09	0.08	0.07	0.09	0.2%	20.4	51.0%

Note:
Assumes continual operation of the ERF at the daily mean ELVs

Max @	HR14	0.18	0.4%
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Annual mean VOC (as benzene)

ID	Receptor	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
HR1	Willows High School	ng/m ³	5,000	1,600	8.4	8.8	9.3	7.7	8.2	9.3	0.2%	1,609.3	32.2%
HR2	Baden Powell County Primary School	ng/m ³	5,000	1,600	6.6	7.0	7.4	7.3	6.9	7.4	0.1%	1,607.4	32.1%
HR3	Splott Health centre	ng/m ³	5,000	1,600	7.0	7.0	7.5	7.5	7.2	7.5	0.2%	1,607.5	32.2%
HR4	Splott Rec South	ng/m ³	5,000	1,600	6.8	7.0	7.4	7.5	7.1	7.5	0.1%	1,607.5	32.1%
HR5	Splott Rec North	ng/m ³	5,000	1,600	6.2	6.1	6.8	7.0	6.2	7.0	0.1%	1,607.0	32.1%
HR6	Moorland Primary School #1	ng/m ³	5,000	1,600	6.3	5.8	6.7	7.1	6.6	7.1	0.1%	1,607.1	32.1%
HR7	College building	ng/m ³	5,000	1,600	5.8	5.2	7.2	6.7	6.0	7.2	0.1%	1,607.2	32.1%
HR8	Library	ng/m ³	5,000	1,600	5.6	5.0	8.2	6.6	6.3	8.2	0.2%	1,608.2	32.2%
HR9	Allotments	ng/m ³	5,000	1,600	4.3	4.1	5.3	4.8	4.4	5.3	0.1%	1,605.3	32.1%
HR10	Howardian Centre	ng/m ³	5,000	1,600	4.3	4.2	5.5	4.8	4.5	5.5	0.1%	1,605.5	32.1%
HR11	University of Wales Institute	ng/m ³	5,000	1,600	4.5	4.3	5.8	5.0	4.7	5.8	0.1%	1,605.8	32.1%
HR12	St Peters Rec	ng/m ³	5,000	1,600	4.9	4.6	6.6	5.6	5.3	6.6	0.1%	1,606.6	32.1%
HR13	Moorland park	ng/m ³	5,000	1,600	5.4	4.6	6.3	6.5	5.9	6.5	0.1%	1,606.5	32.1%
HR14	National Assembly	ng/m ³	5,000	1,600	14.0	11.1	8.4	7.3	9.6	14.0	0.3%	1,614.0	32.3%
HR15	County Hall	ng/m ³	5,000	1,600	7.4	7.1	7.6	9.3	3.8	9.3	0.2%	1,609.3	32.2%
HR16	St Cuthbert's RC Primary School	ng/m ³	5,000	1,600	6.8	6.5	7.1	6.6	3.6	7.1	0.1%	1,607.1	32.1%
HR17	Adamstown County Primary School	ng/m ³	5,000	1,600	5.5	5.9	8.5	6.8	6.0	8.5	0.2%	1,608.5	32.2%
HR18	College	ng/m ³	5,000	1,600	7.0	7.8	10.0	7.7	7.9	10.0	0.2%	1,610.0	32.2%
HR19	Cardiff Royal Infirmary #1	ng/m ³	5,000	1,600	6.1	7.0	9.4	7.1	6.8	9.4	0.2%	1,609.4	32.2%
HR20	Cardiff Royal Infirmary #2	ng/m ³	5,000	1,600	5.6	6.3	8.7	6.8	6.2	8.7	0.2%	1,608.7	32.2%
HR21	Cardiff Royal Infirmary #3	ng/m ³	5,000	1,600	5.3	5.8	8.3	6.5	5.9	8.3	0.2%	1,608.3	32.2%
HR22	St Peter's RC Primary School	ng/m ³	5,000	1,600	4.9	5.2	7.6	6.1	5.6	7.6	0.2%	1,607.6	32.2%
HR23	School building	ng/m ³	5,000	1,600	6.8	7.5	9.5	7.3	8.0	9.5	0.2%	1,609.5	32.2%
HR24	School building	ng/m ³	5,000	1,600	6.1	6.9	9.0	6.8	7.0	9.0	0.2%	1,609.0	32.2%
HR25	College building	ng/m ³	5,000	1,600	5.3	6.1	8.1	6.1	6.1	8.1	0.2%	1,608.1	32.2%
HR26	College building	ng/m ³	5,000	1,600	5.7	6.5	8.8	6.6	6.4	8.8	0.2%	1,608.8	32.2%
HR27	College building	ng/m ³	5,000	1,600	6.8	7.6	9.7	7.4	7.8	9.7	0.2%	1,609.7	32.2%
HR28	Moorland Primary School #2	ng/m ³	5,000	1,600	6.4	6.0	6.9	7.2	6.6	7.2	0.1%	1,607.2	32.1%
HR29	St Anne's Church in Wales Infant	ng/m ³	5,000	1,600	4.4	4.8	6.8	5.5	5.1	6.8	0.1%	1,606.8	32.1%
HR30	Marlborough Junior School	ng/m ³	5,000	1,600	4.3	4.4	6.4	5.2	4.9	6.4	0.1%	1,606.4	32.1%
HR31	College building	ng/m ³	5,000	1,600	3.7	3.9	5.5	4.6	4.2	5.5	0.1%	1,605.5	32.1%
HR32	Roath Park Recreation ground	ng/m ³	5,000	1,600	3.6	4.0	5.4	4.6	4.3	5.4	0.1%	1,605.4	32.1%
HR33	Roath Park Primary School	ng/m ³	5,000	1,600	3.6	4.0	5.4	4.6	4.3	5.4	0.1%	1,605.4	32.1%
HR34	School building	ng/m ³	5,000	1,600	3.9	4.9	6.3	4.8	4.7	6.3	0.1%	1,606.3	32.1%
HR35	School building	ng/m ³	5,000	1,600	4.0	4.6	6.2	5.0	4.7	6.2	0.1%	1,606.2	32.1%
HR36	University of Wales Cardiff	ng/m ³	5,000	1,600	5.9	6.3	7.8	6.3	7.5	7.8	0.2%	1,607.8	32.2%
HR37	Cathays Park	ng/m ³	5,000	1,600	6.4	6.4	7.9	6.6	8.1	8.1	0.2%	1,608.1	32.2%
HR38	Virgin Church in Wales Primary School	ng/m ³	5,000	1,600	6.9	6.2	7.4	6.2	4.2	7.4	0.1%	1,607.4	32.1%
HR39	Mountstuart Primary School	ng/m ³	5,000	1,600	13.5	11.9	11.3	11.6	9.4	13.5	0.3%	1,613.5	32.3%
HR40	Royal Hamadryad Hospital	ng/m ³	5,000	1,600	12.2	11.2	10.8	11.5	8.6	12.2	0.2%	1,612.2	32.2%
HR41	St Pauls Primary School	ng/m ³	5,000	1,600	9.1	9.0	8.8	9.8	5.9	9.8	0.2%	1,609.8	32.2%
HR42	St Patricks RC Primary School	ng/m ³	5,000	1,600	4.5	5.2	4.7	5.3	3.7	5.3	0.1%	1,605.3	32.1%
HR43	Ninian Park Primary School	ng/m ³	5,000	1,600	4.4	5.0	4.5	5.0	3.7	5.0	0.1%	1,605.0	32.1%
HR44	St Davids Hospital	ng/m ³	5,000	1,600	5.8	5.2	6.9	5.5	5.2	6.9	0.1%	1,606.9	32.1%
HR45	Castle Mews – College	ng/m ³	5,000	1,600	6.7	6.4	8.1	6.7	8.1	8.1	0.2%	1,608.1	32.2%
HR46	Nursery – plants	ng/m ³	5,000	1,600	5.9	5.9	7.3	6.2	7.5	7.5	0.2%	1,607.5	32.2%
HR47	Uni library	ng/m ³	5,000	1,600	5.4	6.0	7.4	6.0	6.9	7.4	0.1%	1,607.4	32.1%

HR48	Ysgol Mynydd Bychan School #1	ng/m ³	5,000	1,600	4.0	4.8	5.9	4.8	5.1	5.9	0.1%	1,605.9	32.1%
HR49	Ysgol Mynydd Bychan School #2	ng/m ³	5,000	1,600	3.6	4.5	5.7	4.4	4.3	5.7	0.1%	1,605.7	32.1%
HR50	Severn County Junior School	ng/m ³	5,000	1,600	5.1	4.6	6.1	4.8	4.4	6.1	0.1%	1,606.1	32.1%
HR51	St Marys Catholic Primary School	ng/m ³	5,000	1,600	5.3	4.8	6.4	5.1	4.8	6.4	0.1%	1,606.4	32.1%
HR52	Kitchener County Primary School	ng/m ³	5,000	1,600	4.4	4.1	4.9	4.1	3.4	4.9	0.1%	1,604.9	32.1%
HR53	Llandough Primary School	ng/m ³	5,000	1,600	7.2	7.4	7.0	6.6	6.1	7.4	0.1%	1,607.4	32.1%
HR54	Llandough Hospital N.H.S Trust	ng/m ³	5,000	1,600	6.9	7.1	7.0	6.5	5.8	7.1	0.1%	1,607.1	32.1%

Note:
Assumes continual operation of the ERF at the daily mean ELVs

Max @	HR14	14.0	0.3%
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Annual mean cadmium

ID	Receptor	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
HR1	Willows High School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR2	Baden Powell County Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR3	Splott Health centre	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR4	Splott Rec South	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR5	Splott Rec North	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR6	Moorland Primary School #1	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR7	College building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR8	Library	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR9	Allotments	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR10	Howardian Centre	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR11	University of Wales Institute	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR12	St Peters Rec	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR13	Moorland park	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR14	National Assembly	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.6%	1,400.0	28000.6%
HR15	County Hall	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR16	St Cuthbert's RC Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR17	Adamstown County Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR18	College	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR19	Cardiff Royal Infirmary #1	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR20	Cardiff Royal Infirmary #2	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR21	Cardiff Royal Infirmary #3	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR22	St Peter's RC Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR23	School building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR24	School building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR25	College building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR26	College building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR27	College building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR28	Moorland Primary School #2	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR29	St Anne's Church in Wales Infant	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR30	Marlborough Junior School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR31	College building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR32	Roath Park Recreation ground	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR33	Roath Park Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR34	School building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR35	School building	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR36	University of Wales Cardiff	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR37	Cathays Park	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR38	Virgin Church in Wales Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR39	Mountstuart Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.5%	1,400.0	28000.5%
HR40	Royal Hamadryad Hospital	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.5%	1,400.0	28000.5%
HR41	St Pauls Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.4%	1,400.0	28000.4%
HR42	St Patricks RC Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR43	Ninian Park Primary School	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR44	St Davids Hospital	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR45	Castle Mews – College	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR46	Nursery – plants	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR47	Uni library	ng/m ³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%

HR48	Ysgol Mynydd Bychan School #1	ng/m³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR49	Ysgol Mynydd Bychan School #2	ng/m³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR50	Severn County Junior School	ng/m³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR51	St Marys Catholic Primary School	ng/m³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR52	Kitchener County Primary School	ng/m³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.2%	1,400.0	28000.2%
HR53	Llandough Primary School	ng/m³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%
HR54	Llandough Hospital N.H.S Trust	ng/m³	5	1,400	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	1,400.0	28000.3%

Note:
Assumes continual operation of the ERF at the daily mean ELVs

Max @	HR14	0.0	0.6%
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Annual mean oxides of nitrogen

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	µg/m³	30	25.0	1.02	0.83	0.93	1.08	1.08	1.08	3.60%	26.12	87.1%
E2	River Usk / Afon Wysg	µg/m³	30	23.5	0.04	0.04	0.04	0.04	0.04	0.04	0.15%	23.53	78.4%
E3	Cardiff Beech Woods	µg/m³	30	16.1	0.02	0.03	0.04	0.03	0.03	0.04	0.13%	16.09	53.6%
E4	Severn Estuary (England)	µg/m³	30	25.0	0.12	0.14	0.10	0.12	0.13	0.14	0.47%	25.18	83.9%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	µg/m³	30	15.3	0.04	0.05	0.06	0.06	0.05	0.06	0.21%	15.31	51.0%
E8	Caeau Blaen-bielly	µg/m³	30	9.4	0.02	0.03	0.03	0.03	0.04	0.04	0.12%	9.41	31.4%
E9	Castell Coch Woodlands and Road Section	µg/m³	30	13.6	0.03	0.03	0.04	0.03	0.03	0.04	0.13%	13.66	45.5%
E10	Cefn Onn	µg/m³	30	10.1	0.03	0.03	0.04	0.04	0.03	0.04	0.12%	10.15	33.8%
E11	Cliff Wood - Golden Stairs	µg/m³	30	8.7	0.06	0.06	0.06	0.05	0.05	0.06	0.21%	8.73	29.1%
E12	Coed y Bedw	µg/m³	30	10.0	0.02	0.03	0.03	0.03	0.03	0.03	0.11%	10.06	33.5%
E13	Coedydd y Barri / Barry Woodlands	µg/m³	30	9.6	0.09	0.09	0.10	0.09	0.07	0.10	0.32%	9.65	32.2%
E14	Cog Moors	µg/m³	30	10.7	0.05	0.07	0.05	0.06	0.05	0.07	0.24%	10.78	35.9%
E16	Cwm Cydfin, Leckwith	µg/m³	30	17.2	0.13	0.13	0.13	0.14	0.09	0.14	0.47%	17.34	57.8%
E17	Ely Valley	µg/m³	30	13.0	0.04	0.04	0.05	0.04	0.04	0.05	0.16%	13.08	43.6%
E18	Fforestganol a Chwm Nofydd	µg/m³	30	15.9	0.03	0.03	0.04	0.03	0.03	0.04	0.13%	15.90	53.0%
E19	Flat Holm	µg/m³	30	25.0	0.04	0.04	0.04	0.03	0.03	0.04	0.15%	25.08	83.6%
E20	Garth Wood	µg/m³	30	16.1	0.03	0.03	0.04	0.03	0.04	0.04	0.13%	16.09	53.6%
E21	Glamorgan Canal / Long Wood	µg/m³	30	19.2	0.04	0.04	0.05	0.05	0.05	0.05	0.17%	19.27	64.2%
E22	Gwaun Gledyr	µg/m³	30	14.3	0.02	0.02	0.03	0.03	0.02	0.03	0.09%	14.28	47.6%
E23	Gwent Levels - St. Brides	µg/m³	30	16.7	0.06	0.06	0.06	0.05	0.05	0.06	0.20%	16.78	55.9%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	µg/m³	30	11.0	0.05	0.04	0.05	0.04	0.05	0.05	0.16%	11.08	36.9%
E26	Lisvane Reservoir	µg/m³	30	15.2	0.04	0.05	0.06	0.05	0.05	0.06	0.20%	15.27	50.9%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	µg/m³	30	8.9	0.04	0.06	0.05	0.04	0.04	0.06	0.19%	8.96	29.9%
E28	Nant Whitton Woodlands	µg/m³	30	7.4	0.04	0.05	0.05	0.05	0.05	0.05	0.18%	7.48	24.9%
E29	Penarth Coast	µg/m³	30	10.4	0.04	0.06	0.05	0.04	0.04	0.06	0.18%	10.43	34.8%
E31	Plas Machen Wood	µg/m³	30	10.1	0.03	0.03	0.03	0.03	0.03	0.03	0.11%	10.13	33.8%
E35	Ruperra Castle and Woodlands	µg/m³	30	9.9	0.03	0.03	0.04	0.04	0.03	0.04	0.12%	9.92	33.1%
E38	Ty Du Moor	µg/m³	30	11.6	0.03	0.04	0.05	0.04	0.04	0.05	0.16%	11.63	38.8%
E40	Fferm Walters	µg/m³	30	11.3	0.06	0.07	0.07	0.06	0.05	0.07	0.24%	11.39	38.0%
E41	Gwent Levels - Rumney and Peterstone	µg/m³	30	17.5	0.15	0.15	0.16	0.14	0.12	0.16	0.52%	17.64	58.8%
E46	Cardiff Bay Wetland and Hamadryad Park	µg/m³	30	19.40	0.25	0.21	0.17	0.16	0.18	0.25	0.82%	19.65	65.5%
E47	Cardiff Heliport Fields	µg/m³	30	25.00	0.69	0.66	0.68	0.76	0.83	0.83	2.77%	25.83	86.1%
E48	Tidal Sidings	µg/m³	30	25.00	0.27	0.30	0.33	0.29	0.32	0.33	1.12%	25.33	84.4%
E49	Ocean Park South	µg/m³	30	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%	25.00	83.3%
E50	Beach Sidings	µg/m³	30	19.50	0.09	0.10	0.11	0.08	0.13	0.13	0.42%	19.63	65.4%
E51	Cardiff Bay Wetland Reserve	µg/m³	30	19.40	0.24	0.21	0.17	0.15	0.18	0.24	0.81%	19.64	65.5%
E52	River Taff	µg/m³	30	19.40	0.22	0.20	0.21	0.24	0.13	0.24	0.81%	19.64	65.5%
E53	Pengam Moors	µg/m³	30	19.10	0.17	0.19	0.19	0.16	0.15	0.19	0.63%	19.29	64.3%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	1.08	3.6%
Max @ non-statutory designated site	E47	0.83	2.8%

Daily mean oxides of nitrogen

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	µg/m³	75	50.1	7.20	6.29	7.18	7.34	6.30	7.34	9.78%	57.42	76.6%
E2	River Usk / Afon Wysg	µg/m³	75	47.0	0.72	0.59	0.41	0.45	0.62	0.72	0.95%	47.70	63.6%
E3	Cardiff Beech Woods	µg/m³	75	32.1	0.40	0.60	0.58	0.47	0.40	0.60	0.80%	32.70	43.6%
E4	Severn Estuary (England)	µg/m³	75	50.1	1.44	1.28	1.12	1.46	1.32	1.46	1.95%	51.54	68.7%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	µg/m³	75	30.5	0.89	0.88	1.03	0.89	0.89	1.03	1.37%	31.53	42.0%
E8	Caeau Blaen-bielly	µg/m³	75	18.7	0.32	0.44	0.55	0.39	0.40	0.55	0.74%	19.29	25.7%
E9	Castell Coch Woodlands and Road Section	µg/m³	75	27.2	0.47	0.50	0.47	0.40	0.48	0.50	0.67%	27.74	37.0%
E10	Cefn Onn	µg/m³	75	20.2	0.44	0.51	0.53	0.58	0.64	0.64	0.86%	20.86	27.8%
E11	Cliff Wood - Golden Stairs	µg/m³	75	17.3	0.66	0.55	0.55	0.70	0.57	0.70	0.93%	18.04	24.0%
E12	Coed y Bedw	µg/m³	75	20.1	0.35	0.47	0.42	0.37	0.48	0.48	0.63%	20.54	27.4%
E13	Coedydd y Barri / Barry Woodlands	µg/m³	75	19.1	0.85	0.92	1.11	0.77	0.86	1.11	1.48%	20.21	27.0%
E14	Cog Moors	µg/m³	75	21.4	0.89	0.93	0.87	0.73	1.00	1.00	1.34%	22.42	29.9%
E16	Cwm Cydfin, Leckwith	µg/m³	75	34.4	1.94	1.58	1.77	1.83	1.51	1.94	2.58%	36.34	48.4%
E17	Ely Valley	µg/m³	75	26.1	0.69	0.76	0.72	0.83	0.56	0.83	1.10%	26.89	35.8%
E18	Fforestganol a Chwm Nofydd	µg/m³	75	31.7	0.42	0.67	0.55	0.45	0.44	0.67	0.89%	32.39	43.2%
E19	Flat Holm	µg/m³	75	50.1	0.60	0.66	0.79	0.66	0.57	0.79	1.05%	50.87	67.8%
E20	Garth Wood	µg/m³	75	32.1	0.41	0.50	0.42	0.40	0.54	0.54	0.72%	32.64	43.5%
E21	Glamorgan Canal / Long Wood	µg/m³	75	38.4	0.51	0.65	0.55	0.53	0.73	0.73	0.97%	39.17	52.2%
E22	Gwaun Gledyr	µg/m³	75	28.5	0.27	0.37	0.48	0.43	0.33	0.48	0.64%	28.98	38.6%
E23	Gwent Levels - St. Brides	µg/m³	75	33.4	0.79	0.60	0.63	0.59	0.52	0.79	1.05%	34.23	45.6%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	µg/m³	75	22.1	0.79	0.55	0.41	0.55	0.64	0.79	1.05%	22.85	30.5%
E26	Lisvane Reservoir	µg/m³	75	30.4	0.83	0.78	0.97	0.80	0.84	0.97	1.30%	31.39	41.9%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	µg/m³	75	17.8	0.96	0.92	1.00	0.64	0.59	1.00	1.33%	18.82	25.1%
E28	Nant Whitton Woodlands	µg/m³	75	14.9	0.64	0.56	0.53	0.48	0.85	0.85	1.14%	15.71	20.9%
E29	Penarth Coast	µg/m³	75	20.7	0.72	1.27	0.86	0.74	0.72	1.27	1.69%	22.01	29.3%
E31	Plas Machen Wood	µg/m³	75	20.2	0.31	0.45	0.34	0.48	0.41	0.48	0.64%	20.68	27.6%
E35	Ruperra Castle and Woodlands	µg/m³	75	19.8	0.49	0.76	0.49	0.54	0.51	0.76	1.01%	20.52	27.4%
E38	Ty Du Moor	µg/m³	75	23.2	0.35	0.44	0.92	0.81	0.60	0.92	1.22%	24.08	32.1%
E40	Fferm Walters	µg/m³	75	22.6	0.72	0.66	0.78	0.60	0.63	0.78	1.04%	23.42	31.2%
E41	Gwent Levels - Rumney and Peterstone	µg/m³	75	35.0	2.17	2.02	1.95	1.68	1.63	2.17	2.89%	37.14	49.5%
E46	Cardiff Bay Wetland and Hamadryad Park	µg/m³	75	38.80	5.41	4.27	4.59	3.22	3.97	5.41	7.22%	44.21	59.0%
E47	Cardiff Heliport Fields	µg/m³	75	50.00	3.96	4.52	5.39	4.39	4.93	5.39	7.18%	55.39	73.8%
E48	Tidal Sidings	µg/m³	75	50.00	2.37	3.83	3.83	3.48	4.20	4.20	5.60%	54.20	72.3%
E49	Ocean Park South	µg/m³	75	50.00	0.00	0.04	0.00	0.01	0.00	0.04	0.05%	50.04	66.7%
E50	Beach Sidings	µg/m³	75	39.00	3.39	3.26	2.78	1.76	3.68	3.68	4.90%	42.68	56.9%
E51	Cardiff Bay Wetland Reserve	µg/m³	75	38.80	5.44	4.20	4.61	3.18	3.95	5.44	7.25%	44.24	59.0%
E52	River Taff	µg/m³	75	38.80	3.55	3.83	3.28	4.10	3.37	4.10	5.47%	42.90	57.2%
E53	Pengam Moors	µg/m³	75	38.20	3.15	2.59	2.13	3.01	2.84	3.15	4.20%	41.35	55.1%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	7.34	9.8%
Max @ non-statutory designated site	E51	5.44	7.2%

Annual mean sulphur dioxide

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	10,000	5,630	226.76	185.08	206.16	239.86	239.75	239.9	2.40%	5,870	58.7%
E2	River Usk / Afon Wysg	ng/m ³	10,000	5,340	9.40	9.44	9.92	8.90	9.00	9.9	0.10%	5,350	53.5%
E3	Cardiff Beech Woods	ng/m ³	10,000	2,510	5.20	6.92	8.43	6.74	6.21	8.4	0.08%	2,518	25.2%
E4	Severn Estuary (England)	ng/m ³	10,000	5,630	27.03	31.21	23.19	26.27	29.19	31.2	0.31%	5,661	56.6%
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / L	ng/m ³	10,000	3,310	9.51	10.89	14.05	12.42	11.53	14.0	0.14%	3,324	33.2%
E8	Caeau Blaen-bielly	ng/m ³	10,000	1,850	5.18	5.97	7.08	7.07	7.98	8.0	0.08%	1,858	18.6%
E9	Castell Coch Woodlands and Road Section	ng/m ³	10,000	2,510	5.62	7.19	8.46	7.19	7.48	8.5	0.08%	2,518	25.2%
E10	Cefn Onn	ng/m ³	10,000	2,010	5.79	6.79	8.30	7.81	7.54	8.3	0.08%	2,018	20.2%
E11	Cliff Wood - Golden Stairs	ng/m ³	10,000	1,870	12.29	13.70	13.28	11.42	10.57	13.7	0.14%	1,884	18.8%
E12	Coed y Bedw	ng/m ³	10,000	1,820	5.22	6.25	7.53	7.01	7.36	7.5	0.08%	1,828	18.3%
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	10,000	1,710	19.04	19.45	21.31	19.57	16.17	21.3	0.21%	1,731	17.3%
E14	Cog Moors	ng/m ³	20,000	1,860	10.73	16.05	11.97	13.23	12.05	16.1	0.08%	1,876	9.4%
E16	Cwm Cydfin, Leckwith	ng/m ³	10,000	3,280	29.76	29.00	29.42	31.27	20.77	31.3	0.31%	3,311	33.1%
E17	Ely Valley	ng/m ³	20,000	2,000	8.91	9.72	10.93	9.17	8.82	10.9	0.05%	2,011	10.1%
E18	Fforestganol a Chwm Nofydd	ng/m ³	10,000	2,510	5.63	7.33	8.92	7.17	6.70	8.9	0.09%	2,519	25.2%
E19	Flat Holm	ng/m ³	10,000	5,630	8.06	9.81	8.10	6.62	7.75	9.8	0.10%	5,640	56.4%
E20	Garth Wood	ng/m ³	10,000	2,510	5.81	7.17	8.46	7.63	8.19	8.5	0.08%	2,518	25.2%
E21	Glamorgan Canal / Long Wood	ng/m ³	10,000	2,750	8.11	9.75	11.40	10.49	11.48	11.5	0.11%	2,761	27.6%
E22	Gwaun Gledyr	ng/m ³	10,000	2,640	3.97	5.36	6.31	5.71	5.22	6.3	0.06%	2,646	26.5%
E23	Gwent Levels - St. Brides	ng/m ³	20,000	3,090	12.44	12.72	13.44	12.05	10.78	13.4	0.07%	3,103	15.5%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	20,000	1,870	10.01	9.78	10.43	9.29	10.03	10.4	0.05%	1,880	9.4%
E26	Lisvane Reservoir	ng/m ³	20,000	3,090	9.40	10.52	13.29	11.89	11.05	13.3	0.07%	3,103	15.5%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	20,000	1,585	8.34	12.77	11.41	9.51	9.18	12.8	0.06%	1,598	8.0%
E28	Nant Whitton Woodlands	ng/m ³	10,000	1,440	9.30	10.70	12.10	10.20	11.56	12.1	0.12%	1,452	14.5%
E29	Penarth Coast	ng/m ³	20,000	2,070	8.39	12.27	10.94	8.99	9.27	12.3	0.06%	2,082	10.4%
E31	Plas Machen Wood	ng/m ³	10,000	1,840	5.61	6.66	6.94	7.28	6.45	7.3	0.07%	1,847	18.5%
E35	Ruperra Castle and Woodlands	ng/m ³	20,000	1,850	6.72	7.37	7.83	7.82	7.40	7.8	0.04%	1,858	9.3%
E38	Ty Du Moor	ng/m ³	10,000	1,640	7.70	8.55	10.38	9.19	9.91	10.4	0.10%	1,650	16.5%
E40	Fferm Walters	ng/m ³	10,000	2,540	13.69	15.02	15.67	13.87	11.52	15.7	0.16%	2,556	25.6%
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	20,000	3,514	33.41	32.49	34.86	30.18	27.22	34.9	0.17%	3,549	17.7%
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	20,000	3.40	54.56	46.89	38.85	35.15	39.53	54.6	0.27%	57.96	0.3%
E47	Cardiff Heliport Fields	ng/m ³	20,000	5.60	152.33	145.82	150.01	169.01	184.37	184.4	0.92%	189.97	0.9%
E48	Tidal Sidings	ng/m ³	20,000	5.60	60.44	67.58	74.38	64.42	71.45	74.4	0.37%	79.98	0.4%
E49	Ocean Park South	ng/m ³	20,000	5.60	0.00	0.03	0.00	0.01	0.01	0.0	0.00%	5.63	0.0%
E50	Beach Sidings	ng/m ³	20,000	3.80	20.09	21.40	24.15	17.51	28.20	28.2	0.14%	32.00	0.2%
E51	Cardiff Bay Wetland Reserve	ng/m ³	20,000	3.40	53.72	46.35	37.77	33.99	39.15	53.7	0.27%	57.12	0.3%
E52	River Taff	ng/m ³	20,000	3.40	49.53	45.47	46.00	53.85	29.94	53.8	0.27%	57.25	0.3%
E53	Pengam Moors	ng/m ³	20,000	3.50	38.67	41.29	41.70	35.04	34.16	41.7	0.21%	45.20	0.2%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	239.86	2.4%
Max @ non-statutory designated site	E47	184.37	0.9%

Maximum weekly mean hydrogen fluoride

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	500	-	23.33	17.90	18.80	16.86	19.09	23.3	4.67%	-	-
E2	River Usk / Afon Wysg	ng/m ³	500	-	0.98	0.86	1.05	0.82	0.80	1.1	0.21%	-	-
E3	Cardiff Beech Woods	ng/m ³	500	-	0.53	0.87	0.73	0.71	0.58	0.9	0.17%	-	-
E4	Severn Estuary (England)	ng/m ³	500	-	3.36	1.96	1.88	2.67	2.04	3.4	0.67%	-	-
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / L	ng/m ³	500	-	1.31	1.48	2.46	1.36	1.23	2.5	0.49%	-	-
E8	Caeau Blaen-bielly	ng/m ³	500	-	0.56	0.71	0.71	0.74	0.78	0.8	0.16%	-	-
E9	Castell Coch Woodlands and Road Section	ng/m ³	500	-	0.56	0.94	0.93	0.70	0.77	0.9	0.19%	-	-
E10	Cefn Onn	ng/m ³	500	-	0.71	0.91	1.23	0.84	0.82	1.2	0.25%	-	-
E11	Cliff Wood - Golden Stairs	ng/m ³	500	-	1.70	1.88	1.63	1.93	1.86	1.9	0.39%	-	-
E12	Coed y Bedw	ng/m ³	500	-	0.51	0.83	0.79	0.70	0.65	0.8	0.17%	-	-
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	500	-	2.77	2.68	2.81	3.08	2.62	3.1	0.62%	-	-
E14	Cog Moors	ng/m ³	500	-	1.55	2.72	1.45	2.74	1.33	2.7	0.55%	-	-
E16	Cwm Cydfin, Leckwith	ng/m ³	500	-	5.69	4.56	4.82	7.38	3.27	7.4	1.48%	-	-
E17	Ely Valley	ng/m ³	500	-	1.05	1.98	1.04	1.25	1.12	2.0	0.40%	-	-
E18	Fforestganol a Chwm Nofydd	ng/m ³	500	-	0.51	0.96	0.75	0.67	0.62	1.0	0.19%	-	-
E19	Flat Holm	ng/m ³	500	-	1.28	1.11	1.00	0.86	0.90	1.3	0.26%	-	-
E20	Garth Wood	ng/m ³	500	-	0.57	0.94	0.90	0.76	0.79	0.9	0.19%	-	-
E21	Glamorgan Canal / Long Wood	ng/m ³	500	-	0.79	1.31	1.14	1.05	1.13	1.3	0.26%	-	-
E22	Gwaun Gledyr	ng/m ³	500	-	0.28	0.52	0.48	0.61	0.44	0.6	0.12%	-	-
E23	Gwent Levels - St. Brides	ng/m ³	500	-	1.43	1.06	2.01	1.34	1.03	2.0	0.40%	-	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	500	-	1.04	0.87	1.02	0.78	0.95	1.0	0.21%	-	-
E26	Lisvane Reservoir	ng/m ³	500	-	1.18	1.28	2.49	1.26	1.01	2.5	0.50%	-	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	500	-	0.85	1.37	1.59	1.17	1.02	1.6	0.32%	-	-
E28	Nant Whitton Woodlands	ng/m ³	500	-	0.98	1.52	1.35	1.35	1.92	1.9	0.38%	-	-
E29	Penarth Coast	ng/m ³	500	-	0.70	1.74	1.46	1.27	1.30	1.7	0.35%	-	-
E31	Plas Machen Wood	ng/m ³	500	-	0.51	0.72	0.60	0.75	0.47	0.7	0.15%	-	-
E35	Ruperra Castle and Woodlands	ng/m ³	500	-	0.59	0.86	0.86	0.87	0.65	0.9	0.17%	-	-
E38	Ty Du Moor	ng/m ³	500	-	0.72	0.77	1.05	1.06	1.05	1.1	0.21%	-	-
E40	Fferm Walters	ng/m ³	500	-	1.60	1.77	1.99	1.71	1.84	2.0	0.40%	-	-
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	500	-	3.86	3.04	5.57	3.54	3.88	5.6	1.11%	-	-
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	500	-	12.22	8.49	7.47	5.73	13.58	13.6	2.72%	-	-
E47	Cardiff Heliport Fields	ng/m ³	500	-	14.09	13.00	14.25	11.79	14.77	14.8	2.95%	-	-
E48	Tidal Sidings	ng/m ³	500	-	5.91	8.51	8.58	8.20	6.23	8.6	1.72%	-	-
E49	Ocean Park South	ng/m ³	500	-	0.00	0.03	0.00	0.01	0.00	0.0	0.01%	-	-
E50	Beach Sidings	ng/m ³	500	-	3.68	4.14	5.27	3.34	5.48	5.5	1.10%	-	-
E51	Cardiff Bay Wetland Reserve	ng/m ³	500	-	12.29	8.03	7.20	5.44	13.46	13.5	2.69%	-	-
E52	River Taff	ng/m ³	500	-	11.05	6.28	8.71	15.59	7.34	15.6	3.12%	-	-
E53	Pengam Moors	ng/m ³	500	-	4.44	4.06	5.66	4.89	7.14	7.1	1.43%	-	-

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	23.33	4.7%
Max @ non-statutory designated site	E52	15.59	3.1%

Maximum daily mean hydrogen fluoride

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	5,000	-	39.99	34.94	39.88	40.76	35.01	40.8	0.82%	-	-
E2	River Usk / Afon Wysg	ng/m ³	5,000	-	3.97	3.28	2.29	2.52	3.46	4.0	0.08%	-	-
E3	Cardiff Beech Woods	ng/m ³	5,000	-	2.20	3.34	3.24	2.59	2.21	3.3	0.07%	-	-
E4	Severn Estuary (England)	ng/m ³	5,000	-	7.98	7.11	6.22	8.12	7.31	8.1	0.16%	-	-
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / L	ng/m ³	5,000	-	4.94	4.88	5.71	4.96	4.93	5.7	0.11%	-	-
E8	Caeau Blaen-bielly	ng/m ³	5,000	-	1.76	2.45	3.06	2.16	2.23	3.1	0.06%	-	-
E9	Castell Coch Woodlands and Road Section	ng/m ³	5,000	-	2.59	2.77	2.59	2.24	2.68	2.8	0.06%	-	-
E10	Cefn Onn	ng/m ³	5,000	-	2.42	2.85	2.96	3.24	3.58	3.6	0.07%	-	-
E11	Cliff Wood - Golden Stairs	ng/m ³	5,000	-	3.68	3.07	3.07	3.86	3.17	3.9	0.08%	-	-
E12	Coed y Bedw	ng/m ³	5,000	-	1.94	2.60	2.31	2.04	2.64	2.6	0.05%	-	-
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	5,000	-	4.74	5.12	6.18	4.26	4.79	6.2	0.12%	-	-
E14	Cog Moors	ng/m ³	5,000	-	4.95	5.15	4.84	4.04	5.58	5.6	0.11%	-	-
E16	Cwm Cydfin, Leckwith	ng/m ³	5,000	-	10.75	8.76	9.81	10.15	8.40	10.8	0.22%	-	-
E17	Ely Valley	ng/m ³	5,000	-	3.82	4.24	4.03	4.60	3.11	4.6	0.09%	-	-
E18	Fforestganol a Chwm Nofydd	ng/m ³	5,000	-	2.34	3.72	3.05	2.48	2.42	3.7	0.07%	-	-
E19	Flat Holm	ng/m ³	5,000	-	3.36	3.68	4.37	3.69	3.18	4.4	0.09%	-	-
E20	Garth Wood	ng/m ³	5,000	-	2.26	2.80	2.31	2.25	3.00	3.0	0.06%	-	-
E21	Glamorgan Canal / Long Wood	ng/m ³	5,000	-	2.85	3.60	3.04	2.97	4.04	4.0	0.08%	-	-
E22	Gwaun Gledyr	ng/m ³	5,000	-	1.49	2.04	2.65	2.40	1.82	2.6	0.05%	-	-
E23	Gwent Levels - St. Brides	ng/m ³	5,000	-	4.36	3.31	3.48	3.27	2.90	4.4	0.09%	-	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	5,000	-	4.39	3.04	2.29	3.05	3.58	4.4	0.09%	-	-
E26	Lisvane Reservoir	ng/m ³	5,000	-	4.60	4.34	5.40	4.45	4.65	5.4	0.11%	-	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	5,000	-	5.34	5.09	5.56	3.53	3.27	5.6	0.11%	-	-
E28	Nant Whitton Woodlands	ng/m ³	5,000	-	3.55	3.10	2.97	2.67	4.73	4.7	0.09%	-	-
E29	Penarth Coast	ng/m ³	5,000	-	4.03	7.04	4.80	4.10	4.02	7.0	0.14%	-	-
E31	Plas Machen Wood	ng/m ³	5,000	-	1.74	2.48	1.90	2.68	2.29	2.7	0.05%	-	-
E35	Ruperra Castle and Woodlands	ng/m ³	5,000	-	2.73	4.22	2.75	3.01	2.81	4.2	0.08%	-	-
E38	Ty Du Moor	ng/m ³	5,000	-	1.93	2.44	5.09	4.52	3.34	5.1	0.10%	-	-
E40	Fferm Walters	ng/m ³	5,000	-	3.98	3.68	4.33	3.35	3.52	4.3	0.09%	-	-
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	5,000	-	12.04	11.23	10.83	9.35	9.08	12.0	0.24%	-	-
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	5,000	-	30.08	23.74	25.51	17.90	22.06	30.1	0.60%	-	-
E47	Cardiff Heliport Fields	ng/m ³	5,000	-	22.01	25.13	29.93	24.41	27.40	29.9	0.60%	-	-
E48	Tidal Sidings	ng/m ³	5,000	-	13.15	21.29	21.26	19.35	23.32	23.3	0.47%	-	-
E49	Ocean Park South	ng/m ³	5,000	-	0.00	0.20	0.01	0.04	0.02	0.2	0.00%	-	-
E50	Beach Sidings	ng/m ³	5,000	-	18.85	18.10	15.46	9.78	20.42	20.4	0.41%	-	-
E51	Cardiff Bay Wetland Reserve	ng/m ³	5,000	-	30.21	23.34	25.58	17.65	21.94	30.2	0.60%	-	-
E52	River Taff	ng/m ³	5,000	-	19.70	21.26	18.23	22.78	18.69	22.8	0.46%	-	-
E53	Pengam Moors	ng/m ³	5,000	-	17.52	14.37	11.83	16.71	15.76	17.5	0.35%	-	-

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	40.76	0.8%
Max @ non-statutory designated site	E51	30.21	0.6%

Annual mean ammonia

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	1,000	1,710	84.98	69.36	77.26	89.89	89.84	89.9	8.99%	1799.89	180.0%
E2	River Usk / Afon Wysg	ng/m ³	1,000	1,610	3.52	3.54	3.72	3.34	3.37	3.7	0.37%	1613.72	161.4%
E3	Cardiff Beech Woods	ng/m ³	1,000	990	1.95	2.59	3.16	2.53	2.33	3.2	0.32%	993.16	99.3%
E4	Severn Estuary (England)	ng/m ³	3,000	1,710	10.13	11.70	8.69	9.84	10.94	11.7	0.39%	1721.70	57.4%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	ng/m ³	1,000	1,180	3.56	4.08	5.26	4.65	4.32	5.3	0.53%	1185.26	118.5%
E8	Caeau Blaen-bielly	ng/m ³	1,000	910	1.94	2.24	2.65	2.65	2.99	3.0	0.30%	912.99	91.3%
E9	Castell Coch Woodlands and Road Section	ng/m ³	1,000	990	2.11	2.70	3.17	2.69	2.80	3.2	0.32%	993.17	99.3%
E10	Cefn Onn	ng/m ³	1,000	920	2.17	2.54	3.11	2.93	2.83	3.1	0.31%	923.11	92.3%
E11	Cliff Wood - Golden Stairs	ng/m ³	1,000	960	4.60	5.13	4.98	4.28	3.96	5.1	0.51%	965.13	96.5%
E12	Coed y Bedw	ng/m ³	1,000	910	1.96	2.34	2.82	2.63	2.76	2.8	0.28%	912.82	91.3%
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	1,000	1,060	7.13	7.29	7.99	7.33	6.06	8.0	0.80%	1067.99	106.8%
E14	Cog Moors	ng/m ³	3,000	1,090	4.02	6.01	4.49	4.96	4.52	6.0	0.20%	1096.01	36.5%
E16	Cwm Cydfin, Leckwith	ng/m ³	1,000	1,110	11.15	10.87	11.02	11.72	7.78	11.7	1.17%	1121.72	112.2%
E17	Ely Valley	ng/m ³	3,000	1,000	3.34	3.64	4.09	3.44	3.30	4.1	0.14%	1004.09	33.5%
E18	Fforestganol a Chwm Nofydd	ng/m ³	1,000	1,050	2.11	2.75	3.34	2.69	2.51	3.3	0.33%	1053.34	105.3%
E19	Flat Holm	ng/m ³	1,000	1,710	3.02	3.68	3.04	2.48	2.90	3.7	0.37%	1713.68	171.4%
E20	Garth Wood	ng/m ³	1,000	950	2.18	2.69	3.17	2.86	3.07	3.2	0.32%	953.17	95.3%
E21	Glamorgan Canal / Long Wood	ng/m ³	1,000	1,110	3.04	3.65	4.27	3.93	4.30	4.3	0.43%	1114.30	111.4%
E22	Gwaun Gledyr	ng/m ³	1,000	930	1.49	2.01	2.37	2.14	1.96	2.4	0.24%	932.37	93.2%
E23	Gwent Levels - St. Brides	ng/m ³	3,000	1,570	4.66	4.77	5.04	4.52	4.04	5.0	0.17%	1575.04	52.5%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	3,000	1,460	3.75	3.67	3.91	3.48	3.76	3.9	0.13%	1463.91	48.8%
E26	Lisvane Reservoir	ng/m ³	3,000	1,160	3.52	3.94	4.98	4.46	4.14	5.0	0.17%	1164.98	38.8%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	3,000	1,141	3.13	4.79	4.28	3.56	3.44	4.8	0.16%	1145.79	38.2%
E28	Nant Whitton Woodlands	ng/m ³	1,000	1,070	3.48	4.01	4.53	3.82	4.33	4.5	0.45%	1074.53	107.5%
E29	Penarth Coast	ng/m ³	3,000	1,160	3.14	4.60	4.10	3.37	3.47	4.6	0.15%	1164.60	38.8%
E31	Plas Machen Wood	ng/m ³	1,000	980	2.10	2.50	2.60	2.73	2.42	2.7	0.27%	982.73	98.3%
E35	Ruperra Castle and Woodlands	ng/m ³	3,000	1,020	2.52	2.76	2.93	2.93	2.77	2.9	0.10%	1022.93	34.1%
E38	Ty Du Moor	ng/m ³	1,000	960	2.88	3.20	3.89	3.44	3.71	3.9	0.39%	963.89	96.4%
E40	Fferm Walters	ng/m ³	1,000	1,090	5.13	5.63	5.87	5.20	4.32	5.9	0.59%	1095.87	109.6%
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	3,000	1,365	12.52	12.18	13.06	11.31	10.20	13.1	0.44%	1378.06	45.9%
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	3,000	1,100	20.45	17.57	14.56	13.17	14.82	20.4	0.68%	1120.45	37.3%
E47	Cardiff Heliport Fields	ng/m ³	3,000	1,100	57.08	54.65	56.22	63.34	69.09	69.1	2.30%	1169.09	39.0%
E48	Tidal Sidings	ng/m ³	3,000	1,100	22.65	25.33	27.87	24.14	26.78	27.9	0.93%	1127.87	37.6%
E49	Ocean Park South	ng/m ³	3,000	1,100	0.00	0.01	0.00	0.00	0.00	0.0	0.00%	1100.01	36.7%
E50	Beach Sidings	ng/m ³	3,000	1,100	7.53	8.02	9.05	6.56	10.57	10.6	0.35%	1110.57	37.0%
E51	Cardiff Bay Wetland Reserve	ng/m ³	3,000	1,100	20.13	17.37	14.16	12.74	14.67	20.1	0.67%	1120.13	37.3%
E52	River Taff	ng/m ³	3,000	1,100	18.56	17.04	17.24	20.18	11.22	20.2	0.67%	1120.18	37.3%
E53	Pengam Moors	ng/m ³	3,000	1,100	14.49	15.47	15.63	13.13	12.80	15.6	0.52%	1115.63	37.2%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	89.89	9.0%
Max @ non-statutory designated site	E47	69.09	2.3%

ERF

		Max Conc. (ng/m ³)			
ID	Receptor	NO2	SO2	HCl	NH3
E1	Severn Estuary (Wales)	691.49	219.52	43.90	82.32
E2	River Usk / Afon Wysg	29.39	9.33	1.87	3.50
E3	Cardiff Beech Woods	21.11	6.70	1.34	2.51
E4	Severn Estuary (England)	86.24	27.38	5.48	10.27
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / Llanishen and	36.79	11.68	2.34	4.38
E8	Caeau Blaen-bielly	20.97	6.66	1.33	2.50
E9	Castell Coch Woodlands and Road Section	22.64	7.19	1.44	2.70
E10	Cefn Onn	22.83	7.25	1.45	2.72
E11	Cliff Wood - Golden Stairs	38.58	12.25	2.45	4.59
E12	Coed y Bedw	21.02	6.67	1.33	2.50
E13	Coedydd y Barri / Barry Woodlands	60.19	19.11	3.82	7.17
E14	Cog Moors	40.34	12.81	2.56	4.80
E16	Cwm Cydfin, Leckwith	88.33	28.04	5.61	10.52
E17	Ely Valley	29.95	9.51	1.90	3.57
E18	Fforestganol a Chwm Nofydd	22.52	7.15	1.43	2.68
E19	Flat Holm	25.42	8.07	1.61	3.03
E20	Garth Wood	23.47	7.45	1.49	2.79
E21	Glamorgan Canal / Long Wood	32.27	10.24	2.05	3.84
E22	Gwaun Gledyr	16.75	5.32	1.06	1.99
E23	Gwent Levels - St. Brides	38.70	12.29	2.46	4.61
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	31.20	9.91	1.98	3.71
E26	Lisvane Reservoir	35.37	11.23	2.25	4.21
E27	Llynnoedd Cosmeston / Cosmeston Lakes	32.26	10.24	2.05	3.84
E28	Nant Whitton Woodlands	33.93	10.77	2.15	4.04
E29	Penarth Coast	31.41	9.97	1.99	3.74
E31	Plas Machen Wood	20.75	6.59	1.32	2.47
E35	Ruperra Castle and Woodlands	23.40	7.43	1.49	2.79
E38	Ty Du Moor	28.80	9.14	1.83	3.43
E40	Fferm Walters	43.96	13.96	2.79	5.23
E41	Gwent Levels - Rumney and Peterstone	99.64	31.63	6.33	11.86
E46	Cardiff Bay Wetland and Hamadryad Park	135.44	43.00	8.60	16.12
E47	Cardiff Heliport Fields	504.98	160.31	32.06	60.12
E48	Tidal Sidings	213.11	67.65	13.53	25.37
E49	Ocean Park South	0.03	0.01	0.00	0.00
E50	Beach Sidings	70.15	22.27	4.45	8.35
E51	Cardiff Bay Wetland Reserve	132.92	42.20	8.44	15.82
E52	River Taff	141.62	44.96	8.99	16.86
E53	Pengam Moors	120.24	38.17	7.63	14.31

Note:
Assumes continual operation of the ERF at the daily mean ELV - average of 5-years weather data

Grassland								Woodland							
Deposition (g/ha/yr)				Total N Depositio n (gN/ha/yr)	Acid Deposition keq/ha/yr *1,000			Deposition (g/ha/yr)				Total N Depositio n (gN/ha/yr)	Acid Deposition keq/ha/yr *1,000		
NO2	SO2	HCl	NH3		N	S		NO2	SO2	HCl	NH3		N	S	
99.57	415.42	336.63	427.57	527.15	37.65	44.93		199.15	830.84	807.92	641.36	840.51	60.04	97.44	
4.23	17.66	14.31	18.18	22.41	1.60	1.91		8.47	35.32	34.34	27.26	35.73	2.55	4.14	
3.04	12.68	10.28	13.05	16.09	1.15	1.37		6.08	25.37	24.67	19.58	25.66	1.83	2.98	
12.42	51.81	41.98	53.33	65.74	4.70	5.60		24.84	103.62	100.76	79.99	104.82	7.49	12.15	
5.30	22.10	17.91	22.75	28.04	2.00	2.39		10.59	44.20	42.98	34.12	44.72	3.19	5.18	
3.02	12.60	10.21	12.96	15.98	1.14	1.36		6.04	25.19	24.50	19.45	25.48	1.82	2.95	
3.26	13.60	11.02	14.00	17.26	1.23	1.47		6.52	27.20	26.45	21.00	27.52	1.97	3.19	
3.29	13.72	11.11	14.12	17.40	1.24	1.48		6.57	27.43	26.67	21.17	27.75	1.98	3.22	
5.56	23.18	18.78	23.86	29.41	2.10	2.51		11.11	46.36	45.08	35.79	46.90	3.35	5.44	
3.03	12.63	10.23	13.00	16.02	1.14	1.37		6.05	25.26	24.56	19.50	25.55	1.83	2.96	
8.67	36.16	29.30	37.22	45.89	3.28	3.91		17.33	72.32	70.33	55.83	73.16	5.23	8.48	
5.81	24.24	19.64	24.94	30.75	2.20	2.62		11.62	48.47	47.14	37.42	49.04	3.50	5.69	
12.72	53.07	43.00	54.62	67.34	4.81	5.74		25.44	106.14	103.21	81.93	107.37	7.67	12.45	
4.31	17.99	14.58	18.52	22.83	1.63	1.95		8.63	35.99	34.99	27.78	36.41	2.60	4.22	
3.24	13.53	10.97	13.93	17.17	1.23	1.46		6.49	27.06	26.32	20.89	27.38	1.96	3.17	
3.66	15.27	12.37	15.72	19.38	1.38	1.65		7.32	30.54	29.70	23.57	30.89	2.21	3.58	
3.38	14.10	11.43	14.51	17.90	1.28	1.53		6.76	28.20	27.43	21.77	28.53	2.04	3.31	
4.65	19.39	15.71	19.95	24.60	1.76	2.10		9.29	38.77	37.70	29.93	39.22	2.80	4.55	
2.41	10.06	8.15	10.35	12.77	0.91	1.09		4.82	20.12	19.56	15.53	20.35	1.45	2.36	
5.57	23.25	18.84	23.93	29.50	2.11	2.51		11.14	46.50	45.21	35.89	47.04	3.36	5.45	
4.49	18.75	15.19	19.29	23.79	1.70	2.03		8.99	37.49	36.46	28.94	37.93	2.71	4.40	
5.09	21.25	17.22	21.87	26.97	1.93	2.30		10.19	42.50	41.33	32.81	43.00	3.07	4.98	
4.65	19.38	15.71	19.95	24.60	1.76	2.10		9.29	38.77	37.70	29.93	39.22	2.80	4.55	
4.89	20.38	16.52	20.98	25.86	1.85	2.20		9.77	40.76	39.64	31.47	41.24	2.95	4.78	
4.52	18.87	15.29	19.42	23.95	1.71	2.04		9.05	37.74	36.70	29.13	38.18	2.73	4.43	
2.99	12.46	10.10	12.83	15.82	1.13	1.35		5.98	24.93	24.24	19.24	25.22	1.80	2.92	
3.37	14.06	11.39	14.47	17.84	1.27	1.52		6.74	28.11	27.34	21.70	28.44	2.03	3.30	
4.15	17.30	14.02	17.81	21.96	1.57	1.87		8.30	34.61	33.65	26.72	35.01	2.50	4.06	
6.33	26.41	21.40	27.18	33.51	2.39	2.86		12.66	52.82	51.36	40.77	53.43	3.82	6.19	
14.35	59.86	48.51	61.61	75.96	5.43	6.47		28.70	119.72	116.42	92.42	121.11	8.65	14.04	
19.50	81.36	65.93	83.74	103.25	7.37	8.80		39.01	162.73	158.24	125.62	164.62	11.76	19.09	
72.72	303.37	245.84	312.24	384.96	27.50	32.81		145.43	606.74	590.00	468.37	613.80	43.84	71.16	
30.69	128.03	103.75	131.77	162.46	11.60	13.85		61.37	256.05	248.99	197.66	259.03	18.50	30.03	
0.00	0.02	0.01	0.02	0.02	0.00	0.00		0.01	0.04	0.03	0.03	0.04	0.00	0.00	
10.10	42.14	34.15	43.38	53.48	3.82	4.56		20.20	84.29	81.96	65.06	85.27	6.09	9.89	
19.14	79.85	64.71	82.19	101.33	7.24	8.64		38.28	159.71	155.30	123.28	161.56	11.54	18.73	
20.39	85.08	68.94	87.57	107.96	7.71	9.20		40.79	170.16	165.47	131.35	172.14	12.30	19.96	
17.31	72.23	58.53	74.35	91.66	6.55	7.81		34.63	144.47	140.48	111.52	146.15	10.44	16.94	

Nitrogen Deposition

ID	Name	Nitrogen CL Class	Deposition Velocity	Background (kgN/ha/yr)	CL min (kgN/ha/yr)	PC (gN/ha/yr)	PC (as % of CL)	PEC (kgN/ha/yr)	PEC (as % of CL)
E1	Severn Estuary (Wales)	Atlantic Upper-mid and mid-low salt marshes	Grassland	14.2	10	527.15	5.27%	14.697	146.97%
E2	River Usk / Afon Wysg	Acidophilous Quercus forest	Woodland	33.0	10	35.73	0.36%	33.076	330.76%
E2	River Usk / Afon Wysg	Atlantic upper-mid & mid-low salt marshes	Grassland	21.6	10	22.41	0.22%	21.612	216.12%
E3	Cardiff Beech Woods	Broadleaved deciduous woodland	Woodland	23.3	10	25.66	0.26%	23.306	233.06%
E4	Severn Estuary (England)	Atlantic Upper-mid and mid-low salt marshes	Grassland	14.2	10	65.74	0.66%	14.236	142.36%
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / Lla	No critical load has been assigned for this feature	Grassland	13.3	-	28.04	-	13.348	-
E8	Caeau Blaen-bielly	Low and medium altitude hay meadows	Grassland	12.7	10	15.98	0.16%	12.726	127.26%
E9	Castell Coch Woodlands and Road Section	Broadleaved deciduous woodland	Woodland	23.1	10	27.52	0.28%	23.088	230.88%
E10	Cefn Onn	Semi-dry Perennial calcareous grassland (basic meadow steppe)	Grassland	13.2	10	17.40	0.17%	13.227	132.27%
E11	Cliff Wood - Golden Stairs	Broadleaved deciduous woodland	Woodland	18.4	10	46.90	0.47%	18.467	184.67%
E12	Coed y Bedw	Broadleaved deciduous woodland	Woodland	22.6	10	25.55	0.26%	22.576	225.76%
E13	Coedydd y Barri / Barry Woodlands	Broadleaved deciduous woodland	Woodland	20.5	10	73.16	0.73%	20.603	206.03%
E14	Cog Moors	Low and medium altitude hay meadows	Grassland	10.5	10	30.75	0.31%	10.551	105.51%
E16	Cwm Cydfin, Leckwith	Broadleaved deciduous woodland	Woodland	22.0	10	107.37	1.07%	22.107	221.07%
E17	Ely Valley	No critical load has been assigned for this feature	Grassland	11.9	-	22.83	-	11.953	-
E18	Forestganol a Chwm Nofydd	Broadleaved deciduous woodland	Woodland	23.3	10	27.38	0.27%	23.367	233.67%
E19	Flat Holm	Coastal grassland	Grassland	21.6	5	19.38	0.39%	21.609	432.19%
E20	Garth Wood	Fagus forest on non-acid and acid soils	Woodland	23.1	10	28.53	0.29%	23.089	230.89%
E21	Glamorgan Canal / Long Wood	Broadleaved deciduous woodland	Woodland	22.9	10	39.22	0.39%	22.929	229.29%
E22	Gwaun Gledyr	Lowland to montane, dry to mesic grassland usually dominated b	Grassland	14.3	6	12.77	0.21%	14.293	238.21%
E23	Gwent Levels - St. Brides	No critical load has been assigned for this feature	Grassland	13.4	-	29.50	-	13.420	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	Atlantic upper-mid & mid-low salt marshes	Grassland	12.9	10	23.79	0.24%	12.884	128.84%
E26	Lisvane Reservoir	Atlantic upper-mid & mid-low salt marshes	Grassland	13.3	10	26.97	0.27%	13.347	133.47%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	No critical load has been assigned for this feature	Grassland	10.5	-	24.60	-	10.573	-
E28	Nant Whitton Woodlands	Broadleaved deciduous woodland	Woodland	20.7	10	41.24	0.41%	20.781	207.81%
E29	Penarth Coast	Low and medium altitude hay meadows	Grassland	10.6	10	23.95	0.24%	10.654	106.54%
E31	Plas Machen Wood	Broadleaved deciduous woodland	Woodland	23.3	10	25.22	0.25%	23.285	232.85%
E35	Ruperra Castle and Woodlands	No critical load has been assigned for this feature	Grassland	13.2	-	17.84	-	13.228	-
E38	Ty Du Moor	Rich Fens	Grassland	11.9	15	21.96	0.15%	11.962	79.75%
E40	Fferm Walters	Lowland to montane, dry to mesic grassland usually dominated b	Grassland	10.4	6	33.51	0.56%	10.394	173.23%
E41	Gwent Levels - Rumney and Peterstone	No critical load has been assigned for this feature	Grassland	12.8	-	75.96	-	12.835	-
E46	Cardiff Bay Wetland and Hamadryad Park	Grassland	Grassland	11.9	10	103.25	1.03%	12.003	120.03%
E47	Cardiff Heliport Fields	Grassland	Grassland	11.6	10	384.96	3.85%	11.985	119.85%
E48	Tidal Sidings	Grassland	Grassland	11.6	10	162.46	1.62%	11.762	117.62%
E49	Ocean Park South	Grassland	Grassland	11.6	10	0.02	0.00%	11.600	116.00%
E50	Beach Sidings	Grassland	Grassland	11.2	10	53.48	0.53%	11.253	112.53%
E51	Cardiff Bay Wetland Reserve	Grassland	Grassland	11.9	10	101.33	1.01%	12.001	120.01%
E52	River Taff	Grassland	Grassland	11.9	10	107.96	1.08%	12.008	120.08%
E53	Pengam Moors	Grassland	Grassland	11.5	10	91.66	0.92%	11.592	115.92%

E1 Atlantic Upper-mid and mid-low salt marshes Max @ statutory designated site 5.27%

Acid Deposition

ID	Name	Acidity CL Class	Deposition Velocity	Background (kgN/ha/yr)	Min CL max N (keqN/ha/yr)	N PC (geq/ha/yr)	S PC (geq/ha/yr)	PC (as % of CL)	PEC (kgN/ha/yr)	PEC (as % of CL)
E1	Severn Estuary (Wales)	Freshwater	Grassland	1.06	-	37.65	44.93	-	1.143	-
E2	River Usk / Afon Wysg	Bogs	Grassland	1.64	0.601	1.60	1.91	0.58%	1.644	273.46%
E2	River Usk / Afon Wysg	Unmanaged Broadleaved/Coniferous Woodland	Woodland	2.51	1.313	2.55	4.14	0.51%	2.517	191.68%
E3	Cardiff Beech Woods	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.9	1.428	1.83	2.98	0.34%	1.905	133.39%
E4	Severn Estuary (England)		Grassland	1.06	-	4.70	5.60	-	1.070	-
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / Lla	No critical load has been assigned for this feature	Grassland	1.18	-	2.00	2.39	-	1.184	-
E8	Caeau Blaen-bielly	No acidity critical loads available for this site	Grassland	1.06	-	1.14	1.36	-	1.063	-
E9	Castell Coch Woodlands and Road Section	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.88	1.428	1.97	3.19	0.36%	1.885	132.01%
E10	Cefn Onn	Calcareous grassland (using base cation)	Grassland	1.11	4.856	1.24	1.48	0.06%	1.113	22.91%
E11	Cliff Wood - Golden Stairs	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.43	8.484	3.35	5.44	0.10%	1.439	16.96%
E12	Coed y Bedw	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.83	2.087	1.83	2.96	0.23%	1.835	87.92%
E13	Coedydd y Barri / Barry Woodlands	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.62	8.727	5.23	8.48	0.16%	1.634	18.72%
E14	Cog Moors	No critical load has been assigned for this feature	Grassland	0.85	-	2.20	2.62	-	0.855	-
E16	Cwm Cyffin, Leckwith	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.82	1.744	7.67	12.45	1.15%	1.840	105.51%
E17	Ely Valley	No critical load has been assigned for this feature	Grassland	0.98	-	1.63	1.95	-	0.984	-
E18	Forestganol a Chwm Nofydd	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.92	1.428	1.96	3.17	0.36%	1.925	134.81%
E19	Flat Holm	No critical load has been assigned for this feature	Grassland	1.64	-	1.38	1.65	-	1.643	-
E20	Garth Wood	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.87	1.971	2.04	3.31	0.27%	1.875	95.15%
E21	Glamorgan Canal / Long Wood	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.9	1.964	2.80	4.55	0.37%	1.907	97.12%
E22	Gwaun Gledyr	No critical load has been assigned for this feature	Grassland	1.18	-	0.91	1.09	-	1.182	-
E23	Gwent Levels - St. Brides	No critical load has been assigned for this feature	Grassland	1.09	-	2.11	2.51	-	1.095	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	No critical load has been assigned for this feature	Grassland	1.01	-	1.70	2.03	-	1.014	-
E26	Lisvane Reservoir	No critical load has been assigned for this feature	Grassland	1.18	-	1.93	2.30	-	1.184	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	No critical load has been assigned for this feature	Grassland	0.847	-	1.76	2.10	-	0.851	-
E28	Nant Whitton Woodlands	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.61	2.953	2.95	4.78	0.26%	1.618	54.78%
E29	Penarth Coast	No acidity critical loads available for this site	Grassland	0.86	-	1.71	2.04	-	0.864	-
E31	Plas Machen Wood	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.86	2.048	1.80	2.92	0.23%	1.865	91.05%
E35	Ruperra Castle and Woodlands	No critical load has been assigned for this feature	Grassland	1.1	-	1.27	1.52	-	1.103	-
E38	Ty Du Moor	No acidity critical loads available for this site	Grassland	1	-	1.57	1.87	-	1.003	-
E40	Ferm Walters	No acidity critical loads available for this site	Grassland	0.83	-	2.39	2.86	-	0.835	-
E41	Gwent Levels - Rumney and Peterstone	No critical load has been assigned for this feature	Grassland	1.057	-	5.43	6.47	-	1.069	-
E46	Cardiff Bay Wetland and Hamadryad Park	Calcareous grassland (using base cation)	Grassland	1.11	4.856	7.37	8.80	0.33%	1.126	23.19%
E47	Cardiff Heliport Fields	Calcareous grassland (using base cation)	Grassland	1.1	4.856	27.50	32.81	1.24%	1.160	23.89%
E48	Tidal Sidings	Calcareous grassland (using base cation)	Grassland	1.1	4.856	11.60	13.85	0.52%	1.125	23.18%
E49	Ocean Park South	Calcareous grassland (using base cation)	Grassland	1.1	4.856	0.00	0.00	0.00%	1.100	22.65%
E50	Beach Sidings	Calcareous grassland (using base cation)	Grassland	1.05	4.856	3.82	4.56	0.17%	1.058	21.80%
E51	Cardiff Bay Wetland Reserve	Calcareous grassland (using base cation)	Grassland	1.11	4.856	7.24	8.64	0.33%	1.126	23.19%
E52	River Taff	Calcareous grassland (using base cation)	Grassland	1.11	4.856	7.71	9.20	0.35%	1.127	23.21%
E53	Pengam Moors	Calcareous grassland (using base cation)	Grassland	1.08	4.856	6.55	7.81	0.30%	1.094	22.54%

E16	Unmanaged Broadleaved/Coniferous Woodland	Max @ statutory designated site	1.15%
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E Varied ERF permit – Detailed Results

Continual operation at daily ELV

					Contribution to Ground Level Concentration at Point of Greatest Impact								
Pollutant	Quantity	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	20.3	0.8	0.6	0.7	0.8	0.8	0.8	2.07%	21.1	52.82%
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	40.6	5.4	5.9	5.8	5.5	6.1	6.1	3.1%	46.7	23.36%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	10.4	1.6	1.2	1.5	1.6	1.3	1.6	1.3%	12.0	9.59%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	10.4	3.2	3.6	3.5	3.4	3.8	3.8	1.1%	14.2	4.06%
Sulphur dioxide	99.9th %ile of 15 min. means	µg/m³	266	10.4	4.1	4.3	4.3	4.2	4.4	4.4	1.7%	14.8	5.57%
Particulates (PM10)	Annual mean	µg/m³	40	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.08%	13.2	33.08%
Particulates (PM10)	90.4th %ile of daily means	µg/m³	50	26.4	0.1	0.1	0.1	0.1	0.1	0.1	0.2%	26.5	53.01%
Particulates (PM2.5)	Annual mean	µg/m³	20	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.16%	7.2	36.16%
Particulates (PM2.5)	Annual mean - 2040 target	µg/m³	10	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3%	7.2	72.33%
Carbon monoxide	8 hour running mean	µg/m³	10,000	0.6	3.9	4.2	4.4	3.8	4.3	4.4	0.04%	5.0	0.05%
Carbon monoxide	Hourly mean	µg/m³	30,000	0.6	8.1	8.4	10.5	8.4	8.0	10.5	0.04%	11.1	0.04%
Hydrogen chloride	Hourly mean	µg/m³	750	1.6	1.3	1.3	1.7	1.3	1.3	1.7	0.2%	3.3	0.44%
Hydrogen fluoride	Annual mean	ng/m³	16,000	2,400.0	6.2	5.1	5.7	6.6	6.6	6.6	0.04%	2,406.6	15.04%
Hydrogen fluoride	Hourly mean	ng/m³	160,000	4,800.0	161.6	169.0	210.2	167.8	160.3	210.2	0.13%	5,010.2	3.13%
Ammonia	Annual mean	µg/m³	180	1.4	0.1	0.1	0.1	0.1	0.1	0.1	0.05%	1.5	0.83%
Ammonia	Hourly mean	µg/m³	2,500	2.8	2.4	2.5	3.2	2.5	2.4	3.2	0.13%	6.0	0.24%
VOCs (as benzene)	Annual mean	ng/m³	5,000	1,600.0	62.4	50.7	56.5	65.7	65.8	65.8	1.32%	1,665.8	33.32%
VOCs (as benzene)	Daily mean	ng/m³	30,000	3,200.0	462.7	398.0	456.8	466.7	400.6	466.7	1.6%	3,666.7	12.22%
Mercury	Daily mean	ng/m³	60	32.0	0.9	0.8	0.9	0.9	0.8	0.9	1.6%	32.9	54.89%
Mercury	Hourly mean	ng/m³	600	32.0	3.2	3.4	4.2	3.4	3.2	4.2	0.7%	36.2	6.03%
Cadmium	Annual mean	ng/m³	5	1.4	0.1	0.1	0.1	0.1	0.1	0.1	2.63%	1.5	30.63%
Cadmium	Daily mean	ng/m³	30	2.8	0.9	0.8	0.9	0.9	0.8	0.9	3.1%	3.7	12.44%
PaHs	Annual mean	pg/m³	250	200.0	1.2	1.0	1.1	1.3	1.3	1.3	0.5%	201.3	80.53%
Dioxins and Furans	Annual mean	fg/m³	-	33.0	0.4	0.3	0.3	0.4	0.4	0.4	-	33.4	-
PCBs	Annual mean	ng/m³	200	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.016%	0.2	0.08%
PCBs	Hourly mean	ng/m³	6,000	0.3	0.8	0.8	1.1	0.8	0.8	1.1	0.02%	1.3	0.02%

Note:

Assumes continual operation of the ERF at the daily mean ELVs

Continual operation at half-hourly ELV

					Contribution to Ground Level Concentration at Point of Greatest Impact								
Pollutant	Quantity	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	40.6	11.9	13.2	13.0	12.1	13.6	13.6	6.8%	54.2	27.10%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	10.4	16.2	18.1	17.6	17.1	19.0	19.0	5.4%	29.4	8.41%
Sulphur dioxide	99.9th %ile of 15 min. means	µg/m³	266	10.4	20.6	21.4	21.4	20.9	22.1	22.1	8.3%	32.5	12.21%
Carbon monoxide	8 hour running mean	µg/m³	10,000	0.6	11.6	12.5	13.1	11.3	13.0	13.1	0.13%	13.7	0.14%
Carbon monoxide	Hourly mean	µg/m³	30,000	0.6	24.2	25.3	31.5	25.2	24.1	31.5	0.11%	32.1	0.11%
Hydrogen chloride	Hourly mean	µg/m³	750	1.6	9.7	10.1	12.6	10.0	9.6	12.6	1.7%	14.2	1.89%
Hydrogen fluoride	Hourly mean	ng/m³	160,000	4,800	644.6	674.0	838.7	669.3	639.7	838.7	0.5%	5,638.7	3.52%

Note:

Assumes continual operation of the ERF at the half-hourly mean ELVs

Risk Assessment - Annual Mean

Metal	AQAL (ng/m³)	Background Concentration (ng/m³)	Assuming each metal emitted at 100% of the group ELV				Metal (as % of ELV)	Each metal emitted at the maximum concentration from the EA metals			
			PC		PEC			PC		PEC	
			ng/m³	as % of AQAL	ng/m³	as % of AQAL		ng/m³	as % of AQAL	ng/m³	as % of AQAL
Arsenic	6	0.95	1.80	29.98%	2.75	45.82%	8.3%	0.15	2.50%	1.10	18.33%
Antimony	5,000	1.30	1.80	0.04%	3.10	0.06%	3.8%	0.07	0.001%	1.37	0.03%
Chromium	-	6.10	1.80	-	7.90	-	30.7%	0.55	-	6.65	-
Chromium (VI)	0	1.22	1.80	719.58%	3.02	1207.58%	0.043%	0.0008	0.31%	1.22	488.31%
Cobalt	-	5.50	1.80	-	7.30	-	1.9%	0.03	-	5.53	-
Copper	-	15.00	1.80	-	16.80	-	9.7%	0.17	-	15.17	-
Lead	250	23.00	1.80	0.72%	24.80	9.92%	16.8%	0.30	0.12%	23.30	9.32%
Manganese	150	100.00	1.80	1.20%	101.80	67.87%	20.0%	0.36	0.24%	100.36	66.91%
Nickel	20	1.10	1.80	8.99%	2.90	14.49%	73.3%	1.32	6.60%	2.42	12.10%
Vanadium	-	13.00	1.80	-	14.80	-	2.0%	0.04	-	13.04	-

Risk Assessment - Short-term daily mean

Metal	AQAL (ng/m³)	Background Concentration (ng/m³)	Assuming each metal emitted at 100% of the group ELV				Metal (as % of ELV)	Each metal emitted at the maximum concentration from the EA metals			
			PC		PEC			PC		PEC	
			ng/m³	as % of AQAL	ng/m³	as % of AQAL		ng/m³	as % of AQAL	ng/m³	as % of AQAL
Arsenic	-	1.90	12.23	-	14.13	-	8.3%	1.02	-	2.92	-
Antimony	-	2.60	12.23	-	14.83	-	3.8%	0.47	-	3.07	-
Chromium	2,000	12.20	12.23	0.61%	24.43	1.22%	30.7%	3.75	0.19%	15.95	0.80%
Chromium (VI)	-	2.44	12.23	-	14.67	-	0.0%	0.005	-	2.45	-
Cobalt	-	11.00	12.23	-	23.23	-	1.9%	0.23	-	11.23	-
Copper	50	30.00	12.23	24.46%	42.23	84.46%	9.7%	1.18	2.36%	31.18	62.36%
Lead	-	46.00	12.23	-	58.23	-	16.8%	2.05	-	48.05	-
Manganese	-	200.00	12.23	-	212.23	-	20.0%	2.45	-	202.45	-
Nickel	-	3.00	12.23	-	15.23	-	73.3%	8.97	-	11.97	-
Vanadium	1,000	26.00	12.23	1.22%	38.23	3.82%	2.0%	0.24	0.02%	26.24	2.62%

Risk Assessment - Short-term hourly mean

Metal	AQAL (ng/m³)	Background Concentration (ng/m³)	Assuming each metal emitted at 100% of the group ELV				Metal (as % of ELV)	Each metal emitted at the maximum concentration from the EA metals			
			PC		PEC			PC		PEC	
			ng/m³	as % of AQAL	ng/m³	as % of AQAL		ng/m³	as % of AQAL	ng/m³	as % of AQAL
Arsenic	-	1.90	58.12	-	60.02	-	8.3%	4.84	-	6.74	-
Antimony	150,000	2.60	58.12	0.04%	60.72	0.04%	3.8%	2.23	0.001%	4.83	0.003%
Chromium	-	12.20	58.12	-	70.32	-	30.7%	17.82	-	30.02	-
Chromium (VI)	-	2.44	58.12	-	60.56	-	0.0%	0.03	-	2.47	-
Cobalt	-	11.00	58.12	-	69.12	-	1.9%	1.08	-	12.08	-
Copper	-	30.00	58.12	-	88.12	-	9.7%	5.62	-	35.62	-
Lead	-	46.00	58.12	-	104.12	-	16.8%	9.75	-	55.75	-
Manganese	1,500,000	200.00	58.12	0.0039%	258.12	0.017%	20.0%	11.62	0.0008%	211.62	0.014%
Nickel	700	3.00	58.12	8.30%	61.12	8.73%	73.3%	42.62	6.09%	45.62	6.52%
Vanadium	-	26.00	58.12	-	84.12	-	2.0%	1.16	-	27.16	-

Annual mean nitrogen dioxide

ID	Receptor	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
HR1	Willows High School	µg/m³	40	20.3	0.11	0.12	0.13	0.11	0.11	0.13	0.3%	20.4	51.1%
HR2	Baden Powell County Primary School	µg/m³	40	20.3	0.09	0.09	0.10	0.10	0.09	0.10	0.3%	20.4	51.0%
HR3	Splott Health centre	µg/m³	40	20.3	0.09	0.09	0.10	0.10	0.10	0.10	0.3%	20.4	51.0%
HR4	Splott Rec South	µg/m³	40	20.3	0.09	0.09	0.10	0.10	0.10	0.10	0.3%	20.4	51.0%
HR5	Splott Rec North	µg/m³	40	20.3	0.08	0.08	0.09	0.10	0.08	0.10	0.2%	20.4	51.0%
HR6	Moorland Primary School #1	µg/m³	40	20.3	0.08	0.07	0.09	0.09	0.09	0.09	0.2%	20.4	51.0%
HR7	College building	µg/m³	40	20.3	0.08	0.07	0.10	0.09	0.08	0.10	0.2%	20.4	51.0%
HR8	Library	µg/m³	40	20.3	0.07	0.07	0.11	0.09	0.09	0.11	0.3%	20.4	51.0%
HR9	Allotments	µg/m³	40	20.3	0.06	0.06	0.08	0.07	0.06	0.08	0.2%	20.4	50.9%
HR10	Howardian Centre	µg/m³	40	20.3	0.06	0.06	0.08	0.07	0.06	0.08	0.2%	20.4	50.9%
HR11	University of Wales Institute	µg/m³	40	20.3	0.06	0.06	0.08	0.07	0.07	0.08	0.2%	20.4	51.0%
HR12	St Peters Rec	µg/m³	40	20.3	0.07	0.06	0.09	0.08	0.07	0.09	0.2%	20.4	51.0%
HR13	Moorland park	µg/m³	40	20.3	0.07	0.06	0.08	0.08	0.08	0.08	0.2%	20.4	51.0%
HR14	National Assembly	µg/m³	40	20.3	0.19	0.15	0.11	0.10	0.13	0.19	0.5%	20.5	51.2%
HR15	County Hall	µg/m³	40	20.3	0.10	0.09	0.10	0.12	0.05	0.12	0.3%	20.4	51.1%
HR16	St Cuthbert's RC Primary School	µg/m³	40	20.3	0.09	0.09	0.10	0.09	0.05	0.10	0.2%	20.4	51.0%
HR17	Adamstown County Primary School	µg/m³	40	20.3	0.07	0.08	0.12	0.09	0.08	0.12	0.3%	20.4	51.0%
HR18	College	µg/m³	40	20.3	0.10	0.11	0.14	0.10	0.11	0.14	0.3%	20.4	51.1%
HR19	Cardiff Royal Infirmary #1	µg/m³	40	20.3	0.08	0.10	0.13	0.10	0.09	0.13	0.3%	20.4	51.1%
HR20	Cardiff Royal Infirmary #2	µg/m³	40	20.3	0.08	0.09	0.12	0.09	0.09	0.12	0.3%	20.4	51.1%
HR21	Cardiff Royal Infirmary #3	µg/m³	40	20.3	0.07	0.08	0.11	0.09	0.08	0.11	0.3%	20.4	51.0%
HR22	St Peter's RC Primary School	µg/m³	40	20.3	0.07	0.07	0.11	0.08	0.08	0.11	0.3%	20.4	51.0%
HR23	School building	µg/m³	40	20.3	0.10	0.11	0.13	0.10	0.11	0.13	0.3%	20.4	51.1%
HR24	School building	µg/m³	40	20.3	0.09	0.10	0.13	0.09	0.10	0.13	0.3%	20.4	51.1%
HR25	College building	µg/m³	40	20.3	0.07	0.09	0.11	0.08	0.09	0.11	0.3%	20.4	51.0%
HR26	College building	µg/m³	40	20.3	0.08	0.09	0.12	0.09	0.09	0.12	0.3%	20.4	51.1%
HR27	College building	µg/m³	40	20.3	0.10	0.11	0.14	0.10	0.11	0.14	0.3%	20.4	51.1%
HR28	Moorland Primary School #2	µg/m³	40	20.3	0.08	0.08	0.09	0.09	0.09	0.09	0.2%	20.4	51.0%
HR29	St Anne's Church in Wales Infant	µg/m³	40	20.3	0.06	0.07	0.10	0.08	0.07	0.10	0.2%	20.4	51.0%
HR30	Marlborough Junior School	µg/m³	40	20.3	0.06	0.06	0.09	0.07	0.07	0.09	0.2%	20.4	51.0%
HR31	College building	µg/m³	40	20.3	0.05	0.06	0.08	0.06	0.06	0.08	0.2%	20.4	50.9%
HR32	Roath Park Recreation ground	µg/m³	40	20.3	0.05	0.06	0.08	0.06	0.06	0.08	0.2%	20.4	50.9%
HR33	Roath Park Primary School	µg/m³	40	20.3	0.05	0.06	0.08	0.06	0.06	0.08	0.2%	20.4	50.9%
HR34	School building	µg/m³	40	20.3	0.06	0.07	0.09	0.07	0.07	0.09	0.2%	20.4	51.0%
HR35	School building	µg/m³	40	20.3	0.06	0.07	0.09	0.07	0.07	0.09	0.2%	20.4	51.0%
HR36	University of Wales Cardiff	µg/m³	40	20.3	0.08	0.09	0.11	0.09	0.11	0.11	0.3%	20.4	51.0%
HR37	Cathays Park	µg/m³	40	20.3	0.09	0.09	0.11	0.09	0.11	0.11	0.3%	20.4	51.0%
HR38	Virgin Church in Wales Primary School	µg/m³	40	20.3	0.09	0.09	0.10	0.08	0.06	0.10	0.3%	20.4	51.0%
HR39	Mountstuart Primary School	µg/m³	40	20.3	0.19	0.16	0.15	0.16	0.13	0.19	0.5%	20.5	51.2%
HR40	Royal Hamadryad Hospital	µg/m³	40	20.3	0.17	0.15	0.15	0.16	0.12	0.17	0.4%	20.5	51.2%
HR41	St Pauls Primary School	µg/m³	40	20.3	0.13	0.13	0.12	0.14	0.08	0.14	0.4%	20.4	51.1%
HR42	St Patricks RC Primary School	µg/m³	40	20.3	0.06	0.07	0.07	0.08	0.05	0.08	0.2%	20.4	50.9%
HR43	Ninian Park Primary School	µg/m³	40	20.3	0.06	0.07	0.06	0.07	0.05	0.07	0.2%	20.4	50.9%
HR44	St Davids Hospital	µg/m³	40	20.3	0.08	0.07	0.10	0.08	0.07	0.10	0.2%	20.4	51.0%
HR45	Castle Mews – College	µg/m³	40	20.3	0.10	0.09	0.11	0.10	0.11	0.11	0.3%	20.4	51.0%
HR46	Nursery – plants	µg/m³	40	20.3	0.09	0.09	0.10	0.09	0.11	0.11	0.3%	20.4	51.0%
HR47	Uni library	µg/m³	40	20.3	0.08	0.09	0.11	0.08	0.10	0.11	0.3%	20.4	51.0%

HR48	Ysgol Mynydd Bychan School #1	µg/m³	40	20.3	0.06	0.07	0.09	0.07	0.07	0.09	0.2%	20.4	51.0%
HR49	Ysgol Mynydd Bychan School #2	µg/m³	40	20.3	0.05	0.07	0.08	0.06	0.06	0.08	0.2%	20.4	51.0%
HR50	Severn County Junior School	µg/m³	40	20.3	0.07	0.07	0.09	0.07	0.06	0.09	0.2%	20.4	51.0%
HR51	St Marys Catholic Primary School	µg/m³	40	20.3	0.08	0.07	0.09	0.07	0.07	0.09	0.2%	20.4	51.0%
HR52	Kitchener County Primary School	µg/m³	40	20.3	0.06	0.06	0.07	0.06	0.05	0.07	0.2%	20.4	50.9%
HR53	Llandough Primary School	µg/m³	40	20.3	0.10	0.11	0.10	0.09	0.09	0.11	0.3%	20.4	51.0%
HR54	Llandough Hospital N.H.S Trust	µg/m³	40	20.3	0.10	0.10	0.10	0.09	0.08	0.10	0.3%	20.4	51.0%

Note:
Assumes continual operation of the ERF at the daily mean ELVs

Max @	HR14	0.19	0.5%
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Annual mean VOC (as benzene)

ID	Receptor	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
HR1	Willows High School	ng/m ³	5,000	1,600	9.1	9.5	10.0	8.4	8.8	10.0	0.2%	1,610.0	32.2%
HR2	Baden Powell County Primary School	ng/m ³	5,000	1,600	7.2	7.4	8.0	7.9	7.5	8.0	0.2%	1,608.0	32.2%
HR3	Splott Health centre	ng/m ³	5,000	1,600	7.4	7.4	8.0	8.0	7.7	8.0	0.2%	1,608.0	32.2%
HR4	Splott Rec South	ng/m ³	5,000	1,600	7.3	7.3	7.9	8.0	7.6	8.0	0.2%	1,608.0	32.2%
HR5	Splott Rec North	ng/m ³	5,000	1,600	6.7	6.5	7.3	7.6	6.7	7.6	0.2%	1,607.6	32.2%
HR6	Moorland Primary School #1	ng/m ³	5,000	1,600	6.6	5.9	7.0	7.3	6.9	7.3	0.1%	1,607.3	32.1%
HR7	College building	ng/m ³	5,000	1,600	6.1	5.4	7.7	7.1	6.4	7.7	0.2%	1,607.7	32.2%
HR8	Library	ng/m ³	5,000	1,600	5.9	5.2	8.7	7.0	6.8	8.7	0.2%	1,608.7	32.2%
HR9	Allotments	ng/m ³	5,000	1,600	4.8	4.6	6.0	5.4	4.9	6.0	0.1%	1,606.0	32.1%
HR10	Howardian Centre	ng/m ³	5,000	1,600	4.8	4.6	6.2	5.4	5.0	6.2	0.1%	1,606.2	32.1%
HR11	University of Wales Institute	ng/m ³	5,000	1,600	5.0	4.7	6.4	5.6	5.2	6.4	0.1%	1,606.4	32.1%
HR12	St Peters Rec	ng/m ³	5,000	1,600	5.4	5.0	7.3	6.2	6.0	7.3	0.1%	1,607.3	32.1%
HR13	Moorland park	ng/m ³	5,000	1,600	5.6	4.7	6.5	6.6	6.1	6.6	0.1%	1,606.6	32.1%
HR14	National Assembly	ng/m ³	5,000	1,600	15.2	11.7	8.9	7.6	10.2	15.2	0.3%	1,615.2	32.3%
HR15	County Hall	ng/m ³	5,000	1,600	7.7	7.4	7.9	9.9	3.8	9.9	0.2%	1,609.9	32.2%
HR16	St Cuthbert's RC Primary School	ng/m ³	5,000	1,600	7.2	7.0	7.6	7.1	3.8	7.6	0.2%	1,607.6	32.2%
HR17	Adamstown County Primary School	ng/m ³	5,000	1,600	6.0	6.3	9.3	7.2	6.5	9.3	0.2%	1,609.3	32.2%
HR18	College	ng/m ³	5,000	1,600	7.8	8.7	11.1	8.3	8.7	11.1	0.2%	1,611.1	32.2%
HR19	Cardiff Royal Infirmary #1	ng/m ³	5,000	1,600	6.7	7.7	10.3	7.7	7.5	10.3	0.2%	1,610.3	32.2%
HR20	Cardiff Royal Infirmary #2	ng/m ³	5,000	1,600	6.2	6.9	9.6	7.3	6.9	9.6	0.2%	1,609.6	32.2%
HR21	Cardiff Royal Infirmary #3	ng/m ³	5,000	1,600	5.8	6.4	9.1	7.0	6.5	9.1	0.2%	1,609.1	32.2%
HR22	St Peter's RC Primary School	ng/m ³	5,000	1,600	5.4	5.7	8.4	6.5	6.2	8.4	0.2%	1,608.4	32.2%
HR23	School building	ng/m ³	5,000	1,600	7.7	8.5	10.6	8.1	8.9	10.6	0.2%	1,610.6	32.2%
HR24	School building	ng/m ³	5,000	1,600	6.8	7.8	10.1	7.5	7.8	10.1	0.2%	1,610.1	32.2%
HR25	College building	ng/m ³	5,000	1,600	5.9	7.0	9.1	6.7	6.9	9.1	0.2%	1,609.1	32.2%
HR26	College building	ng/m ³	5,000	1,600	6.3	7.3	9.8	7.2	7.2	9.8	0.2%	1,609.8	32.2%
HR27	College building	ng/m ³	5,000	1,600	7.6	8.5	10.8	8.1	8.7	10.8	0.2%	1,610.8	32.2%
HR28	Moorland Primary School #2	ng/m ³	5,000	1,600	6.7	6.2	7.2	7.5	7.0	7.5	0.2%	1,607.5	32.2%
HR29	St Anne's Church in Wales Infant	ng/m ³	5,000	1,600	5.0	5.4	7.6	6.0	5.8	7.6	0.2%	1,607.6	32.2%
HR30	Marlborough Junior School	ng/m ³	5,000	1,600	4.8	4.9	7.1	5.7	5.5	7.1	0.1%	1,607.1	32.1%
HR31	College building	ng/m ³	5,000	1,600	4.2	4.5	6.2	5.0	4.8	6.2	0.1%	1,606.2	32.1%
HR32	Roath Park Recreation ground	ng/m ³	5,000	1,600	4.1	4.5	6.2	5.0	4.8	6.2	0.1%	1,606.2	32.1%
HR33	Roath Park Primary School	ng/m ³	5,000	1,600	4.0	4.6	6.1	5.0	4.8	6.1	0.1%	1,606.1	32.1%
HR34	School building	ng/m ³	5,000	1,600	4.5	5.7	7.2	5.4	5.4	7.2	0.1%	1,607.2	32.1%
HR35	School building	ng/m ³	5,000	1,600	4.5	5.2	7.0	5.5	5.3	7.0	0.1%	1,607.0	32.1%
HR36	University of Wales Cardiff	ng/m ³	5,000	1,600	6.8	7.3	8.9	7.1	8.4	8.9	0.2%	1,608.9	32.2%
HR37	Cathays Park	ng/m ³	5,000	1,600	7.5	7.4	9.0	7.4	9.0	9.0	0.2%	1,609.0	32.2%
HR38	Virgin Church in Wales Primary School	ng/m ³	5,000	1,600	7.5	6.8	8.1	6.7	4.5	8.1	0.2%	1,608.1	32.2%
HR39	Mountstuart Primary School	ng/m ³	5,000	1,600	14.9	12.9	12.2	12.6	10.1	14.9	0.3%	1,614.9	32.3%
HR40	Royal Hamadryad Hospital	ng/m ³	5,000	1,600	13.6	12.3	11.9	12.6	9.4	13.6	0.3%	1,613.6	32.3%
HR41	St Pauls Primary School	ng/m ³	5,000	1,600	10.2	10.0	9.8	11.1	6.4	11.1	0.2%	1,611.1	32.2%
HR42	St Patricks RC Primary School	ng/m ³	5,000	1,600	5.1	5.8	5.3	6.0	4.0	6.0	0.1%	1,606.0	32.1%
HR43	Ninian Park Primary School	ng/m ³	5,000	1,600	5.0	5.6	5.1	5.8	4.0	5.8	0.1%	1,605.8	32.1%
HR44	St Davids Hospital	ng/m ³	5,000	1,600	6.6	5.9	7.8	6.2	5.9	7.8	0.2%	1,607.8	32.2%
HR45	Castle Mews – College	ng/m ³	5,000	1,600	7.7	7.4	9.1	7.6	9.0	9.1	0.2%	1,609.1	32.2%
HR46	Nursery – plants	ng/m ³	5,000	1,600	6.9	6.8	8.3	7.0	8.5	8.5	0.2%	1,608.5	32.2%
HR47	Uni library	ng/m ³	5,000	1,600	6.2	6.9	8.4	6.7	7.9	8.4	0.2%	1,608.4	32.2%

HR48	Ysgol Mynydd Bychan School #1	ng/m ³	5,000	1,600	4.6	5.6	6.8	5.5	5.9	6.8	0.1%	1,606.8	32.1%
HR49	Ysgol Mynydd Bychan School #2	ng/m ³	5,000	1,600	4.1	5.3	6.6	5.0	5.0	6.6	0.1%	1,606.6	32.1%
HR50	Severn County Junior School	ng/m ³	5,000	1,600	5.9	5.3	7.0	5.4	5.0	7.0	0.1%	1,607.0	32.1%
HR51	St Marys Catholic Primary School	ng/m ³	5,000	1,600	6.1	5.5	7.3	5.8	5.4	7.3	0.1%	1,607.3	32.1%
HR52	Kitchener County Primary School	ng/m ³	5,000	1,600	4.9	4.7	5.6	4.5	3.7	5.6	0.1%	1,605.6	32.1%
HR53	Llandough Primary School	ng/m ³	5,000	1,600	8.3	8.4	8.0	7.5	6.9	8.4	0.2%	1,608.4	32.2%
HR54	Llandough Hospital N.H.S Trust	ng/m ³	5,000	1,600	8.0	8.2	8.0	7.5	6.7	8.2	0.2%	1,608.2	32.2%

Note:

Assumes continual operation of the ERF at the daily mean ELVs

Max @	HR14	15.2	0.3%
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Annual mean cadmium

ID	Receptor	Units	AQAL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of AQAL	PEC	PEC as % of AQAL
HR1	Willows High School	ng/m ³	5,000	1,400	18.3	18.9	20.0	16.7	17.7	20.0	0.4%	1,420.0	28.4%
HR2	Baden Powell County Primary School	ng/m ³	5000	1,400	14.4	14.8	15.9	15.8	14.9	15.9	0.3%	1,415.9	28.3%
HR3	Splott Health centre	ng/m ³	5000	1,400	14.9	14.7	16.0	16.1	15.4	16.1	0.3%	1,416.1	28.3%
HR4	Splott Rec South	ng/m ³	5000	1,400	14.7	14.7	15.9	16.1	15.1	16.1	0.3%	1,416.1	28.3%
HR5	Splott Rec North	ng/m ³	5000	1,400	13.5	13.0	14.6	15.2	13.5	15.2	0.3%	1,415.2	28.3%
HR6	Moorland Primary School #1	ng/m ³	5000	1,400	13.1	11.9	14.0	14.7	13.7	14.7	0.3%	1,414.7	28.3%
HR7	College building	ng/m ³	5000	1,400	12.2	10.7	15.4	14.2	12.9	15.4	0.3%	1,415.4	28.3%
HR8	Library	ng/m ³	5000	1,400	11.9	10.5	17.5	13.9	13.5	17.5	0.3%	1,417.5	28.3%
HR9	Allotments	ng/m ³	5000	1,400	9.6	9.2	12.0	10.7	9.8	12.0	0.2%	1,412.0	28.2%
HR10	Howardian Centre	ng/m ³	5000	1,400	9.6	9.2	12.3	10.8	10.0	12.3	0.2%	1,412.3	28.2%
HR11	University of Wales Institute	ng/m ³	5000	1,400	10.0	9.5	12.9	11.2	10.4	12.9	0.3%	1,412.9	28.3%
HR12	St Peters Rec	ng/m ³	5000	1,400	10.8	10.1	14.6	12.4	11.9	14.6	0.3%	1,414.6	28.3%
HR13	Moorland park	ng/m ³	5000	1,400	11.1	9.3	13.0	13.2	12.2	13.2	0.3%	1,413.2	28.3%
HR14	National Assembly	ng/m ³	5000	1,400	30.5	23.5	17.9	15.2	20.3	30.5	0.6%	1,430.5	28.6%
HR15	County Hall	ng/m ³	5000	1,400	15.4	14.8	15.8	19.7	7.7	19.7	0.4%	1,419.7	28.4%
HR16	St Cuthbert's RC Primary School	ng/m ³	5000	1,400	14.4	13.9	15.2	14.2	7.6	15.2	0.3%	1,415.2	28.3%
HR17	Adamstown County Primary School	ng/m ³	5000	1,400	11.9	12.6	18.5	14.4	13.1	18.5	0.4%	1,418.5	28.4%
HR18	College	ng/m ³	5000	1,400	15.6	17.4	22.2	16.7	17.3	22.2	0.4%	1,422.2	28.4%
HR19	Cardiff Royal Infirmary #1	ng/m ³	5000	1,400	13.5	15.4	20.6	15.4	15.0	20.6	0.4%	1,420.6	28.4%
HR20	Cardiff Royal Infirmary #2	ng/m ³	5000	1,400	12.4	13.9	19.2	14.6	13.8	19.2	0.4%	1,419.2	28.4%
HR21	Cardiff Royal Infirmary #3	ng/m ³	5000	1,400	11.7	12.8	18.2	14.0	13.1	18.2	0.4%	1,418.2	28.4%
HR22	St Peter's RC Primary School	ng/m ³	5000	1,400	10.8	11.5	16.7	13.1	12.3	16.7	0.3%	1,416.7	28.3%
HR23	School building	ng/m ³	5000	1,400	15.3	17.0	21.3	16.1	17.7	21.3	0.4%	1,421.3	28.4%
HR24	School building	ng/m ³	5000	1,400	13.6	15.6	20.2	15.0	15.7	20.2	0.4%	1,420.2	28.4%
HR25	College building	ng/m ³	5000	1,400	11.9	14.0	18.3	13.4	13.7	18.3	0.4%	1,418.3	28.4%
HR26	College building	ng/m ³	5000	1,400	12.7	14.6	19.5	14.5	14.4	19.5	0.4%	1,419.5	28.4%
HR27	College building	ng/m ³	5000	1,400	15.2	17.0	21.6	16.2	17.3	21.6	0.4%	1,421.6	28.4%
HR28	Moorland Primary School #2	ng/m ³	5000	1,400	13.5	12.4	14.4	15.1	14.0	15.1	0.3%	1,415.1	28.3%
HR29	St Anne's Church in Wales Infant	ng/m ³	5000	1,400	9.9	10.7	15.2	12.0	11.5	15.2	0.3%	1,415.2	28.3%
HR30	Marlborough Junior School	ng/m ³	5000	1,400	9.6	9.7	14.2	11.3	10.9	14.2	0.3%	1,414.2	28.3%
HR31	College building	ng/m ³	5000	1,400	8.3	9.0	12.5	10.1	9.6	12.5	0.2%	1,412.5	28.2%
HR32	Roath Park Recreation ground	ng/m ³	5000	1,400	8.2	9.0	12.3	10.1	9.7	12.3	0.2%	1,412.3	28.2%
HR33	Roath Park Primary School	ng/m ³	5000	1,400	8.1	9.2	12.3	10.0	9.7	12.3	0.2%	1,412.3	28.2%
HR34	School building	ng/m ³	5000	1,400	9.1	11.5	14.4	10.8	10.9	14.4	0.3%	1,414.4	28.3%
HR35	School building	ng/m ³	5000	1,400	9.1	10.4	13.9	11.0	10.6	13.9	0.3%	1,413.9	28.3%
HR36	University of Wales Cardiff	ng/m ³	5000	1,400	13.5	14.6	17.8	14.2	16.9	17.8	0.4%	1,417.8	28.4%
HR37	Cathays Park	ng/m ³	5000	1,400	14.9	14.8	18.1	14.9	18.1	18.1	0.4%	1,418.1	28.4%
HR38	Virgin Church in Wales Primary School	ng/m ³	5000	1,400	15.1	13.6	16.2	13.4	9.0	16.2	0.3%	1,416.2	28.3%
HR39	Mountstuart Primary School	ng/m ³	5000	1,400	29.8	25.9	24.5	25.2	20.1	29.8	0.6%	1,429.8	28.6%
HR40	Royal Hamadryad Hospital	ng/m ³	5000	1,400	27.2	24.6	23.8	25.2	18.8	27.2	0.5%	1,427.2	28.5%
HR41	St Pauls Primary School	ng/m ³	5000	1,400	20.5	20.0	19.6	22.3	12.8	22.3	0.4%	1,422.3	28.4%
HR42	St Patricks RC Primary School	ng/m ³	5000	1,400	10.2	11.5	10.5	12.1	8.0	12.1	0.2%	1,412.1	28.2%
HR43	Ninian Park Primary School	ng/m ³	5000	1,400	9.9	11.2	10.3	11.5	8.1	11.5	0.2%	1,411.5	28.2%
HR44	St Davids Hospital	ng/m ³	5000	1,400	13.2	11.8	15.6	12.3	11.7	15.6	0.3%	1,415.6	28.3%
HR45	Castle Mews – College	ng/m ³	5000	1,400	15.5	14.7	18.3	15.1	18.1	18.3	0.4%	1,418.3	28.4%
HR46	Nursery – plants	ng/m ³	5000	1,400	13.7	13.6	16.6	14.0	17.0	17.0	0.3%	1,417.0	28.3%
HR47	Uni library	ng/m ³	5000	1,400	12.4	13.9	16.8	13.5	15.8	16.8	0.3%	1,416.8	28.3%

HR48	Ysgol Mynydd Bychan School #1	ng/m ³	5000	1,400	9.2	11.3	13.7	10.9	11.7	13.7	0.3%	1,413.7	28.3%
HR49	Ysgol Mynydd Bychan School #2	ng/m ³	5000	1,400	8.2	10.6	13.1	10.0	10.0	13.1	0.3%	1,413.1	28.3%
HR50	Severn County Junior School	ng/m ³	5000	1,400	11.7	10.6	13.9	10.9	9.9	13.9	0.3%	1,413.9	28.3%
HR51	St Marys Catholic Primary School	ng/m ³	5000	1,400	12.1	11.0	14.6	11.5	10.8	14.6	0.3%	1,414.6	28.3%
HR52	Kitchener County Primary School	ng/m ³	5000	1,400	9.9	9.3	11.2	9.1	7.5	11.2	0.2%	1,411.2	28.2%
HR53	Llandough Primary School	ng/m ³	5000	1,400	16.7	16.8	15.9	15.1	13.8	16.8	0.3%	1,416.8	28.3%
HR54	Llandough Hospital N.H.S Trust	ng/m ³	5000	1,400	16.0	16.3	16.0	15.0	13.4	16.3	0.3%	1,416.3	28.3%

Note:

Assumes continual operation of the ERF at the daily mean ELVs

Max @	HR14	30.5	0.6%
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Annual mean oxides of nitrogen

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	µg/m³	30	25.0	1.12	0.91	1.02	1.18	1.18	1.18	3.9%	26.22	87.4%
E2	River Usk / Afon Wysg	µg/m³	30	23.5	0.05	0.05	0.05	0.05	0.05	0.05	0.2%	23.54	78.5%
E3	Cardiff Beech Woods	µg/m³	30	16.1	0.03	0.04	0.05	0.04	0.03	0.05	0.2%	16.10	53.7%
E4	Severn Estuary (England)	µg/m³	30	25.0	0.14	0.16	0.12	0.13	0.15	0.16	0.5%	25.20	84.0%
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / L	µg/m³	30	15.3	0.05	0.06	0.07	0.06	0.06	0.07	0.2%	15.32	51.1%
E8	Caeau Blaen-bielly	µg/m³	30	9.4	0.03	0.03	0.04	0.04	0.04	0.04	0.1%	9.41	31.4%
E9	Castell Coch Woodlands and Road Section	µg/m³	30	13.6	0.03	0.04	0.05	0.04	0.04	0.05	0.2%	13.67	45.6%
E10	Cefn Onn	µg/m³	30	10.1	0.03	0.04	0.04	0.04	0.04	0.04	0.1%	10.15	33.8%
E11	Cliff Wood - Golden Stairs	µg/m³	30	8.7	0.07	0.07	0.07	0.06	0.06	0.07	0.2%	8.74	29.1%
E12	Coed y Bedw	µg/m³	30	10.0	0.03	0.03	0.04	0.04	0.04	0.04	0.1%	10.07	33.6%
E13	Coedydd y Barri / Barry Woodlands	µg/m³	30	9.6	0.10	0.10	0.11	0.10	0.08	0.11	0.4%	9.66	32.2%
E14	Cog Moors	µg/m³	30	10.7	0.05	0.08	0.06	0.07	0.06	0.08	0.3%	10.79	36.0%
E16	Cwm Cydfin, Leckwith	µg/m³	30	17.2	0.15	0.15	0.15	0.16	0.10	0.16	0.5%	17.36	57.9%
E17	Ely Valley	µg/m³	30	13.0	0.05	0.05	0.06	0.05	0.05	0.06	0.2%	13.09	43.6%
E18	Fforestganol a Chwm Nofydd	µg/m³	30	15.9	0.03	0.04	0.05	0.04	0.04	0.05	0.2%	15.91	53.0%
E19	Flat Holm	µg/m³	30	25.0	0.04	0.05	0.04	0.03	0.04	0.05	0.2%	25.09	83.6%
E20	Garth Wood	µg/m³	30	16.1	0.03	0.04	0.05	0.04	0.04	0.05	0.2%	16.10	53.7%
E21	Glamorgan Canal / Long Wood	µg/m³	30	19.2	0.04	0.05	0.06	0.06	0.06	0.06	0.2%	19.28	64.3%
E22	Gwaun Gledyr	µg/m³	30	14.3	0.02	0.03	0.03	0.03	0.03	0.03	0.1%	14.28	47.6%
E23	Gwent Levels - St. Brides	µg/m³	30	16.7	0.07	0.07	0.07	0.06	0.06	0.07	0.2%	16.79	56.0%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	µg/m³	30	11.0	0.05	0.05	0.06	0.05	0.05	0.06	0.2%	11.09	37.0%
E26	Lisvane Reservoir	µg/m³	30	15.2	0.05	0.05	0.07	0.06	0.06	0.07	0.2%	15.28	50.9%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	µg/m³	30	8.9	0.04	0.06	0.06	0.05	0.05	0.06	0.2%	8.97	29.9%
E28	Nant Whitton Woodlands	µg/m³	30	7.4	0.05	0.06	0.07	0.06	0.06	0.07	0.2%	7.50	25.0%
E29	Penarth Coast	µg/m³	30	10.4	0.04	0.06	0.05	0.04	0.05	0.06	0.2%	10.43	34.8%
E31	Plas Machen Wood	µg/m³	30	10.1	0.03	0.04	0.04	0.04	0.03	0.04	0.1%	10.14	33.8%
E35	Ruperra Castle and Woodlands	µg/m³	30	9.9	0.04	0.04	0.04	0.04	0.04	0.04	0.1%	9.92	33.1%
E38	Ty Du Moor	µg/m³	30	11.6	0.04	0.05	0.06	0.05	0.05	0.06	0.2%	11.64	38.8%
E40	Fferm Walters	µg/m³	30	11.3	0.07	0.08	0.08	0.07	0.06	0.08	0.3%	11.40	38.0%
E41	Gwent Levels - Rumney and Peterstone	µg/m³	30	17.5	0.17	0.17	0.18	0.15	0.14	0.18	0.6%	17.67	58.9%
E46	Cardiff Bay Wetland and Hamadryad Park	µg/m³	30	19.4	0.27	0.23	0.19	0.17	0.19	0.27	0.9%	19.67	65.6%
E47	Cardiff Heliport Fields	µg/m³	30	25.0	0.70	0.68	0.70	0.78	0.86	0.86	2.9%	25.86	86.2%
E48	Tidal Sidings	µg/m³	30	25.0	0.26	0.30	0.33	0.28	0.31	0.33	1.1%	25.33	84.4%
E49	Ocean Park South	µg/m³	30	25.0	0.00	0.00	0.00	0.00	0.00	0.00	0.0%	25.00	83.3%
E50	Beach Sidings	µg/m³	30	19.5	0.09	0.10	0.11	0.08	0.14	0.14	0.5%	19.64	65.5%
E51	Cardiff Bay Wetland Reserve	µg/m³	30	19.4	0.27	0.23	0.19	0.16	0.19	0.27	0.9%	19.67	65.6%
E52	River Taff	µg/m³	30	19.4	0.25	0.22	0.23	0.27	0.14	0.27	0.9%	19.67	65.6%
E53	Pengam Moors	µg/m³	30	19.1	0.19	0.20	0.20	0.17	0.17	0.20	0.7%	19.30	64.3%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	1.18	3.9%
Max @ non-statutory designated site	E47	0.86	2.9%

Daily mean oxides of nitrogen

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	µg/m³	75	50.1	8.31	7.15	8.21	8.39	7.20	8.39	11.18%	58.47	78.0%
E2	River Usk / Afon Wysg	µg/m³	75	47.0	0.86	0.71	0.47	0.54	0.71	0.86	1.14%	47.84	63.8%
E3	Cardiff Beech Woods	µg/m³	75	32.1	0.49	0.73	0.70	0.56	0.49	0.73	0.97%	32.83	43.8%
E4	Severn Estuary (England)	µg/m³	75	50.1	1.66	1.45	1.31	1.72	1.46	1.72	2.29%	51.80	69.1%
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / L	µg/m³	75	30.5	1.09	1.01	1.16	1.02	1.04	1.16	1.55%	31.66	42.2%
E8	Caeau Blaen-bielly	µg/m³	75	18.7	0.38	0.53	0.67	0.46	0.50	0.67	0.90%	19.41	25.9%
E9	Castell Coch Woodlands and Road Section	µg/m³	75	27.2	0.56	0.62	0.57	0.46	0.61	0.62	0.82%	27.86	37.1%
E10	Cefn Onn	µg/m³	75	20.2	0.54	0.62	0.62	0.68	0.74	0.74	0.99%	20.96	28.0%
E11	Cliff Wood - Golden Stairs	µg/m³	75	17.3	0.79	0.66	0.68	0.79	0.67	0.79	1.06%	18.13	24.2%
E12	Coed y Bedw	µg/m³	75	20.1	0.42	0.57	0.50	0.44	0.60	0.60	0.80%	20.66	27.5%
E13	Coedydd y Barri / Barry Woodlands	µg/m³	75	19.1	1.01	1.04	1.32	0.93	1.03	1.32	1.76%	20.42	27.2%
E14	Cog Moors	µg/m³	75	21.4	1.09	1.08	0.96	0.87	1.23	1.23	1.64%	22.65	30.2%
E16	Cwm Cydfin, Leckwith	µg/m³	75	34.4	2.16	1.87	2.03	2.21	1.70	2.21	2.95%	36.61	48.8%
E17	Ely Valley	µg/m³	75	26.1	0.80	0.91	0.84	0.95	0.67	0.95	1.27%	27.01	36.0%
E18	Fforestganol a Chwm Nofydd	µg/m³	75	31.7	0.53	0.81	0.65	0.53	0.54	0.81	1.08%	32.53	43.4%
E19	Flat Holm	µg/m³	75	50.1	0.69	0.75	0.75	0.71	0.70	0.75	1.01%	50.83	67.8%
E20	Garth Wood	µg/m³	75	32.1	0.49	0.62	0.49	0.48	0.68	0.68	0.90%	32.78	43.7%
E21	Glamorgan Canal / Long Wood	µg/m³	75	38.4	0.62	0.79	0.66	0.64	0.91	0.91	1.22%	39.35	52.5%
E22	Gwaun Gledyr	µg/m³	75	28.5	0.32	0.45	0.58	0.51	0.39	0.58	0.78%	29.08	38.8%
E23	Gwent Levels - St. Brides	µg/m³	75	33.4	0.94	0.72	0.74	0.69	0.61	0.94	1.26%	34.38	45.8%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	µg/m³	75	22.1	0.95	0.66	0.50	0.67	0.73	0.95	1.26%	23.01	30.7%
E26	Lisvane Reservoir	µg/m³	75	30.4	0.94	0.89	1.09	0.91	0.99	1.09	1.46%	31.51	42.0%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	µg/m³	75	17.8	1.11	1.10	1.13	0.75	0.67	1.13	1.50%	18.94	25.3%
E28	Nant Whitton Woodlands	µg/m³	75	14.9	0.76	0.69	0.65	0.56	1.06	1.06	1.42%	15.92	21.2%
E29	Penarth Coast	µg/m³	75	20.7	0.82	1.50	0.99	0.87	0.79	1.50	2.00%	22.24	29.6%
E31	Plas Machen Wood	µg/m³	75	20.2	0.38	0.55	0.39	0.55	0.50	0.55	0.73%	20.75	27.7%
E35	Ruperra Castle and Woodlands	µg/m³	75	19.8	0.58	0.89	0.59	0.65	0.59	0.89	1.19%	20.65	27.5%
E38	Ty Du Moor	µg/m³	75	23.2	0.41	0.54	1.12	0.96	0.71	1.12	1.49%	24.28	32.4%
E40	Fferm Walters	µg/m³	75	22.6	0.82	0.79	0.95	0.73	0.75	0.95	1.27%	23.59	31.5%
E41	Gwent Levels - Rumney and Peterstone	µg/m³	75	35.0	2.49	2.34	2.13	2.02	1.89	2.49	3.32%	37.46	49.9%
E46	Cardiff Bay Wetland and Hamadryad Park	µg/m³	75	38.80	6.39	4.88	5.39	3.58	4.48	6.39	8.52%	45.19	60.3%
E47	Cardiff Heliport Fields	µg/m³	75	50.00	4.27	4.90	5.93	4.73	5.29	5.93	7.90%	55.93	74.6%
E48	Tidal Sidings	µg/m³	75	50.00	2.46	3.92	3.94	3.52	4.29	4.29	5.72%	54.29	72.4%
E49	Ocean Park South	µg/m³	75	50.00	0.00	0.02	0.00	0.00	0.02	0.02	0.03%	50.02	66.7%
E50	Beach Sidings	µg/m³	75	39.00	3.72	3.68	3.08	1.86	4.17	4.17	5.56%	43.17	57.6%
E51	Cardiff Bay Wetland Reserve	µg/m³	75	38.80	6.43	4.81	5.42	3.54	4.46	6.43	8.58%	45.23	60.3%
E52	River Taff	µg/m³	75	38.80	4.00	4.33	3.73	4.75	3.81	4.75	6.34%	43.55	58.1%
E53	Pengam Moors	µg/m³	75	38.20	3.51	2.98	2.47	3.39	3.23	3.51	4.67%	41.71	55.6%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	8.39	11.2%
Max @ non-statutory designated site	E51	6.43	8.6%

Annual mean sulphur dioxide

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	10,000	5,630	249.29	202.62	225.83	262.24	262.60	262.6	2.63%	5,893	58.9%
E2	River Usk / Afon Wysg	ng/m ³	10,000	5,340	11.09	11.20	11.78	10.59	10.49	11.8	0.12%	5,352	53.5%
E3	Cardiff Beech Woods	ng/m ³	10,000	2,510	6.18	8.27	10.11	7.91	7.36	10.1	0.10%	2,520	25.2%
E4	Severn Estuary (England)	ng/m ³	10,000	5,630	30.41	34.97	25.87	29.89	33.37	35.0	0.35%	5,665	56.6%
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / L	ng/m ³	10,000	3,310	11.08	12.71	16.35	14.14	13.26	16.4	0.16%	3,326	33.3%
E8	Caeau Blaen-bielly	ng/m ³	10,000	1,850	6.27	7.19	8.45	8.43	9.61	9.6	0.10%	1,860	18.6%
E9	Castell Coch Woodlands and Road Section	ng/m ³	10,000	2,510	6.70	8.67	10.09	8.52	8.91	10.1	0.10%	2,520	25.2%
E10	Cefn Onn	ng/m ³	10,000	2,010	6.95	8.16	10.00	9.17	8.99	10.0	0.10%	2,020	20.2%
E11	Cliff Wood - Golden Stairs	ng/m ³	10,000	1,870	14.74	16.46	16.04	13.72	12.66	16.5	0.16%	1,886	18.9%
E12	Coed y Bedw	ng/m ³	10,000	1,820	6.26	7.55	9.00	8.34	8.82	9.0	0.09%	1,829	18.3%
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	10,000	1,710	22.51	22.74	24.97	23.05	18.85	25.0	0.25%	1,735	17.3%
E14	Cog Moors	ng/m ³	20,000	1,860	12.17	18.11	13.39	14.75	13.62	18.1	0.09%	1,878	9.4%
E16	Cwm Cydfin, Leckwith	ng/m ³	10,000	3,280	33.76	32.72	33.15	35.80	23.09	35.8	0.36%	3,316	33.2%
E17	Ely Valley	ng/m ³	20,000	2,000	10.50	11.36	12.83	10.69	10.19	12.8	0.06%	2,013	10.1%
E18	Fforestganol a Chwm Nofydd	ng/m ³	10,000	2,510	6.65	8.70	10.61	8.33	7.90	10.6	0.11%	2,521	25.2%
E19	Flat Holm	ng/m ³	10,000	5,630	8.71	10.65	8.73	7.23	8.69	10.6	0.11%	5,641	56.4%
E20	Garth Wood	ng/m ³	10,000	2,510	6.94	8.64	10.06	9.02	9.77	10.1	0.10%	2,520	25.2%
E21	Glamorgan Canal / Long Wood	ng/m ³	10,000	2,750	9.62	11.62	13.43	12.25	13.58	13.6	0.14%	2,764	27.6%
E22	Gwaun Gledyr	ng/m ³	10,000	2,640	4.82	6.47	7.62	6.75	6.26	7.6	0.08%	2,648	26.5%
E23	Gwent Levels - St. Brides	ng/m ³	20,000	3,090	14.64	14.97	15.74	14.12	12.35	15.7	0.08%	3,106	15.5%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	20,000	1,870	11.84	11.58	12.43	11.03	11.69	12.4	0.06%	1,882	9.4%
E26	Lisvane Reservoir	ng/m ³	20,000	3,090	10.94	12.22	15.47	13.61	12.72	15.5	0.08%	3,105	15.5%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	20,000	1,585	9.23	14.10	12.53	10.40	10.23	14.1	0.07%	1,599	8.0%
E28	Nant Whitton Woodlands	ng/m ³	10,000	1,440	11.20	12.94	14.53	12.28	13.85	14.5	0.15%	1,455	14.5%
E29	Penarth Coast	ng/m ³	20,000	2,070	9.07	13.31	11.79	9.77	10.16	13.3	0.07%	2,083	10.4%
E31	Plas Machen Wood	ng/m ³	10,000	1,840	6.66	7.91	8.22	8.57	7.62	8.6	0.09%	1,849	18.5%
E35	Ruperra Castle and Woodlands	ng/m ³	20,000	1,850	8.01	8.69	9.25	9.33	8.81	9.3	0.05%	1,859	9.3%
E38	Ty Du Moor	ng/m ³	10,000	1,640	9.20	10.07	12.33	10.89	11.58	12.3	0.12%	1,652	16.5%
E40	Fferm Walters	ng/m ³	10,000	2,540	16.48	17.91	18.74	16.62	13.73	18.7	0.19%	2,559	25.6%
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	20,000	3,514	38.11	37.15	40.17	34.37	30.52	40.2	0.20%	3,554	17.8%
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	20,000	3.40	61.06	51.16	42.38	37.86	43.20	61.1	0.31%	64.46	0.3%
E47	Cardiff Heliport Fields	ng/m ³	20,000	5.60	156.02	151.66	155.86	173.72	191.71	191.7	0.96%	197.31	1.0%
E48	Tidal Sidings	ng/m ³	20,000	5.60	57.92	66.23	72.63	61.99	69.56	72.6	0.36%	78.23	0.4%
E49	Ocean Park South	ng/m ³	20,000	5.60	0.00	0.02	0.00	0.01	0.01	0.0	0.00%	5.62	0.0%
E50	Beach Sidings	ng/m ³	20,000	3.80	20.95	22.47	25.14	17.97	30.18	30.2	0.15%	33.98	0.2%
E51	Cardiff Bay Wetland Reserve	ng/m ³	20,000	3.40	60.26	50.65	41.29	36.64	42.91	60.3	0.30%	63.66	0.3%
E52	River Taff	ng/m ³	20,000	3.40	54.50	49.41	50.42	59.75	32.16	59.8	0.30%	63.15	0.3%
E53	Pengam Moors	ng/m ³	20,000	3.50	42.17	44.90	45.18	38.03	36.84	45.2	0.23%	48.68	0.2%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	262.60	2.6%
Max @ non-statutory designated site	E47	191.71	1.0%

Maximum weekly mean hydrogen fluoride

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	500	-	25.83	20.02	20.86	18.69	21.22	25.8	5.17%	-	-
E2	River Usk / Afon Wysg	ng/m ³	500	-	1.16	1.03	1.28	0.98	0.93	1.3	0.26%	-	-
E3	Cardiff Beech Woods	ng/m ³	500	-	0.64	1.06	0.89	0.84	0.72	1.1	0.21%	-	-
E4	Severn Estuary (England)	ng/m ³	500	-	3.82	2.12	2.07	3.14	2.22	3.8	0.76%	-	-
E5	Argloddiau Cronfeyedd Dwr Llanisien a Lllys-Faen / L	ng/m ³	500	-	1.58	1.73	2.84	1.59	1.47	2.8	0.57%	-	-
E8	Caeau Blaen-bielly	ng/m ³	500	-	0.65	0.87	0.86	0.89	0.95	0.9	0.19%	-	-
E9	Castell Coch Woodlands and Road Section	ng/m ³	500	-	0.68	1.18	1.14	0.84	0.93	1.2	0.24%	-	-
E10	Cefn Onn	ng/m ³	500	-	0.87	1.09	1.45	1.02	0.97	1.5	0.29%	-	-
E11	Cliff Wood - Golden Stairs	ng/m ³	500	-	2.05	2.25	1.98	2.29	2.27	2.3	0.46%	-	-
E12	Coed y Bedw	ng/m ³	500	-	0.59	1.03	0.97	0.84	0.79	1.0	0.21%	-	-
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	500	-	3.33	3.10	3.34	3.71	3.11	3.7	0.74%	-	-
E14	Cog Moors	ng/m ³	500	-	1.80	3.20	1.60	3.12	1.56	3.2	0.64%	-	-
E16	Cwm Cydfin, Leckwith	ng/m ³	500	-	6.58	5.06	5.64	8.68	3.78	8.7	1.74%	-	-
E17	Ely Valley	ng/m ³	500	-	1.25	2.31	1.24	1.47	1.32	2.3	0.46%	-	-
E18	Fforestganol a Chwm Nofydd	ng/m ³	500	-	0.62	1.16	0.90	0.79	0.75	1.2	0.23%	-	-
E19	Flat Holm	ng/m ³	500	-	1.39	1.27	1.14	0.91	0.98	1.4	0.28%	-	-
E20	Garth Wood	ng/m ³	500	-	0.71	1.16	1.09	0.90	0.95	1.2	0.23%	-	-
E21	Glamorgan Canal / Long Wood	ng/m ³	500	-	0.98	1.62	1.36	1.21	1.35	1.6	0.32%	-	-
E22	Gwaun Gledyr	ng/m ³	500	-	0.35	0.64	0.58	0.73	0.53	0.7	0.15%	-	-
E23	Gwent Levels - St. Brides	ng/m ³	500	-	1.73	1.27	2.40	1.58	1.24	2.4	0.48%	-	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	500	-	1.24	1.05	1.24	0.92	1.09	1.2	0.25%	-	-
E26	Lisvane Reservoir	ng/m ³	500	-	1.44	1.50	2.86	1.46	1.21	2.9	0.57%	-	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	500	-	0.96	1.51	1.75	1.27	1.13	1.7	0.35%	-	-
E28	Nant Whittton Woodlands	ng/m ³	500	-	1.18	1.85	1.63	1.63	2.28	2.3	0.46%	-	-
E29	Penarth Coast	ng/m ³	500	-	0.80	1.92	1.56	1.40	1.37	1.9	0.38%	-	-
E31	Plas Machen Wood	ng/m ³	500	-	0.61	0.85	0.72	0.87	0.57	0.9	0.17%	-	-
E35	Ruperra Castle and Woodlands	ng/m ³	500	-	0.70	0.99	1.00	1.03	0.78	1.0	0.21%	-	-
E38	Ty Du Moor	ng/m ³	500	-	0.88	0.88	1.27	1.26	1.26	1.3	0.25%	-	-
E40	Fferm Walters	ng/m ³	500	-	1.97	2.14	2.40	2.08	2.24	2.4	0.48%	-	-
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	500	-	4.48	3.50	6.44	4.01	4.56	6.4	1.29%	-	-
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	500	-	13.94	9.39	8.16	6.27	15.05	15.1	3.01%	-	-
E47	Cardiff Heliport Fields	ng/m ³	500	-	14.62	13.82	15.16	12.52	15.53	15.5	3.11%	-	-
E48	Tidal Sidings	ng/m ³	500	-	5.87	8.47	8.75	8.13	6.26	8.7	1.75%	-	-
E49	Ocean Park South	ng/m ³	500	-	0.00	0.01	0.00	0.01	0.01	0.0	0.00%	-	-
E50	Beach Sidings	ng/m ³	500	-	3.96	4.51	5.85	3.63	6.19	6.2	1.24%	-	-
E51	Cardiff Bay Wetland Reserve	ng/m ³	500	-	14.05	9.03	8.01	5.72	14.96	15.0	2.99%	-	-
E52	River Taff	ng/m ³	500	-	12.41	6.74	9.78	17.69	8.11	17.7	3.54%	-	-
E53	Pengam Moors	ng/m ³	500	-	4.82	4.57	6.13	5.36	8.07	8.1	1.61%	-	-

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	25.83	5.2%
Max @ non-statutory designated site	E52	17.69	3.5%

Maximum daily mean hydrogen fluoride

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	5,000	-	46.18	39.73	45.60	46.59	39.99	46.6	0.93%	-	-
E2	River Usk / Afon Wysg	ng/m ³	5,000	-	4.76	3.95	2.59	2.98	3.96	4.8	0.10%	-	-
E3	Cardiff Beech Woods	ng/m ³	5,000	-	2.75	4.05	3.90	3.08	2.74	4.1	0.08%	-	-
E4	Severn Estuary (England)	ng/m ³	5,000	-	9.20	8.06	7.29	9.53	8.14	9.5	0.19%	-	-
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	ng/m ³	5,000	-	6.03	5.59	6.46	5.69	5.79	6.5	0.13%	-	-
E8	Caeau Blaen-bielly	ng/m ³	5,000	-	2.11	2.93	3.74	2.57	2.78	3.7	0.07%	-	-
E9	Castell Coch Woodlands and Road Section	ng/m ³	5,000	-	3.10	3.42	3.15	2.55	3.38	3.4	0.07%	-	-
E10	Cefn Onn	ng/m ³	5,000	-	3.01	3.42	3.42	3.77	4.13	4.1	0.08%	-	-
E11	Cliff Wood - Golden Stairs	ng/m ³	5,000	-	4.40	3.67	3.76	4.38	3.73	4.4	0.09%	-	-
E12	Coed y Bedw	ng/m ³	5,000	-	2.34	3.18	2.80	2.44	3.32	3.3	0.07%	-	-
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	5,000	-	5.64	5.81	7.35	5.16	5.74	7.3	0.15%	-	-
E14	Cog Moors	ng/m ³	5,000	-	6.03	6.00	5.34	4.85	6.81	6.8	0.14%	-	-
E16	Cwm Cydfin, Leckwith	ng/m ³	5,000	-	11.97	10.39	11.30	12.29	9.45	12.3	0.25%	-	-
E17	Ely Valley	ng/m ³	5,000	-	4.44	5.05	4.66	5.27	3.72	5.3	0.11%	-	-
E18	Fforestganol a Chwm Nofydd	ng/m ³	5,000	-	2.93	4.50	3.60	2.93	3.00	4.5	0.09%	-	-
E19	Flat Holm	ng/m ³	5,000	-	3.83	4.19	4.17	3.95	3.89	4.2	0.08%	-	-
E20	Garth Wood	ng/m ³	5,000	-	2.73	3.42	2.70	2.67	3.77	3.8	0.08%	-	-
E21	Glamorgan Canal / Long Wood	ng/m ³	5,000	-	3.45	4.37	3.67	3.57	5.07	5.1	0.10%	-	-
E22	Gwaun Gledyr	ng/m ³	5,000	-	1.76	2.50	3.25	2.86	2.17	3.2	0.06%	-	-
E23	Gwent Levels - St. Brides	ng/m ³	5,000	-	5.24	4.01	4.13	3.83	3.37	5.2	0.10%	-	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	5,000	-	5.25	3.68	2.77	3.73	4.05	5.3	0.11%	-	-
E26	Lisvane Reservoir	ng/m ³	5,000	-	5.23	4.96	6.06	5.07	5.48	6.1	0.12%	-	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	5,000	-	6.16	6.10	6.26	4.18	3.71	6.3	0.13%	-	-
E28	Nant Whittton Woodlands	ng/m ³	5,000	-	4.21	3.83	3.59	3.13	5.91	5.9	0.12%	-	-
E29	Penarth Coast	ng/m ³	5,000	-	4.56	8.32	5.48	4.84	4.41	8.3	0.17%	-	-
E31	Plas Machen Wood	ng/m ³	5,000	-	2.11	3.05	2.17	3.05	2.79	3.0	0.06%	-	-
E35	Ruperra Castle and Woodlands	ng/m ³	5,000	-	3.24	4.95	3.27	3.61	3.27	4.9	0.10%	-	-
E38	Ty Du Moor	ng/m ³	5,000	-	2.30	2.99	6.20	5.35	3.95	6.2	0.12%	-	-
E40	Fferm Walters	ng/m ³	5,000	-	4.56	4.38	5.30	4.06	4.16	5.3	0.11%	-	-
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	5,000	-	13.83	13.03	11.85	11.20	10.53	13.8	0.28%	-	-
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	5,000	-	35.50	27.13	29.92	19.89	24.90	35.5	0.71%	-	-
E47	Cardiff Heliport Fields	ng/m ³	5,000	-	23.74	27.22	32.94	26.30	29.39	32.9	0.66%	-	-
E48	Tidal Sidings	ng/m ³	5,000	-	13.68	21.75	21.89	19.58	23.84	23.8	0.48%	-	-
E49	Ocean Park South	ng/m ³	5,000	-	0.00	0.11	0.00	0.03	0.10	0.1	0.00%	-	-
E50	Beach Sidings	ng/m ³	5,000	-	20.68	20.43	17.13	10.32	23.15	23.1	0.46%	-	-
E51	Cardiff Bay Wetland Reserve	ng/m ³	5,000	-	35.74	26.74	30.09	19.64	24.76	35.7	0.71%	-	-
E52	River Taff	ng/m ³	5,000	-	22.21	24.08	20.73	26.40	21.15	26.4	0.53%	-	-
E53	Pengam Moors	ng/m ³	5,000	-	19.48	16.58	13.75	18.82	17.96	19.5	0.39%	-	-

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	46.59	0.9%
Max @ non-statutory designated site	E51	35.74	0.7%

Annual mean ammonia

ID	Receptor	Units	CL	Background Concentration	2020	2021	2022	2023	2024	Max	Max as % of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	1,000	1,710	93.39	75.90	84.59	98.23	98.37	98.4	9.84%	1808.37	180.8%
E2	River Usk / Afon Wysg	ng/m ³	1,000	1,610	4.15	4.19	4.41	3.97	3.93	4.4	0.44%	1614.41	161.4%
E3	Cardiff Beech Woods	ng/m ³	1,000	990	2.32	3.10	3.79	2.96	2.76	3.8	0.38%	993.79	99.4%
E4	Severn Estuary (England)	ng/m ³	3,000	1,710	11.39	13.10	9.69	11.20	12.50	13.1	0.44%	1723.10	57.4%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	ng/m ³	1,000	1,180	4.15	4.76	6.13	5.30	4.97	6.1	0.61%	1186.13	118.6%
E8	Caeau Blaen-bielly	ng/m ³	1,000	910	2.35	2.70	3.16	3.16	3.60	3.6	0.36%	913.60	91.4%
E9	Castell Coch Woodlands and Road Section	ng/m ³	1,000	990	2.51	3.25	3.78	3.19	3.34	3.8	0.38%	993.78	99.4%
E10	Cefn Onn	ng/m ³	1,000	920	2.60	3.06	3.75	3.44	3.37	3.7	0.37%	923.75	92.4%
E11	Cliff Wood - Golden Stairs	ng/m ³	1,000	960	5.52	6.17	6.01	5.14	4.74	6.2	0.62%	966.17	96.6%
E12	Coed y Bedw	ng/m ³	1,000	910	2.34	2.83	3.37	3.13	3.30	3.4	0.34%	913.37	91.3%
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	1,000	1,060	8.43	8.52	9.35	8.63	7.06	9.4	0.94%	1069.35	106.9%
E14	Cog Moors	ng/m ³	3,000	1,090	4.56	6.78	5.01	5.53	5.10	6.8	0.23%	1096.78	36.6%
E16	Cwm Cyffin, Leckwith	ng/m ³	1,000	1,110	12.64	12.26	12.42	13.41	8.65	13.4	1.34%	1123.41	112.3%
E17	Ely Valley	ng/m ³	3,000	1,000	3.93	4.26	4.81	4.00	3.82	4.8	0.16%	1004.81	33.5%
E18	Fforestganol a Chwm Nofydd	ng/m ³	1,000	1,050	2.49	3.26	3.97	3.12	2.96	4.0	0.40%	1053.97	105.4%
E19	Flat Holm	ng/m ³	1,000	1,710	3.26	3.99	3.27	2.71	3.25	4.0	0.40%	1713.99	171.4%
E20	Garth Wood	ng/m ³	1,000	950	2.60	3.24	3.77	3.38	3.66	3.8	0.38%	953.77	95.4%
E21	Glamorgan Canal / Long Wood	ng/m ³	1,000	1,110	3.61	4.35	5.03	4.59	5.09	5.1	0.51%	1115.09	111.5%
E22	Gwaun Gledyr	ng/m ³	1,000	930	1.80	2.42	2.85	2.53	2.35	2.9	0.29%	932.85	93.3%
E23	Gwent Levels - St. Brides	ng/m ³	3,000	1,570	5.49	5.61	5.90	5.29	4.63	5.9	0.20%	1575.90	52.5%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	3,000	1,460	4.44	4.34	4.66	4.13	4.38	4.7	0.16%	1464.66	48.8%
E26	Lisvane Reservoir	ng/m ³	3,000	1,160	4.10	4.58	5.79	5.10	4.76	5.8	0.19%	1165.79	38.9%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	3,000	1,141	3.46	5.28	4.69	3.90	3.83	5.3	0.18%	1146.28	38.2%
E28	Nant Whittton Woodlands	ng/m ³	1,000	1,070	4.20	4.85	5.44	4.60	5.19	5.4	0.54%	1075.44	107.5%
E29	Penarth Coast	ng/m ³	3,000	1,160	3.40	4.99	4.42	3.66	3.80	5.0	0.17%	1164.99	38.8%
E31	Plas Machen Wood	ng/m ³	1,000	980	2.50	2.96	3.08	3.21	2.86	3.2	0.32%	983.21	98.3%
E35	Ruperra Castle and Woodlands	ng/m ³	3,000	1,020	3.00	3.26	3.46	3.50	3.30	3.5	0.12%	1023.50	34.1%
E38	Ty Du Moor	ng/m ³	1,000	960	3.45	3.77	4.62	4.08	4.34	4.6	0.46%	964.62	96.5%
E40	Fferm Walters	ng/m ³	1,000	1,090	6.17	6.71	7.02	6.22	5.14	7.0	0.70%	1097.02	109.7%
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	3,000	1,365	14.28	13.92	15.05	12.87	11.43	15.0	0.50%	1380.05	46.0%
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	3,000	1,100	22.87	19.17	15.88	14.18	16.18	22.9	0.76%	1122.87	37.4%
E47	Cardiff Heliport Fields	ng/m ³	3,000	1,100	58.45	56.81	58.38	65.07	71.82	71.8	2.39%	1171.82	39.1%
E48	Tidal Sidings	ng/m ³	3,000	1,100	21.70	24.81	27.21	23.22	26.06	27.2	0.91%	1127.21	37.6%
E49	Ocean Park South	ng/m ³	3,000	1,100	0.00	0.01	0.00	0.00	0.00	0.0	0.00%	1100.01	36.7%
E50	Beach Sidings	ng/m ³	3,000	1,100	7.85	8.42	9.42	6.73	11.30	11.3	0.38%	1111.30	37.0%
E51	Cardiff Bay Wetland Reserve	ng/m ³	3,000	1,100	22.57	18.97	15.47	13.73	16.08	22.6	0.75%	1122.57	37.4%
E52	River Taff	ng/m ³	3,000	1,100	20.41	18.51	18.89	22.38	12.05	22.4	0.75%	1122.38	37.4%
E53	Pengam Moors	ng/m ³	3,000	1,100	15.80	16.82	16.92	14.25	13.80	16.9	0.56%	1116.92	37.2%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	98.37	9.8%
Max @ non-statutory designated site	E47	71.82	2.4%

ERF

		Max Conc. (ng/m ³)			
ID	Receptor	NO2	SO2	HCl	NH3
E1	Severn Estuary (Wales)	757.48	240.51	48.10	90.19
E2	River Usk / Afon Wysg	34.73	11.03	2.21	4.14
E3	Cardiff Beech Woods	25.09	7.97	1.59	2.99
E4	Severn Estuary (England)	97.33	30.90	6.18	11.59
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / Llanishen and	42.55	13.51	2.70	5.07
E8	Caeau Blaen-bielly	25.16	7.99	1.60	3.00
E9	Castell Coch Woodlands and Road Section	27.01	8.58	1.72	3.22
E10	Cefn Onn	27.26	8.65	1.73	3.25
E11	Cliff Wood - Golden Stairs	46.38	14.73	2.95	5.52
E12	Coed y Bedw	25.17	7.99	1.60	3.00
E13	Coedydd y Barri / Barry Woodlands	70.62	22.42	4.48	8.41
E14	Cog Moors	45.37	14.41	2.88	5.40
E16	Cwm Cydfin, Leckwith	99.85	31.70	6.34	11.89
E17	Ely Valley	35.00	11.11	2.22	4.17
E18	Fforestganol a Chwm Nofydd	26.57	8.44	1.69	3.16
E19	Flat Holm	27.71	8.80	1.76	3.30
E20	Garth Wood	27.98	8.88	1.78	3.33
E21	Glamorgan Canal / Long Wood	38.11	12.10	2.42	4.54
E22	Gwaun Gledyr	20.11	6.38	1.28	2.39
E23	Gwent Levels - St. Brides	45.25	14.37	2.87	5.39
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	36.89	11.71	2.34	4.39
E26	Lisvane Reservoir	40.92	12.99	2.60	4.87
E27	Llynnoedd Cosmeston / Cosmeston Lakes	35.59	11.30	2.26	4.24
E28	Nant Whitton Woodlands	40.82	12.96	2.59	4.86
E29	Penarth Coast	34.08	10.82	2.16	4.06
E31	Plas Machen Wood	24.56	7.80	1.56	2.92
E35	Ruperra Castle and Woodlands	27.78	8.82	1.76	3.31
E38	Ty Du Moor	34.06	10.82	2.16	4.06
E40	Fferm Walters	52.58	16.69	3.34	6.26
E41	Gwent Levels - Rumney and Peterstone	113.58	36.06	7.21	13.52
E46	Cardiff Bay Wetland and Hamadryad Park	148.44	47.13	9.43	17.67
E47	Cardiff Heliport Fields	522.16	165.79	33.16	62.17
E48	Tidal Sidings	206.80	65.66	13.13	24.62
E49	Ocean Park South	0.02	0.01	0.00	0.00
E50	Beach Sidings	73.52	23.34	4.67	8.75
E51	Cardiff Bay Wetland Reserve	145.97	46.35	9.27	17.38
E52	River Taff	155.10	49.25	9.85	18.47
E53	Pengam Moors	130.46	41.42	8.28	15.53

Note:
Assumes continual operation of the ERF at the daily mean ELV - average of 5-years weather data

Grassland								Woodland							
Deposition (g/ha/yr)				Total N Depositio n (gN/ha/yr	Acid Deposition keq/ha/yr *1,000			Deposition (g/ha/yr)				Total N Depositio n (gN/ha/yr	Acid Deposition keq/ha/yr *1,000		
NO2	SO2	HCl	NH3		N	S		NO2	SO2	HCl	NH3		N	S	
109.08	455.15	368.83	468.46	577.54	41.25	49.23		218.15	910.29	885.18	702.69	920.84	65.77	106.76	
5.00	20.87	16.91	21.48	26.48	1.89	2.26		10.00	41.74	40.59	32.22	42.22	3.02	4.90	
3.61	15.08	12.22	15.52	19.13	1.37	1.63		7.23	30.15	29.32	23.28	30.50	2.18	3.54	
14.02	58.48	47.39	60.19	74.21	5.30	6.32		28.03	116.96	113.74	90.29	118.32	8.45	13.72	
6.13	25.56	20.72	26.31	32.44	2.32	2.76		12.25	51.13	49.72	39.47	51.72	3.69	6.00	
3.62	15.12	12.25	15.56	19.18	1.37	1.64		7.25	30.24	29.40	23.34	30.59	2.18	3.55	
3.89	16.23	13.15	16.70	20.59	1.47	1.76		7.78	32.46	31.56	25.06	32.84	2.35	3.81	
3.92	16.38	13.27	16.86	20.78	1.48	1.77		7.85	32.75	31.85	25.28	33.13	2.37	3.84	
6.68	27.87	22.58	28.68	35.36	2.53	3.01		13.36	55.73	54.20	43.02	56.38	4.03	6.54	
3.62	15.13	12.26	15.57	19.19	1.37	1.64		7.25	30.25	29.42	23.35	30.60	2.19	3.55	
10.17	42.44	34.39	43.68	53.85	3.85	4.59		20.34	84.87	82.53	65.52	85.86	6.13	9.95	
6.53	27.26	22.09	28.06	34.59	2.47	2.95		13.07	54.53	53.02	42.09	55.16	3.94	6.39	
14.38	60.00	48.62	61.75	76.13	5.44	6.49		28.76	119.99	116.68	92.63	121.38	8.67	14.07	
5.04	21.03	17.04	21.65	26.69	1.91	2.27		10.08	42.07	40.91	32.47	42.55	3.04	4.93	
3.83	15.97	12.94	16.43	20.26	1.45	1.73		7.65	31.93	31.05	24.65	32.30	2.31	3.75	
3.99	16.65	13.49	17.14	21.13	1.51	1.80		7.98	33.30	32.38	25.71	33.69	2.41	3.91	
4.03	16.81	13.62	17.30	21.33	1.52	1.82		8.06	33.62	32.70	25.96	34.01	2.43	3.94	
5.49	22.90	18.56	23.57	29.06	2.08	2.48		10.98	45.80	44.54	35.35	46.33	3.31	5.37	
2.90	12.08	9.79	12.43	15.33	1.09	1.31		5.79	24.16	23.50	18.65	24.44	1.75	2.83	
6.52	27.19	22.03	27.98	34.50	2.46	2.94		13.03	54.38	52.88	41.98	55.01	3.93	6.38	
5.31	22.17	17.96	22.81	28.13	2.01	2.40		10.62	44.33	43.11	34.22	44.84	3.20	5.20	
5.89	24.59	19.92	25.30	31.20	2.23	2.66		11.78	49.17	47.81	37.96	49.74	3.55	5.77	
5.12	21.38	17.33	22.01	27.13	1.94	2.31		10.25	42.77	41.59	33.01	43.26	3.09	5.02	
5.88	24.53	19.88	25.24	31.12	2.22	2.65		11.76	49.05	47.70	37.87	49.62	3.54	5.75	
4.91	20.48	16.60	21.08	25.99	1.86	2.21		9.82	40.96	39.83	31.62	41.43	2.96	4.80	
3.54	14.76	11.96	15.19	18.72	1.34	1.60		7.07	29.51	28.70	22.78	29.85	2.13	3.46	
4.00	16.69	13.53	17.18	21.18	1.51	1.81		8.00	33.38	32.46	25.77	33.77	2.41	3.92	
4.90	20.47	16.58	21.07	25.97	1.85	2.21		9.81	40.93	39.80	31.60	41.41	2.96	4.80	
7.57	31.59	25.60	32.52	40.09	2.86	3.42		15.14	63.18	61.44	48.77	63.92	4.57	7.41	
16.36	68.25	55.30	70.24	86.60	6.19	7.38		32.71	136.49	132.73	105.36	138.07	9.86	16.01	
21.38	89.19	72.28	91.80	113.18	8.08	9.65		42.75	178.39	173.47	137.71	180.46	12.89	20.92	
75.19	313.75	254.24	322.92	398.12	28.44	33.93		150.38	627.50	610.19	484.39	634.77	45.34	73.60	
29.78	124.26	100.69	127.90	157.67	11.26	13.44		59.56	248.52	241.67	191.84	251.40	17.96	29.15	
0.00	0.01	0.01	0.01	0.02	0.00	0.00		0.01	0.03	0.03	0.02	0.03	0.00	0.00	
10.59	44.17	35.80	45.47	56.05	4.00	4.78		21.17	88.35	85.91	68.20	89.37	6.38	10.36	
21.02	87.71	71.08	90.28	111.30	7.95	9.49		42.04	175.42	170.58	135.42	177.46	12.68	20.57	
22.33	93.19	75.52	95.92	118.25	8.45	10.08		44.67	186.39	181.24	143.88	188.55	13.47	21.86	
18.79	78.39	63.52	80.68	99.47	7.11	8.48		37.57	156.78	152.46	121.03	158.60	11.33	18.39	

Nitrogen Deposition

ID	Name	Nitrogen CL Class	Deposition Velocity	Background (kgN/ha/yr)	CL min (kgN/ha/yr)	PC (gN/ha/yr)	PC (as % of CL)	PEC (kgN/ha/yr)	PEC (as % of CL)
E1	Severn Estuary (Wales)	Atlantic Upper-mid and mid-low salt marshes	Grassland	14.2	10	577.54	5.78%	14.748	147.48%
E2	River Usk / Afon Wysg	Acidophilous Quercus forest	Woodland	33.0	10	42.22	0.42%	33.082	330.82%
E2	River Usk / Afon Wysg	Atlantic upper-mid & mid-low salt marshes	Grassland	21.6	10	26.48	0.26%	21.616	216.16%
E3	Cardiff Beech Woods	Broadleaved deciduous woodland	Woodland	23.3	10	30.50	0.31%	23.311	233.11%
E4	Severn Estuary (England)		Grassland	14.2	10	74.21	0.74%	14.244	142.44%
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / Lla	No critical load has been assigned for this feature	Grassland	13.3	-	32.44	-	13.352	-
E8	Caeau Blaen-bielly	Low and medium altitude hay meadows	Grassland	12.7	10	19.18	0.19%	12.729	127.29%
E9	Castell Coch Woodlands and Road Section	Broadleaved deciduous woodland	Woodland	23.1	10	32.84	0.33%	23.093	230.93%
E10	Cefn Onn	Semi-dry Perennial calcareous grassland (basic meadow steppe)	Grassland	13.2	10	20.78	0.21%	13.231	132.31%
E11	Cliff Wood - Golden Stairs	Broadleaved deciduous woodland	Woodland	18.4	10	56.38	0.56%	18.476	184.76%
E12	Coed y Bedw	Broadleaved deciduous woodland	Woodland	22.6	10	30.60	0.31%	22.581	225.81%
E13	Coedydd y Barri / Barry Woodlands	Broadleaved deciduous woodland	Woodland	20.5	10	85.86	0.86%	20.616	206.16%
E14	Cog Moors	Low and medium altitude hay meadows	Grassland	10.5	10	34.59	0.35%	10.555	105.55%
E16	Cwm Cydfin, Leckwith	Broadleaved deciduous woodland	Woodland	22.0	10	121.38	1.21%	22.121	221.21%
E17	Ely Valley	No critical load has been assigned for this feature	Grassland	11.9	-	26.69	-	11.957	-
E18	Forestganol a Chwm Nofydd	Broadleaved deciduous woodland	Woodland	23.3	10	32.30	0.32%	23.372	233.72%
E19	Flat Holm	Coastal grassland	Grassland	21.6	5	21.13	0.42%	21.611	432.22%
E20	Garth Wood	Fagus forest on non-acid and acid soils	Woodland	23.1	10	34.01	0.34%	23.094	230.94%
E21	Glamorgan Canal / Long Wood	Broadleaved deciduous woodland	Woodland	22.9	10	46.33	0.46%	22.936	229.36%
E22	Gwaun Gledyr	Lowland to montane, dry to mesic grassland usually dominated b	Grassland	14.3	6	15.33	0.26%	14.295	238.26%
E23	Gwent Levels - St. Brides	No critical load has been assigned for this feature	Grassland	13.4	-	34.50	-	13.424	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	Atlantic upper-mid & mid-low salt marshes	Grassland	12.9	10	28.13	0.28%	12.888	128.88%
E26	Lisvane Reservoir	Atlantic upper-mid & mid-low salt marshes	Grassland	13.3	10	31.20	0.31%	13.351	133.51%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	No critical load has been assigned for this feature	Grassland	10.5	-	27.13	-	10.575	-
E28	Nant Whitton Woodlands	Broadleaved deciduous woodland	Woodland	20.7	10	49.62	0.50%	20.790	207.90%
E29	Penarth Coast	Low and medium altitude hay meadows	Grassland	10.6	10	25.99	0.26%	10.656	106.56%
E31	Plas Machen Wood	Broadleaved deciduous woodland	Woodland	23.3	10	29.85	0.30%	23.290	232.90%
E35	Ruperra Castle and Woodlands	No critical load has been assigned for this feature	Grassland	13.2	-	21.18	-	13.231	-
E38	Ty Du Moor	Rich Fens	Grassland	11.9	15	25.97	0.17%	11.966	79.77%
E40	Fferm Walters	Lowland to montane, dry to mesic grassland usually dominated b	Grassland	10.4	6	40.09	0.67%	10.400	173.33%
E41	Gwent Levels - Rumney and Peterstone	No critical load has been assigned for this feature	Grassland	12.8	-	86.60	-	12.846	-
E46	Cardiff Bay Wetland and Hamadryad Park	Grassland	Grassland	11.9	10	113.18	1.13%	12.013	120.13%
E47	Cardiff Heliport Fields	Grassland	Grassland	11.6	10	398.12	3.98%	11.998	119.98%
E48	Tidal Sidings	Grassland	Grassland	11.6	10	157.67	1.58%	11.758	117.58%
E49	Ocean Park South	Grassland	Grassland	11.6	10	0.02	0.00%	11.600	116.00%
E50	Beach Sidings	Grassland	Grassland	11.2	10	56.05	0.56%	11.256	112.56%
E51	Cardiff Bay Wetland Reserve	Grassland	Grassland	11.9	10	111.30	1.11%	12.011	120.11%
E52	River Taff	Grassland	Grassland	11.9	10	118.25	1.18%	12.018	120.18%
E53	Pengam Moors	Grassland	Grassland	11.5	10	99.47	0.99%	11.599	115.99%

E1 Atlantic Upper-mid and mid-low salt marshes Max @ statutory designated site 5.78%

Acid Deposition

ID	Name	Acidity CL Class	Deposition Velocity	Background (kgN/ha/yr)	Min CL max N (keqN/ha/yr)	N PC (geq/ha/yr)	S PC (geq/ha/yr)	PC (as % of CL)	PEC (kgN/ha/yr)	PEC (as % of CL)
E1	Severn Estuary (Wales)	Freshwater	Grassland	1.06	-	41.25	49.23	-	1.150	-
E2	River Usk / Afon Wysg	Bogs	Grassland	1.64	0.601	1.89	2.26	0.69%	1.644	273.57%
E2	River Usk / Afon Wysg	Unmanaged Broadleaved/Coniferous Woodland	Woodland	2.51	1.313	3.02	4.90	0.60%	2.518	191.77%
E3	Cardiff Beech Woods	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.9	1.428	2.18	3.54	0.40%	1.906	133.45%
E4	Severn Estuary (England)		Grassland	1.06	-	5.30	6.32	-	1.072	-
E5	Argloddiau Cronfeydd Dwr Llanisien a Llys-Faen / Lla	No critical load has been assigned for this feature	Grassland	1.18	-	2.32	2.76	-	1.185	-
E8	Caeau Blaen-bielly	No acidity critical loads available for this site	Grassland	1.06	-	1.37	1.64	-	1.063	-
E9	Castell Coch Woodlands and Road Section	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.88	1.428	2.35	3.81	0.43%	1.886	132.08%
E10	Cefn Onn	Calcareous grassland (using base cation)	Grassland	1.11	4.856	1.48	1.77	0.07%	1.113	22.93%
E11	Cliff Wood - Golden Stairs	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.43	8.484	4.03	6.54	0.12%	1.441	16.98%
E12	Coed y Bedw	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.83	2.087	2.19	3.55	0.27%	1.836	87.96%
E13	Coedydd y Barri / Barry Woodlands	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.62	8.727	6.13	9.95	0.18%	1.636	18.75%
E14	Cog Moors	No critical load has been assigned for this feature	Grassland	0.85	-	2.47	2.95	-	0.855	-
E16	Cwm Cydfin, Leckwith	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.82	1.744	8.67	14.07	1.30%	1.843	105.66%
E17	Ely Valley	No critical load has been assigned for this feature	Grassland	0.98	-	1.91	2.27	-	0.984	-
E18	Forestganol a Chwm Nofydd	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.92	1.428	2.31	3.75	0.42%	1.926	134.88%
E19	Flat Holm	No critical load has been assigned for this feature	Grassland	1.64	-	1.51	1.80	-	1.643	-
E20	Garth Wood	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.87	1.971	2.43	3.94	0.32%	1.876	95.20%
E21	Glamorgan Canal / Long Wood	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.9	1.964	3.31	5.37	0.44%	1.909	97.18%
E22	Gwaun Gledyr	No critical load has been assigned for this feature	Grassland	1.18	-	1.09	1.31	-	1.182	-
E23	Gwent Levels - St. Brides	No critical load has been assigned for this feature	Grassland	1.09	-	2.46	2.94	-	1.095	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	No critical load has been assigned for this feature	Grassland	1.01	-	2.01	2.40	-	1.014	-
E26	Lisvane Reservoir	No critical load has been assigned for this feature	Grassland	1.18	-	2.23	2.66	-	1.185	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	No critical load has been assigned for this feature	Grassland	0.847	-	1.94	2.31	-	0.851	-
E28	Nant Whitton Woodlands	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.61	2.953	3.54	5.75	0.31%	1.619	54.84%
E29	Penarth Coast	No acidity critical loads available for this site	Grassland	0.86	-	1.86	2.21	-	0.864	-
E31	Plas Machen Wood	Unmanaged Broadleaved/Coniferous Woodland	Woodland	1.86	2.048	2.13	3.46	0.27%	1.866	91.09%
E35	Ruperra Castle and Woodlands	No critical load has been assigned for this feature	Grassland	1.1	-	1.51	1.81	-	1.103	-
E38	Ty Du Moor	No acidity critical loads available for this site	Grassland	1	-	1.85	2.21	-	1.004	-
E40	Fferm Walters	No acidity critical loads available for this site	Grassland	0.83	-	2.86	3.42	-	0.836	-
E41	Gwent Levels - Rumney and Peterstone	No critical load has been assigned for this feature	Grassland	1.057	-	6.19	7.38	-	1.071	-
E46	Cardiff Bay Wetland and Hamadryad Park	Calcareous grassland	Grassland	1.11	4.856	8.08	9.65	0.37%	1.128	23.22%
E47	Cardiff Heliport Fields	Calcareous grassland	Grassland	1.1	4.856	28.44	33.93	1.28%	1.162	23.94%
E48	Tidal Sidings	Calcareous grassland	Grassland	1.1	4.856	11.26	13.44	0.51%	1.125	23.16%
E49	Ocean Park South	Calcareous grassland	Grassland	1.1	4.856	0.00	0.00	0.00%	1.100	22.65%
E50	Beach Sidings	Calcareous grassland	Grassland	1.05	4.856	4.00	4.78	0.18%	1.059	21.80%
E51	Cardiff Bay Wetland Reserve	Calcareous grassland	Grassland	1.11	4.856	7.95	9.49	0.36%	1.127	23.22%
E52	River Taff	Calcareous grassland	Grassland	1.11	4.856	8.45	10.08	0.38%	1.129	23.24%
E53	Pengam Moors	Calcareous grassland	Grassland	1.08	4.856	7.11	8.48	0.32%	1.096	22.56%

E16 Unmanaged Broadleaved/Coniferous Woodland Max @ statutory designated site 1.30%

F Change in Impact

Continual operation at daily ELV

Pollutant	Quantity	Units	AQAL	Background Concentration	Permitted		Proposed		Change in Impact		Proposed	
					Conc.	% of AQAL	Conc.	% of AQAL	Conc.	% of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m ³	40	20.3	0.8	1.89%	0.8	2.07%	0.1	0.18%	21.1	52.82%
Nitrogen dioxide	99.79th %ile of hourly means	µg/m ³	200	40.6	5.7	2.86%	6.1	3.06%	0.4	0.20%	46.7	23.36%
Sulphur dioxide	99.18th %ile of daily means	µg/m ³	125	10.4	1.4	1.13%	1.6	1.27%	0.2	0.14%	12.0	9.59%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m ³	350	10.4	3.6	1.03%	3.8	1.09%	0.2	0.06%	14.2	4.06%
Sulphur dioxide	99.9th %ile of 15 min. means	µg/m ³	266	10.4	4.1	1.55%	4.4	1.66%	0.3	0.11%	14.8	5.57%
Particulates (PM10)	Annual mean	µg/m ³	40	13.2	0.0	0.07%	0.0	0.08%	0.0	0.01%	13.2	33.08%
Particulates (PM10)	90.4th %ile of daily means	µg/m ³	50	26.4	0.1	0.19%	0.1	0.21%	0.0	0.02%	26.5	53.01%
Particulates (PM2.5)	Annual mean	µg/m ³	20	7.2	0.0	0.15%	0.0	0.16%	0.0	0.01%	7.2	36.16%
Particulates (PM2.5)	Annual mean - 2040 target	µg/m ³	10	7.2	0.0	0.30%	0.0	0.33%	0.0	0.03%	7.2	72.33%
Carbon monoxide	8 hour running mean	µg/m ³	10,000	0.6	4.1	0.04%	4.4	0.04%	0.3	0.00%	5.0	0.05%
Carbon monoxide	Hourly mean	µg/m ³	30,000	0.6	9.7	0.03%	10.5	0.04%	0.8	0.00%	11.1	0.04%
Hydrogen chloride	Hourly mean	µg/m ³	750	1.6	1.5	0.21%	1.7	0.22%	0.1	0.02%	3.3	0.44%
Hydrogen fluoride	Annual mean	ng/m ³	16,000	2,400	6.0	0.04%	6.6	0.04%	0.6	0.00%	2,407	15.04%
Hydrogen fluoride	Hourly mean	ng/m ³	160,000	4,800	193.7	0.12%	210.2	0.13%	16.5	0.01%	5,010	3.13%
Ammonia	Annual mean	µg/m ³	180	1.4	0.1	0.05%	0.1	0.05%	0.0	0.00%	1.5	0.83%
Ammonia	Hourly mean	µg/m ³	2,500	2.8	2.9	0.12%	3.2	0.13%	0.2	0.01%	6.0	0.24%
VOCs (as benzene)	Annual mean	ng/m ³	5,000	1,600	60.0	1.20%	65.8	1.32%	5.8	0.12%	1,666	33.32%
VOCs (as benzene)	Daily mean	ng/m ³	30,000	3,200	407.6	1.36%	466.7	1.56%	59.1	0.20%	3,667	12.22%
Mercury	Daily mean	ng/m ³	60	32.0	0.8	1.36%	0.9	1.56%	0.1	0.20%	32.9	54.89%
Mercury	Hourly mean	ng/m ³	600	32.0	3.9	0.65%	4.2	0.70%	0.3	0.05%	36.2	6.03%
Cadmium	Annual mean	ng/m ³	5	1.4	0.1	2.40%	0.1	2.63%	0.0	0.23%	1.5	30.63%
Cadmium	Daily mean	ng/m ³	30	2.8	0.8	2.72%	0.9	3.11%	0.1	0.39%	3.7	12.44%
PaHs	Annual mean	pg/m ³	250	200.0	1.2	0.48%	1.3	0.53%	0.1	0.05%	201.3	80.53%
Dioxins and Furans	Annual mean	fg/m ³	-	33.0	0.4	-	0.4	-	0.0	-	33.4	-
PCBs	Annual mean	ng/m ³	200	0.1	0.0	0.01%	0.0	0.02%	0.0	0.00%	0.2	0.08%
PCBs	Hourly mean	ng/m ³	6,000	0.3	1.0	0.02%	1.1	0.02%	0.1	0.00%	1.3	0.02%

Note:

Assumes continual operation of the ERF at the daily mean ELVs

Continual operation at half-hourly ELV

Pollutant	Quantity	Units	AQAL	Background Concentration	Permitted		Proposed		Change in Impact		Proposed	
					Conc.	% of AQAL	Conc.	% of AQAL	Conc.	% of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m ³	200	40.6	12.7	6.36%	13.6	6.80%	0.9	0.44%	54.2	27.10%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m ³	350	10.4	17.9	5.13%	19.0	5.44%	1.1	0.31%	29.4	8.41%
Sulphur dioxide	99.9th %ile of 15 min. means	µg/m ³	266	10.4	20.6	7.74%	22.1	8.30%	1.5	0.56%	32.5	12.21%
Carbon monoxide	8 hour running mean	µg/m ³	10,000	0.6	12.2	0.12%	13.1	0.13%	1.0	0.01%	13.7	0.14%
Carbon monoxide	Hourly mean	µg/m ³	30,000	0.6	29.1	0.10%	31.5	0.11%	2.5	0.01%	32.1	0.11%
Hydrogen chloride	Hourly mean	µg/m ³	750	1.6	11.6	1.55%	12.6	1.68%	1.0	0.13%	14.2	1.89%
Hydrogen fluoride	Hourly mean	ng/m ³	160,000	4,800	774.4	0.48%	838.7	0.52%	64.2	0.04%	5,639	3.52%

Note:

Assumes continual operation of the ERF at the half-hourly mean ELVs

Annual mean oxides of nitrogen

					Permitted		Proposed		Change in Impact		Proposed	
ID	Receptor	Units	CL	Background Concentration	Conc.	% of CL	Conc.	% of CL	Conc.	% of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	µg/m³	30	25.0	1.08	3.6%	1.18	3.9%	0.10	0.3%	26.22	87.4%
E2	River Usk / Afon Wysg	µg/m³	30	23.5	0.04	0.1%	0.05	0.2%	0.01	0.0%	23.54	78.5%
E3	Cardiff Beech Woods	µg/m³	30	16.1	0.04	0.1%	0.05	0.2%	0.01	0.0%	16.10	53.7%
E4	Severn Estuary (England)	µg/m³	30	25.0	0.14	0.5%	0.16	0.5%	0.02	0.1%	25.20	84.0%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	µg/m³	30	15.3	0.06	0.2%	0.07	0.2%	0.01	0.0%	15.32	51.1%
E8	Caeau Blaen-bielly	µg/m³	30	9.4	0.04	0.1%	0.04	0.1%	0.01	0.0%	9.41	31.4%
E9	Castell Coch Woodlands and Road Section	µg/m³	30	13.6	0.04	0.1%	0.05	0.2%	0.01	0.0%	13.67	45.6%
E10	Cefn Onn	µg/m³	30	10.1	0.04	0.1%	0.04	0.1%	0.01	0.0%	10.15	33.8%
E11	Cliff Wood - Golden Stairs	µg/m³	30	8.7	0.06	0.2%	0.07	0.2%	0.01	0.0%	8.74	29.1%
E12	Coed y Bedw	µg/m³	30	10.0	0.03	0.1%	0.04	0.1%	0.01	0.0%	10.07	33.6%
E13	Coedydd y Barri / Barry Woodlands	µg/m³	30	9.6	0.10	0.3%	0.11	0.4%	0.02	0.1%	9.66	32.2%
E14	Cog Moors	µg/m³	30	10.7	0.07	0.2%	0.08	0.3%	0.01	0.0%	10.79	36.0%
E16	Cwm Cydfin, Leckwith	µg/m³	30	17.2	0.14	0.5%	0.16	0.5%	0.02	0.1%	17.36	57.9%
E17	Ely Valley	µg/m³	30	13.0	0.05	0.2%	0.06	0.2%	0.01	0.0%	13.09	43.6%
E18	Fforestganol a Chwm Nofydd	µg/m³	30	15.9	0.04	0.1%	0.05	0.2%	0.01	0.0%	15.91	53.0%
E19	Flat Holm	µg/m³	30	25.0	0.04	0.1%	0.05	0.2%	0.00	0.0%	25.09	83.6%
E20	Garth Wood	µg/m³	30	16.1	0.04	0.1%	0.05	0.2%	0.01	0.0%	16.10	53.7%
E21	Glamorgan Canal / Long Wood	µg/m³	30	19.2	0.05	0.2%	0.06	0.2%	0.01	0.0%	19.28	64.3%
E22	Gwaun Gledyr	µg/m³	30	14.3	0.03	0.1%	0.03	0.1%	0.01	0.0%	14.28	47.6%
E23	Gwent Levels - St. Brides	µg/m³	30	16.7	0.06	0.2%	0.07	0.2%	0.01	0.0%	16.79	56.0%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	µg/m³	30	11.0	0.05	0.2%	0.06	0.2%	0.01	0.0%	11.09	37.0%
E26	Lisvane Reservoir	µg/m³	30	15.2	0.06	0.2%	0.07	0.2%	0.01	0.0%	15.28	50.9%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	µg/m³	30	8.9	0.06	0.2%	0.06	0.2%	0.01	0.0%	8.97	29.9%
E28	Nant Whitton Woodlands	µg/m³	30	7.4	0.05	0.2%	0.07	0.2%	0.01	0.0%	7.50	25.0%
E29	Penarth Coast	µg/m³	30	10.4	0.06	0.2%	0.06	0.2%	0.00	0.0%	10.43	34.8%
E31	Plas Machen Wood	µg/m³	30	10.1	0.03	0.1%	0.04	0.1%	0.01	0.0%	10.14	33.8%
E35	Ruperra Castle and Woodlands	µg/m³	30	9.9	0.04	0.1%	0.04	0.1%	0.01	0.0%	9.92	33.1%
E38	Ty Du Moor	µg/m³	30	11.6	0.05	0.2%	0.06	0.2%	0.01	0.0%	11.64	38.8%
E40	Fferm Walters	µg/m³	30	11.3	0.07	0.2%	0.08	0.3%	0.01	0.0%	11.40	38.0%
E41	Gwent Levels - Rumney and Peterstone	µg/m³	30	17.5	0.16	0.5%	0.18	0.6%	0.02	0.1%	17.67	58.9%
E46	Cardiff Bay Wetland and Hamadryad Park	µg/m³	30	19.4	0.25	0.8%	0.27	0.9%	0.03	0.1%	19.67	65.6%
E47	Cardiff Heliport Fields	µg/m³	30	25.0	0.83	2.8%	0.86	2.9%	0.03	0.1%	25.86	86.2%
E48	Tidal Sidings	µg/m³	30	25.0	0.33	1.1%	0.33	1.1%	-0.01	0.0%	25.33	84.4%
E49	Ocean Park South	µg/m³	30	25.0	0.00	0.0%	0.00	0.0%	0.00	0.0%	25.00	83.3%
E50	Beach Sidings	µg/m³	30	19.5	0.13	0.4%	0.14	0.5%	0.01	0.0%	19.64	65.5%
E51	Cardiff Bay Wetland Reserve	µg/m³	30	19.4	0.24	0.8%	0.27	0.9%	0.03	0.1%	19.67	65.6%
E52	River Taff	µg/m³	30	19.4	0.24	0.8%	0.27	0.9%	0.03	0.1%	19.67	65.6%
E53	Pengam Moors	µg/m³	30	19.1	0.19	0.6%	0.20	0.7%	0.02	0.1%	19.30	64.3%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	0.10	0.3%
Max @ non-statutory designated site	E47	0.03	0.1%

Daily mean oxides of nitrogen

					Permitted		Proposed		Change in Impact		Proposed	
ID	Receptor	Units	CL	Background Concentration	Conc.	% of CL	Conc.	% of CL	Conc.	% of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	µg/m³	75	50.1	7.34	9.8%	8.39	11.2%	1.05	1.4%	58.47	78.0%
E2	River Usk / Afon Wysg	µg/m³	75	47.0	0.72	1.0%	0.86	1.1%	0.14	0.2%	47.84	63.8%
E3	Cardiff Beech Woods	µg/m³	75	32.1	0.60	0.8%	0.73	1.0%	0.13	0.2%	32.83	43.8%
E4	Severn Estuary (England)	µg/m³	75	50.1	1.46	1.9%	1.72	2.3%	0.25	0.3%	51.80	69.1%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	µg/m³	75	30.5	1.03	1.4%	1.16	1.6%	0.14	0.2%	31.66	42.2%
E8	Caeau Blaen-bielly	µg/m³	75	18.7	0.55	0.7%	0.67	0.9%	0.12	0.2%	19.41	25.9%
E9	Castell Coch Woodlands and Road Section	µg/m³	75	27.2	0.50	0.7%	0.62	0.8%	0.12	0.2%	27.86	37.1%
E10	Cefn Onn	µg/m³	75	20.2	0.64	0.9%	0.74	1.0%	0.10	0.1%	20.96	28.0%
E11	Cliff Wood - Golden Stairs	µg/m³	75	17.3	0.70	0.9%	0.79	1.1%	0.10	0.1%	18.13	24.2%
E12	Coed y Bedw	µg/m³	75	20.1	0.48	0.6%	0.60	0.8%	0.12	0.2%	20.66	27.5%
E13	Coedydd y Barri / Barry Woodlands	µg/m³	75	19.1	1.11	1.5%	1.32	1.8%	0.21	0.3%	20.42	27.2%
E14	Cog Moors	µg/m³	75	21.4	1.00	1.3%	1.23	1.6%	0.22	0.3%	22.65	30.2%
E16	Cwm Cydfin, Leckwith	µg/m³	75	34.4	1.94	2.6%	2.21	2.9%	0.28	0.4%	36.61	48.8%
E17	Ely Valley	µg/m³	75	26.1	0.83	1.1%	0.95	1.3%	0.12	0.2%	27.01	36.0%
E18	Fforestganol a Chwm Nofydd	µg/m³	75	31.7	0.67	0.9%	0.81	1.1%	0.14	0.2%	32.53	43.4%
E19	Flat Holm	µg/m³	75	50.1	0.79	1.0%	0.75	1.0%	-0.03	0.0%	50.83	67.8%
E20	Garth Wood	µg/m³	75	32.1	0.54	0.7%	0.68	0.9%	0.14	0.2%	32.78	43.7%
E21	Glamorgan Canal / Long Wood	µg/m³	75	38.4	0.73	1.0%	0.91	1.2%	0.19	0.2%	39.35	52.5%
E22	Gwaun Gledyr	µg/m³	75	28.5	0.48	0.6%	0.58	0.8%	0.11	0.1%	29.08	38.8%
E23	Gwent Levels - St. Brides	µg/m³	75	33.4	0.79	1.0%	0.94	1.3%	0.16	0.2%	34.38	45.8%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	µg/m³	75	22.1	0.79	1.1%	0.95	1.3%	0.15	0.2%	23.01	30.7%
E26	Lisvane Reservoir	µg/m³	75	30.4	0.97	1.3%	1.09	1.5%	0.12	0.2%	31.51	42.0%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	µg/m³	75	17.8	1.00	1.3%	1.13	1.5%	0.13	0.2%	18.94	25.3%
E28	Nant Whitton Woodlands	µg/m³	75	14.9	0.85	1.1%	1.06	1.4%	0.21	0.3%	15.92	21.2%
E29	Penarth Coast	µg/m³	75	20.7	1.27	1.7%	1.50	2.0%	0.23	0.3%	22.24	29.6%
E31	Plas Machen Wood	µg/m³	75	20.2	0.48	0.6%	0.55	0.7%	0.07	0.1%	20.75	27.7%
E35	Ruperra Castle and Woodlands	µg/m³	75	19.8	0.76	1.0%	0.89	1.2%	0.13	0.2%	20.65	27.5%
E38	Ty Du Moor	µg/m³	75	23.2	0.92	1.2%	1.12	1.5%	0.20	0.3%	24.28	32.4%
E40	Fferm Walters	µg/m³	75	22.6	0.78	1.0%	0.95	1.3%	0.17	0.2%	23.59	31.5%
E41	Gwent Levels - Rumney and Peterstone	µg/m³	75	35.0	2.17	2.9%	2.49	3.3%	0.32	0.4%	37.46	49.9%
E46	Cardiff Bay Wetland and Hamadryad Park	µg/m³	75	38.80	5.41	7.2%	6.39	8.5%	0.98	1.3%	45.19	60.3%
E47	Cardiff Heliport Fields	µg/m³	75	50.00	5.39	7.2%	5.93	7.9%	0.54	0.7%	55.93	74.6%
E48	Tidal Sidings	µg/m³	75	50.00	4.20	5.6%	4.29	5.7%	0.09	0.1%	54.29	72.4%
E49	Ocean Park South	µg/m³	75	50.00	0.04	0.0%	0.02	0.0%	-0.02	0.0%	50.02	66.7%
E50	Beach Sidings	µg/m³	75	39.00	3.68	4.9%	4.17	5.6%	0.49	0.7%	43.17	57.6%
E51	Cardiff Bay Wetland Reserve	µg/m³	75	38.80	5.44	7.2%	6.43	8.6%	1.00	1.3%	45.23	60.3%
E52	River Taff	µg/m³	75	38.80	4.10	5.5%	4.75	6.3%	0.65	0.9%	43.55	58.1%
E53	Pengam Moors	µg/m³	75	38.20	3.15	4.2%	3.51	4.7%	0.35	0.5%	41.71	55.6%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	1.05	1.4%
Max @ non-statutory designated site	E51	1.00	1.3%

Annual mean sulphur dioxide

					Permitted		Proposed		Change in Impact		Proposed	
ID	Receptor	Units	CL	Background Concentration	Conc.	% of CL	Conc.	% of CL	Conc.	% of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	10,000	5,630	239.86	2.4%	262.60	2.6%	22.74	0.2%	5892.60	58.9%
E2	River Usk / Afon Wysg	ng/m ³	10,000	5,340	9.92	0.1%	11.78	0.1%	1.86	0.0%	5351.78	53.5%
E3	Cardiff Beech Woods	ng/m ³	10,000	2,510	8.43	0.1%	10.11	0.1%	1.68	0.0%	2520.11	25.2%
E4	Severn Estuary (England)	ng/m ³	10,000	5,630	31.21	0.3%	34.97	0.3%	3.76	0.0%	5664.97	56.6%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	ng/m ³	10,000	3,310	14.05	0.1%	16.35	0.2%	2.30	0.0%	3326.35	33.3%
E8	Caeau Blaen-bielly	ng/m ³	10,000	1,850	7.98	0.1%	9.61	0.1%	1.63	0.0%	1859.61	18.6%
E9	Castell Coch Woodlands and Road Section	ng/m ³	10,000	2,510	8.46	0.1%	10.09	0.1%	1.63	0.0%	2520.09	25.2%
E10	Cefn Onn	ng/m ³	10,000	2,010	8.30	0.1%	10.00	0.1%	1.69	0.0%	2020.00	20.2%
E11	Cliff Wood - Golden Stairs	ng/m ³	10,000	1,870	13.70	0.1%	16.46	0.2%	2.76	0.0%	1886.46	18.9%
E12	Coed y Bedw	ng/m ³	10,000	1,820	7.53	0.1%	9.00	0.1%	1.46	0.0%	1829.00	18.3%
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	10,000	1,710	21.31	0.2%	24.97	0.2%	3.66	0.0%	1734.97	17.3%
E14	Cog Moors	ng/m ³	20,000	1,860	16.05	0.1%	18.11	0.1%	2.05	0.0%	1878.11	9.4%
E16	Cwm Cydfin, Leckwith	ng/m ³	10,000	3,280	31.27	0.3%	35.80	0.4%	4.53	0.0%	3315.80	33.2%
E17	Ely Valley	ng/m ³	20,000	2,000	10.93	0.1%	12.83	0.1%	1.90	0.0%	2012.83	10.1%
E18	Fforestganol a Chwm Nofydd	ng/m ³	10,000	2,510	8.92	0.1%	10.61	0.1%	1.68	0.0%	2520.61	25.2%
E19	Flat Holm	ng/m ³	10,000	5,630	9.81	0.1%	10.65	0.1%	0.84	0.0%	5640.65	56.4%
E20	Garth Wood	ng/m ³	10,000	2,510	8.46	0.1%	10.06	0.1%	1.60	0.0%	2520.06	25.2%
E21	Glamorgan Canal / Long Wood	ng/m ³	10,000	2,750	11.48	0.1%	13.58	0.1%	2.10	0.0%	2763.58	27.6%
E22	Gwaun Gledyr	ng/m ³	10,000	2,640	6.31	0.1%	7.62	0.1%	1.31	0.0%	2647.62	26.5%
E23	Gwent Levels - St. Brides	ng/m ³	20,000	3,090	13.44	0.1%	15.74	0.1%	2.31	0.0%	3105.74	15.5%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	20,000	1,870	10.43	0.1%	12.43	0.1%	2.00	0.0%	1882.43	9.4%
E26	Lisvane Reservoir	ng/m ³	20,000	3,090	13.29	0.1%	15.47	0.1%	2.17	0.0%	3105.47	15.5%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	20,000	1,585	12.77	0.1%	14.10	0.1%	1.33	0.0%	1599.10	8.0%
E28	Nant Whitton Woodlands	ng/m ³	10,000	1,440	12.10	0.1%	14.53	0.1%	2.44	0.0%	1454.53	14.5%
E29	Penarth Coast	ng/m ³	20,000	2,070	12.27	0.1%	13.31	0.1%	1.05	0.0%	2083.31	10.4%
E31	Plas Machen Wood	ng/m ³	10,000	1,840	7.28	0.1%	8.57	0.1%	1.29	0.0%	1848.57	18.5%
E35	Ruperra Castle and Woodlands	ng/m ³	20,000	1,850	7.83	0.0%	9.33	0.0%	1.50	0.0%	1859.33	9.3%
E38	Ty Du Moor	ng/m ³	10,000	1,640	10.38	0.1%	12.33	0.1%	1.95	0.0%	1652.33	16.5%
E40	Fferm Walters	ng/m ³	10,000	2,540	15.67	0.2%	18.74	0.2%	3.07	0.0%	2558.74	25.6%
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	20,000	3,514	34.86	0.2%	40.17	0.2%	5.30	0.0%	3554.17	17.8%
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	20,000	3.40	54.56	0.3%	61.06	0.3%	6.50	0.0%	64.46	0.3%
E47	Cardiff Heliport Fields	ng/m ³	20,000	5.60	184.37	0.9%	191.71	1.0%	7.34	0.0%	197.31	1.0%
E48	Tidal Sidings	ng/m ³	20,000	5.60	74.38	0.4%	72.63	0.4%	-1.75	0.0%	78.23	0.4%
E49	Ocean Park South	ng/m ³	20,000	5.60	0.03	0.0%	0.02	0.0%	-0.01	0.0%	5.62	0.0%
E50	Beach Sidings	ng/m ³	20,000	3.80	28.20	0.1%	30.18	0.2%	1.98	0.0%	33.98	0.2%
E51	Cardiff Bay Wetland Reserve	ng/m ³	20,000	3.40	53.72	0.3%	60.26	0.3%	6.53	0.0%	63.66	0.3%
E52	River Taff	ng/m ³	20,000	3.40	53.85	0.3%	59.75	0.3%	5.90	0.0%	63.15	0.3%
E53	Pengam Moors	ng/m ³	20,000	3.50	41.70	0.2%	45.18	0.2%	3.48	0.0%	48.68	0.2%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	22.74	0.2%
Max @ non-statutory designated site	E47	7.34	0.0%

Maximum weekly mean hydrogen fluoride

					Permitted		Proposed		Change in Impact		Proposed	
ID	Receptor	Units	CL	Background Concentration	Conc.	% of CL	Conc.	% of CL	Conc.	% of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	500	-	23.33	4.7%	25.83	5.2%	2.49	0.5%	-	-
E2	River Usk / Afon Wysg	ng/m ³	500	-	1.05	0.2%	1.28	0.3%	0.23	0.0%	-	-
E3	Cardiff Beech Woods	ng/m ³	500	-	0.87	0.2%	1.06	0.2%	0.19	0.0%	-	-
E4	Severn Estuary (England)	ng/m ³	500	-	3.36	0.7%	3.82	0.8%	0.47	0.1%	-	-
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	ng/m ³	500	-	2.46	0.5%	2.84	0.6%	0.37	0.1%	-	-
E8	Caeau Blaen-bielly	ng/m ³	500	-	0.78	0.2%	0.95	0.2%	0.16	0.0%	-	-
E9	Castell Coch Woodlands and Road Section	ng/m ³	500	-	0.94	0.2%	1.18	0.2%	0.23	0.0%	-	-
E10	Cefn Onn	ng/m ³	500	-	1.23	0.2%	1.45	0.3%	0.22	0.0%	-	-
E11	Cliff Wood - Golden Stairs	ng/m ³	500	-	1.93	0.4%	2.29	0.5%	0.36	0.1%	-	-
E12	Coed y Bedw	ng/m ³	500	-	0.83	0.2%	1.03	0.2%	0.20	0.0%	-	-
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	500	-	3.08	0.6%	3.71	0.7%	0.63	0.1%	-	-
E14	Cog Moors	ng/m ³	500	-	2.74	0.5%	3.20	0.6%	0.46	0.1%	-	-
E16	Cwm Cydfin, Leckwith	ng/m ³	500	-	7.38	1.5%	8.68	1.7%	1.31	0.3%	-	-
E17	Ely Valley	ng/m ³	500	-	1.98	0.4%	2.31	0.5%	0.33	0.1%	-	-
E18	Fforestganol a Chwm Nofydd	ng/m ³	500	-	0.96	0.2%	1.16	0.2%	0.20	0.0%	-	-
E19	Flat Holm	ng/m ³	500	-	1.28	0.3%	1.39	0.3%	0.12	0.0%	-	-
E20	Garth Wood	ng/m ³	500	-	0.94	0.2%	1.16	0.2%	0.22	0.0%	-	-
E21	Glamorgan Canal / Long Wood	ng/m ³	500	-	1.31	0.3%	1.62	0.3%	0.31	0.1%	-	-
E22	Gwaun Gledyr	ng/m ³	500	-	0.61	0.1%	0.73	0.1%	0.12	0.0%	-	-
E23	Gwent Levels - St. Brides	ng/m ³	500	-	2.01	0.4%	2.40	0.5%	0.39	0.1%	-	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	500	-	1.04	0.2%	1.24	0.2%	0.20	0.0%	-	-
E26	Lisvane Reservoir	ng/m ³	500	-	2.49	0.5%	2.86	0.6%	0.37	0.1%	-	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	500	-	1.59	0.3%	1.75	0.3%	0.16	0.0%	-	-
E28	Nant Whitton Woodlands	ng/m ³	500	-	1.92	0.4%	2.28	0.5%	0.36	0.1%	-	-
E29	Penarth Coast	ng/m ³	500	-	1.74	0.3%	1.92	0.4%	0.17	0.0%	-	-
E31	Plas Machen Wood	ng/m ³	500	-	0.75	0.1%	0.87	0.2%	0.12	0.0%	-	-
E35	Ruperra Castle and Woodlands	ng/m ³	500	-	0.87	0.2%	1.03	0.2%	0.16	0.0%	-	-
E38	Ty Du Moor	ng/m ³	500	-	1.06	0.2%	1.27	0.3%	0.21	0.0%	-	-
E40	Fferm Walters	ng/m ³	500	-	1.99	0.4%	2.40	0.5%	0.42	0.1%	-	-
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	500	-	5.57	1.1%	6.44	1.3%	0.88	0.2%	-	-
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	500	-	13.58	2.7%	15.05	3.0%	1.47	0.3%	-	-
E47	Cardiff Heliport Fields	ng/m ³	500	-	14.77	3.0%	15.53	3.1%	0.75	0.2%	-	-
E48	Tidal Sidings	ng/m ³	500	-	8.58	1.7%	8.75	1.7%	0.17	0.0%	-	-
E49	Ocean Park South	ng/m ³	500	-	0.03	0.0%	0.01	0.0%	-0.01	0.0%	-	-
E50	Beach Sidings	ng/m ³	500	-	5.48	1.1%	6.19	1.2%	0.71	0.1%	-	-
E51	Cardiff Bay Wetland Reserve	ng/m ³	500	-	13.46	2.7%	14.96	3.0%	1.50	0.3%	-	-
E52	River Taff	ng/m ³	500	-	15.59	3.1%	17.69	3.5%	2.10	0.4%	-	-
E53	Pengam Moors	ng/m ³	500	-	7.14	1.4%	8.07	1.6%	0.93	0.2%	-	-

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	2.49	0.5%
Max @ non-statutory designated site	E52	2.10	0.4%

Maximum daily mean hydrogen fluoride

					Permitted		Proposed		Change in Impact		Proposed	
ID	Receptor	Units	CL	Background Concentration	Conc.	% of CL	Conc.	% of CL	Conc.	% of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	5,000	-	40.76	0.8%	46.59	0.9%	5.83	0.1%	-	-
E2	River Usk / Afon Wysg	ng/m ³	5,000	-	3.97	0.1%	4.76	0.1%	0.78	0.0%	-	-
E3	Cardiff Beech Woods	ng/m ³	5,000	-	3.34	0.1%	4.05	0.1%	0.71	0.0%	-	-
E4	Severn Estuary (England)	ng/m ³	5,000	-	8.12	0.2%	9.53	0.2%	1.41	0.0%	-	-
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	ng/m ³	5,000	-	5.71	0.1%	6.46	0.1%	0.75	0.0%	-	-
E8	Caeau Blaen-bielly	ng/m ³	5,000	-	3.06	0.1%	3.74	0.1%	0.67	0.0%	-	-
E9	Castell Coch Woodlands and Road Section	ng/m ³	5,000	-	2.77	0.1%	3.42	0.1%	0.64	0.0%	-	-
E10	Cefn Onn	ng/m ³	5,000	-	3.58	0.1%	4.13	0.1%	0.55	0.0%	-	-
E11	Cliff Wood - Golden Stairs	ng/m ³	5,000	-	3.86	0.1%	4.40	0.1%	0.54	0.0%	-	-
E12	Coed y Bedw	ng/m ³	5,000	-	2.64	0.1%	3.32	0.1%	0.67	0.0%	-	-
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	5,000	-	6.18	0.1%	7.35	0.1%	1.17	0.0%	-	-
E14	Cog Moors	ng/m ³	5,000	-	5.58	0.1%	6.81	0.1%	1.23	0.0%	-	-
E16	Cwm Cydfin, Leckwith	ng/m ³	5,000	-	10.75	0.2%	12.29	0.2%	1.54	0.0%	-	-
E17	Ely Valley	ng/m ³	5,000	-	4.60	0.1%	5.27	0.1%	0.68	0.0%	-	-
E18	Fforestganol a Chwm Nofydd	ng/m ³	5,000	-	3.72	0.1%	4.50	0.1%	0.78	0.0%	-	-
E19	Flat Holm	ng/m ³	5,000	-	4.37	0.1%	4.19	0.1%	-0.18	0.0%	-	-
E20	Garth Wood	ng/m ³	5,000	-	3.00	0.1%	3.77	0.1%	0.77	0.0%	-	-
E21	Glamorgan Canal / Long Wood	ng/m ³	5,000	-	4.04	0.1%	5.07	0.1%	1.03	0.0%	-	-
E22	Gwaun Gledyr	ng/m ³	5,000	-	2.65	0.1%	3.25	0.1%	0.60	0.0%	-	-
E23	Gwent Levels - St. Brides	ng/m ³	5,000	-	4.36	0.1%	5.24	0.1%	0.87	0.0%	-	-
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	5,000	-	4.39	0.1%	5.25	0.1%	0.86	0.0%	-	-
E26	Lisvane Reservoir	ng/m ³	5,000	-	5.40	0.1%	6.06	0.1%	0.67	0.0%	-	-
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	5,000	-	5.56	0.1%	6.26	0.1%	0.70	0.0%	-	-
E28	Nant Whitton Woodlands	ng/m ³	5,000	-	4.73	0.1%	5.91	0.1%	1.17	0.0%	-	-
E29	Penarth Coast	ng/m ³	5,000	-	7.04	0.1%	8.32	0.2%	1.28	0.0%	-	-
E31	Plas Machen Wood	ng/m ³	5,000	-	2.68	0.1%	3.05	0.1%	0.37	0.0%	-	-
E35	Ruperra Castle and Woodlands	ng/m ³	5,000	-	4.22	0.1%	4.95	0.1%	0.73	0.0%	-	-
E38	Ty Du Moor	ng/m ³	5,000	-	5.09	0.1%	6.20	0.1%	1.11	0.0%	-	-
E40	Fferm Walters	ng/m ³	5,000	-	4.33	0.1%	5.30	0.1%	0.97	0.0%	-	-
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	5,000	-	12.04	0.2%	13.83	0.3%	1.78	0.0%	-	-
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	5,000	-	30.08	0.6%	35.50	0.7%	5.42	0.1%	-	-
E47	Cardiff Heliport Fields	ng/m ³	5,000	-	29.93	0.6%	32.94	0.7%	3.01	0.1%	-	-
E48	Tidal Sidings	ng/m ³	5,000	-	23.32	0.5%	23.84	0.5%	0.52	0.0%	-	-
E49	Ocean Park South	ng/m ³	5,000	-	0.20	0.0%	0.11	0.0%	-0.10	0.0%	-	-
E50	Beach Sidings	ng/m ³	5,000	-	20.42	0.4%	23.15	0.5%	2.73	0.1%	-	-
E51	Cardiff Bay Wetland Reserve	ng/m ³	5,000	-	30.21	0.6%	35.74	0.7%	5.53	0.1%	-	-
E52	River Taff	ng/m ³	5,000	-	22.78	0.5%	26.40	0.5%	3.62	0.1%	-	-
E53	Pengam Moors	ng/m ³	5,000	-	17.52	0.4%	19.48	0.4%	1.96	0.0%	-	-

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	5.83	0.1%
Max @ non-statutory designated site	E51	5.53	0.1%

Annual mean ammonia

					Permitted		Proposed		Change in Impact		Proposed	
ID	Receptor	Units	CL	Background Concentration	Conc.	% of CL	Conc.	% of CL	Conc.	% of CL	PEC	PEC as % of CL
E1	Severn Estuary (Wales)	ng/m ³	1,000	1,710	89.89	9.0%	98.37	9.8%	8.48	0.8%	1808.37	180.8%
E2	River Usk / Afon Wysg	ng/m ³	1,000	1,610	3.72	0.4%	4.41	0.4%	0.70	0.1%	1614.41	161.4%
E3	Cardiff Beech Woods	ng/m ³	1,000	990	3.16	0.3%	3.79	0.4%	0.63	0.1%	993.79	99.4%
E4	Severn Estuary (England)	ng/m ³	3,000	1,710	11.70	0.4%	13.10	0.4%	1.40	0.0%	1723.10	57.4%
E5	Argloddiau Cronfeyedd Dwr Llanisien a Llys-Faen / L	ng/m ³	1,000	1,180	5.26	0.5%	6.13	0.6%	0.86	0.1%	1186.13	118.6%
E8	Caeau Blaen-bielly	ng/m ³	1,000	910	2.99	0.3%	3.60	0.4%	0.61	0.1%	913.60	91.4%
E9	Castell Coch Woodlands and Road Section	ng/m ³	1,000	990	3.17	0.3%	3.78	0.4%	0.61	0.1%	993.78	99.4%
E10	Cefn Onn	ng/m ³	1,000	920	3.11	0.3%	3.75	0.4%	0.63	0.1%	923.75	92.4%
E11	Cliff Wood - Golden Stairs	ng/m ³	1,000	960	5.13	0.5%	6.17	0.6%	1.03	0.1%	966.17	96.6%
E12	Coed y Bedw	ng/m ³	1,000	910	2.82	0.3%	3.37	0.3%	0.55	0.1%	913.37	91.3%
E13	Coedydd y Barri / Barry Woodlands	ng/m ³	1,000	1,060	7.99	0.8%	9.35	0.9%	1.37	0.1%	1069.35	106.9%
E14	Cog Moors	ng/m ³	3,000	1,090	6.01	0.2%	6.78	0.2%	0.77	0.0%	1096.78	36.6%
E16	Cwm Cydfin, Leckwith	ng/m ³	1,000	1,110	11.72	1.2%	13.41	1.3%	1.69	0.2%	1123.41	112.3%
E17	Ely Valley	ng/m ³	3,000	1,000	4.09	0.1%	4.81	0.2%	0.71	0.0%	1004.81	33.5%
E18	Fforestganol a Chwm Nofydd	ng/m ³	1,000	1,050	3.34	0.3%	3.97	0.4%	0.63	0.1%	1053.97	105.4%
E19	Flat Holm	ng/m ³	1,000	1,710	3.68	0.4%	3.99	0.4%	0.31	0.0%	1713.99	171.4%
E20	Garth Wood	ng/m ³	1,000	950	3.17	0.3%	3.77	0.4%	0.60	0.1%	953.77	95.4%
E21	Glamorgan Canal / Long Wood	ng/m ³	1,000	1,110	4.30	0.4%	5.09	0.5%	0.79	0.1%	1115.09	111.5%
E22	Gwaun Gledyr	ng/m ³	1,000	930	2.37	0.2%	2.85	0.3%	0.49	0.0%	932.85	93.3%
E23	Gwent Levels - St. Brides	ng/m ³	3,000	1,570	5.04	0.2%	5.90	0.2%	0.86	0.0%	1575.90	52.5%
E24	Gwlyptiroedd Casnewydd / Newport Wetlands	ng/m ³	3,000	1,460	3.91	0.1%	4.66	0.2%	0.75	0.0%	1464.66	48.8%
E26	Lisvane Reservoir	ng/m ³	3,000	1,160	4.98	0.2%	5.79	0.2%	0.81	0.0%	1165.79	38.9%
E27	Llynnoedd Cosmeston / Cosmeston Lakes	ng/m ³	3,000	1,141	4.79	0.2%	5.28	0.2%	0.50	0.0%	1146.28	38.2%
E28	Nant Whitton Woodlands	ng/m ³	1,000	1,070	4.53	0.5%	5.44	0.5%	0.91	0.1%	1075.44	107.5%
E29	Penarth Coast	ng/m ³	3,000	1,160	4.60	0.2%	4.99	0.2%	0.39	0.0%	1164.99	38.8%
E31	Plas Machen Wood	ng/m ³	1,000	980	2.73	0.3%	3.21	0.3%	0.48	0.0%	983.21	98.3%
E35	Ruperra Castle and Woodlands	ng/m ³	3,000	1,020	2.93	0.1%	3.50	0.1%	0.56	0.0%	1023.50	34.1%
E38	Ty Du Moor	ng/m ³	1,000	960	3.89	0.4%	4.62	0.5%	0.73	0.1%	964.62	96.5%
E40	Fferm Walters	ng/m ³	1,000	1,090	5.87	0.6%	7.02	0.7%	1.15	0.1%	1097.02	109.7%
E41	Gwent Levels - Rumney and Peterstone	ng/m ³	3,000	1,365	13.06	0.4%	15.05	0.5%	1.98	0.1%	1380.05	46.0%
E46	Cardiff Bay Wetland and Hamadryad Park	ng/m ³	3,000	1,100	20.45	0.7%	22.87	0.8%	2.43	0.1%	1122.87	37.4%
E47	Cardiff Heliport Fields	ng/m ³	3,000	1,100	69.09	2.3%	71.82	2.4%	2.72	0.1%	1171.82	39.1%
E48	Tidal Sidings	ng/m ³	3,000	1,100	27.87	0.9%	27.21	0.9%	-0.67	0.0%	1127.21	37.6%
E49	Ocean Park South	ng/m ³	3,000	1,100	0.01	0.0%	0.01	0.0%	-0.01	0.0%	1100.01	36.7%
E50	Beach Sidings	ng/m ³	3,000	1,100	10.57	0.4%	11.30	0.4%	0.74	0.0%	1111.30	37.0%
E51	Cardiff Bay Wetland Reserve	ng/m ³	3,000	1,100	20.13	0.7%	22.57	0.8%	2.44	0.1%	1122.57	37.4%
E52	River Taff	ng/m ³	3,000	1,100	20.18	0.7%	22.38	0.7%	2.20	0.1%	1122.38	37.4%
E53	Pengam Moors	ng/m ³	3,000	1,100	15.63	0.5%	16.92	0.6%	1.30	0.0%	1116.92	37.2%

Note:

Assumes continual operation of the ERF at the daily mean ELV

Max @ statutory designated site	E1	8.48	0.8%
Max @ non-statutory designated site	E47	2.72	0.1%

B Dioxin Pathway Assessment

FICHTNER

Consulting Engineers Limited



Cardiff Energy Recovery Centre



Viridor Trident Park Limited

Dioxin Pathway Intake Assessment

Document approval

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1 Introduction

This Dioxin Pathway Intake Assessment has been produced to support the application for a variation to the Environmental Permit (EP) for the Cardiff Energy Recovery Facility (the ERF). The ERF comprises two incineration lines and is currently permitted to accept 425,000 tonnes of waste per annum (tpa). Viridor is seeking to vary the EP to increase the total throughput to 500,000 tpa. Full details of the proposed changes being applied for can be found in the Supporting Information submitted with the application pack.

As the fuel combusted at the ERF is sourced from waste, the limits on emissions to air are based on those outlined in Chapter IV and Annex VI of the Industrial Emissions Directive (IED) (2010/75/EU) for waste incineration and co-incineration plants. This includes limits on emissions of dioxins and furans (collectively referred to as “dioxins” for the purpose of this assessment).

The existing EP includes emission limits for emissions to air based on the Industrial Emissions Directive (IED) (Directive 2010/75/EU) and the Waste Incineration BREF¹.

The advice from health specialists such as the UK Health Security Agency (formerly the Health Protection Agency, “HPA”) is that the damage to health from emissions from incineration and co-incineration plants is likely to be very small, and probably not detectable. Nevertheless, the specific effects on human health of the Facility have been considered and are presented in this report. This includes a review of published literature on the health effects of energy recovery facilities, and a quantitative assessment of the effect of the ERF.

For most substances released from the ERF, the most significant effects on human health will arise by inhalation. These have been considered with the Dispersion Modelling Assessment. However, for dioxins and dioxin-like polychlorinated biphenyls (PCBs) which accumulate in the environment, inhalation is only one of the potential exposure routes.

For dioxins and dioxin-like PCBs the health assessment criteria are expressed as the total intake from ingestion and inhalation. Therefore, this assessment considers exposure routes other than just inhalation.

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

2 Literature review

The HPA, whose role was taken over by Public Health England (PHE) and more recently by the UK Health Security Agency, published a note RCE-13 titled, *“The Impact on Health of Emissions to Air from Municipal Waste Incinerators”*, in 2009². The summary states:

“While it is not possible to rule out adverse health effects from modern, well-regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable”

PHE commissioned further research in 2012, while continuing to state that the conclusions of RCE-13 remain applicable. These studies were commissioned from the Small Area Health Statistics Unit, which is based at Imperial College London and Kings College London. The methodology and results of the studies have been published in a series of papers in scientific journals. The three most recent papers, known as Ghosh et al (2018)³, Freni-Sterrantino et al (2019)⁴ and Parkes et al (2019)⁵, are the most relevant.

These studies considered whether living near a municipal waste incinerator (MWI) is linked with adverse reproductive and infant health outcomes. These outcomes were studied as they are considered more sensitive to the accumulation of pollutants in the environment than other potential markers such as lifetime cancer rates.

Ghosh et al (2018) concluded that:

“This large national study found no evidence for increased risk of a range of birth outcomes, including birth weight, preterm delivery and infant mortality, in relation to either MWI emissions or living near an MWI operating to the current EU waste incinerator regulations in Great Britain.”

Freni-Sterrantino et al (2019) concluded that:

“we did not find an association between the opening of a new MWI and changes in infant mortality trends or sex ratio at birth for 10 and 4 km buffers, using distance as proxy of exposure, after taking into account temporal trends in comparator areas and potential confounding factors.”

The objective of Parkes et al (2019) was as follows: *“To conduct a national investigation into the risk of congenital anomalies in babies born to mothers living within 10 km of an MWI associated with: i) modelled concentrations of PM₁₀ as a proxy for MWI emissions more generally and; ii) proximity of residential postcode to nearest MWI, in areas in England and Scotland that are covered by a congenital anomaly register.”* Under objective (i), which related congenital anomalies to modelled concentrations and so would be considered the more representative approach, the study

² <https://www.gov.uk/government/publications/municipal-waste-incinerators-emissions-impact-on-health>

³ Ghosh RE, Freni Sterrantino A, Douglas P, Parkes B, Fecht D, de Hoogh K, Fuller G, Gulliver J, Font A, Smith RB, Blangiardo M, Elliott P, Toledano MB, Hansell AL. (2018) Fetal growth, stillbirth, infant mortality and other birth outcomes near UK municipal waste incinerators; retrospective population based cohort and case-control study. Environment International.

⁴ Freni-Sterrantino, A; Ghosh, RE; Fecht, D; Toledano, MB; Elliott, P; Hansell, AL; Blangiardo, M. (2019) Bayesian spatial modelling for quasi-experimental designs: An interrupted time series study of the opening of Municipal Waste Incinerators in relation to infant mortality and sex ratio. Environment International. 128 106-115

⁵ Parkes B, Hansell A.L., Ghosh R.E, Douglas P., Fecht D., Wellesley D., Kurinczuk J.J., Rankin J., de Hoogh K., Fuller G.W, Elliot P., and Toledano M.B. “Risk of congenital anomalies near municipal waste incinerators in England and Scotland: Retrospective population-based cohort study”. Environment International (Parkes et al).

found no association with congenital abnormalities. Under objective (ii), there was a small excess risk, but the paper's authors note that this may be due to residual confounding.

The Imperial College website includes Frequently Asked Questions on this study. One of these is "Does the study show that MWIs are causing increased congenital anomalies in populations living nearby?" The answer is as follows:

"No. The study does not say that the small excess risks associated with congenital heart disease and genital anomalies in proximity to MWIs are caused by those MWIs, as these results may be explained by residual confounding factors i.e., other influences which it was not possible to take into account in the study. This possible explanation is supported further by the fact that the study found no increased risk in congenital anomalies due to exposure to emissions from incinerators."

A further study by Parsons et al (2024)⁶ aimed to measure levels of dioxins and PCBs in mothers' milk, with the measurements being taken between 2013 and 2015. This concluded that there was no detectable change in dioxin and PCB levels for individuals residing closer to their nearest MWI. However, when the modelled PM₁₀ from the MWIs was considered (as a spatial proxy for other pollutants), a doubling of mean MWI modelled PM₁₀ contribution resulted in small (<10%) increases in dioxin and furan levels in breast milk. The study concludes that although diet is the main source of exposure, MWI emissions may make a small contribution to the body burden of dioxins and PCBs. The paper does not attempt to make any link between this small contribution from MWIs and effects on human health.

These four recent papers consider facilities in the UK, operating under the same regulatory regime which applies to the ERF and operating to the standards of the IED. The papers found no conclusive evidence of an association of waste incineration facilities with the health outcomes considered. Given that the ERF operates to tighter standards, as it is subject to the reduced emissions limit from the Waste Incineration BREF, the conclusions are directly relevant and support PHE's position statement that "any potential damage to the health of those living close-by is likely to be very small, if detectable".

Therefore, it can be concluded that the effect of emissions from the ERF of pollutants that accumulate in the environment would not be significant. Nonetheless, a quantitative assessment of the effect of emissions from the ERF has been undertaken and is presented in the following sections.

⁶ Parsons, R., Douglas, P., Ashworth, D., Hansell, A., Sepai, O., Chadeau-Hyam, M., Toledano, M., & , (2024). Polychlorinated dibenzo-dioxin/furan and polychlorinated biphenyl concentrations in the human milk of individuals living near municipal waste incinerators in the UK: Findings from the Breast milk, Environment, Early-life, and Development (BEED) human biomonitoring study. Environmental Research, 120588

3 Issue Identification

3.1 Issue

The key issue for consideration is the release of substances to atmosphere from the ERF which have the potential to harm human health. Details of the dispersion modelling can be found in the Dispersion Modelling Assessment submitted with the EP application.

The ERF is required to meet the ELVs outlined in the existing EP. Limits have been set for pollutants known to be produced during the combustion of municipal waste which have the potential to impact upon the local environment either on human health or ecological receptors. Dioxins and dioxin-like PCBs can accumulate in the environment, which means that inhalation is only one of the potential exposure routes. The health assessment criterion is expressed as the total intake from ingestion and inhalation. Pathway modelling considering the intake from inhalation and ingestion has been carried out using the software “Industrial Risk Assessment Program-Human Health” (IRAP-h View – Version 5.1, “IRAP”). In addition, a review of published literature on the health effects of energy recovery facilities has been undertaken.

3.2 Chemicals of Potential Concern (COPC)

The following substances have been considered COPCs for the purpose of this assessment:

- PCDD/Fs (individual congeners), i.e., dioxins; and
- Dioxin-like PCBs;

This risk assessment investigates the potential for long term health effect of these COPCs through routes other than just inhalation.

4 Assessment Criteria

IRAP calculates the total exposure through each of the different pathways so that a dose from inhalation and ingestion can be calculated for each receptor. By default, these doses are then used to calculate a cancer risk, using the United States Environment Protection Agency's (USEPA)'s approach. However, this assessment applies the approach set out in the Environment Agency guidance titled, "*Human Health Toxicological Assessment of Contaminants in Soil*", (Ref: SC050021, 2009).

For the COPCs considered, which have a threshold level for toxicity, a Tolerable Daily Intake (TDI) is defined. This is "an estimate of the amount of a contaminant, expressed on a bodyweight basis, which can be ingested daily over a lifetime without appreciable health risk." A Mean Daily Intake (MDI) is also defined, which is the typical intake from background sources (including dietary intake) across the UK. In order to assess the impact of the ERF, the predicted intake of a substance due to emissions from the ERF is added to the MDI and compared with the TDI.

The following table outlines the MDIs (the typical intake from existing background sources) and TDIs for dioxins and dioxin-like PCBs. These figures are defined in the "Contaminants in soil: updated collation of toxicology data and intake values for humans: dioxins, furans and dioxin-like PCBs" (Environment Agency, 2009).

Table 1: Assessment Criteria for Intake of Dioxins

Item	Units	Intake	
		70 kg adult	20 kg child
Tolerable Daily Intake (TDI)	pg WHO-TEQ/kg bw/day		2.0
Mean Daily Intake (MDI)	pg WHO-TEQ/kg bw/day	0.7	1.8
	% of TDI	35.00%	90.00%

Source: *Contaminants in soil: updated collation of toxicology data and intake values for humans: dioxins, furans and dioxin-like PCBs*, Environment Agency 2009⁷.

To allow comparison with the TDI for dioxins, intake values for each dioxin are multiplied by a factor known as the WHO-TEF. A full list of the WHO-TEF values for each dioxin is provided in Table 7. The TDI has been set at a level which can be ingested daily over a lifetime without appreciable health risk. Therefore, if the total exposure is less than the TDI, it can be concluded that the impact of the ERF is not significant.

⁷ This document has been archived by the EA. The page detailing the TDI and MDI has been appended as Annex C.

5 Conceptual Site Model

5.1 Conceptual site model

IRAP, created by Lakes Environmental, is based on the USEPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities⁸. This Protocol is a development of the approach defined by Her Majesty's Inspectorate on Pollution (HMIP) in the UK in 1996⁹, taking account of further research since that date. The exposure pathways included in the IRAP model are shown in Table 2.

Exposure to gaseous contaminants has the potential to occur by direct inhalation or vapour phase transfer to plants. In addition, exposure to particulate phase contaminants may occur via indirect pathways following the deposition of particles to soil. These pathways include:

- ingestion of soil and dust;
- uptake of contaminants from soil into the food-chain (through home-grown produce and crops); and
- direct deposition of particles onto above ground crops.

The pathways through which inhalation and ingestion occur and the receptors that have been considered to be impacted via each pathway are shown in Table 2.

Table 2: Pathways Considered

Pathway	Residential	Agricultural
Direct inhalation	Yes	Yes
Ingestion of soil	Yes	Yes
Ingestion of home-grown produce	Yes	Yes
Ingestion of drinking water	Yes	Yes
Ingestion of eggs from home-grown chickens	-	Yes
Ingestion of home-grown poultry	-	Yes
Ingestion of home-grown beef	-	Yes
Ingestion of home-grown pork	-	Yes
Ingestion of home-grown milk	-	Yes
Ingestion of breast milk (infants only)	Yes	Yes

Some households may keep chickens and consume eggs and potentially the birds. The impact on these households is considered to be between the impact at an agricultural receptor and a standard resident receptor. The approach used considers an agricultural receptor at the point of maximum impact as a complete worst case.

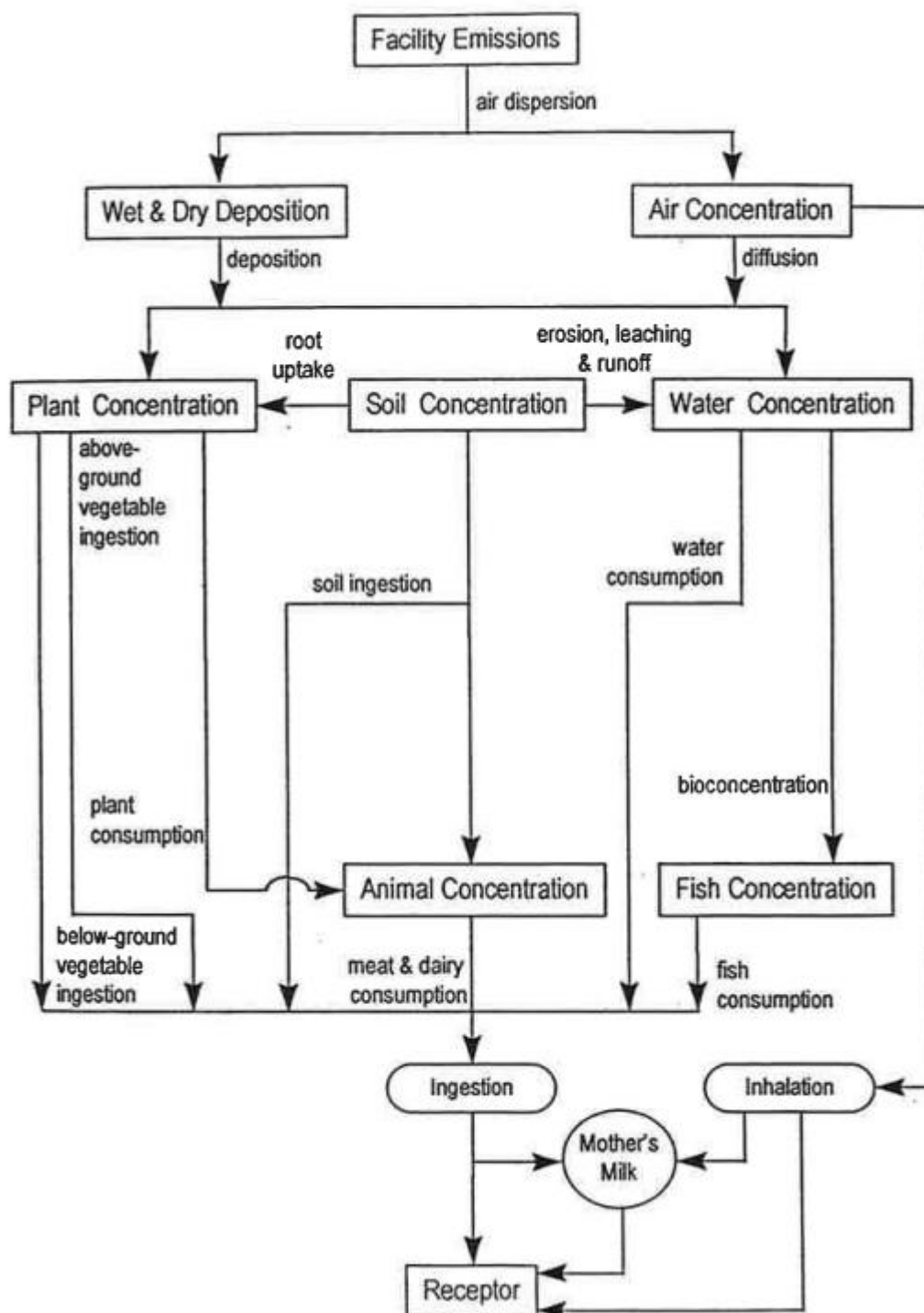
As shown in Figure 1, the pathway from the ingestion of mother's milk in infants is considered within the assessment. The IRAP model calculates the amount of dioxins entering the mother's milk and being passed on to the infants. IRAP does not include data on individual PCBs, but it does include data for take-up and accumulation rates within the food chain for two groups of PCBs,

⁸ USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

⁹ HMIP (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes.

known as Aroclor 1254 and Aroclor 1016. IRAP does not include these when determining the intake via mother's milk. Therefore, a safety factor of 1.5 has been applied to the dioxin and dioxin-like PCBs emission rate when considering the impact of the intake via mother's milk. The impacts are then compared against the TDI.

Figure 1: Conceptual Site Model – Exposure Pathways



5.2 Pathways excluded from assessment

The intake of dioxins via dermal absorption, groundwater and surface water exposure, and fish consumption pathways is very limited and as such these pathways are excluded from this assessment. The justification for excluding these pathways is highlighted in sections 5.2.1 to 5.2.4.

5.2.1 Dermal absorption

Both the HMIP and the USEPA note that the contribution from dermal exposure to soils impacted from thermal treatment facilities is typically a very minor pathway and is typically very small relative to contributions resulting from exposures via the food chain.

The USEPA¹⁰ provide an example from the risk assessment conducted for the Waste Technologies, Inc. hazardous thermal treatment in East Liverpool, Ohio. This indicated that for an adult subsistence farmer in an area with high exposures, the risk resulting from soil ingestion and dermal contact was 50-fold less than the risk from any other pathway and 300-fold less than the total estimated risk.

The HMIP document¹¹ provides a screening calculation using conservative assumptions, which states that the intake via dermal absorption is 30 times lower than the intake via inhalation, which is itself a minor contributor to the total risk.

As such the pathway from dermal absorption is deemed to be an insignificant risk and has been excluded from this assessment.

5.2.2 Groundwater

Exposure via groundwater can only occur if the groundwater is contaminated and consumed untreated by an individual.

The USEPA¹² has concluded that the build-up of dioxins in the aquifer over realistic travel times relevant to human exposure was predicted to be so small as to be essentially zero.

As such the pathway from groundwater is deemed to be an insignificant risk and has been excluded from this assessment.

5.2.3 Surface water

A possible pathway is via deposition of emissions directly onto surface water – i.e., local drinking water supplies or rainwater storage tanks.

Surface water generally goes through several treatment steps and as such any contaminants would be removed from the water before consumption. Run off to rainwater tanks may not go through the same treatment. However, rainwater tanks have a very small surface area and as such the potential for deposition and build-up of COPCs is limited. As such, the pathway from contaminated surface water is deemed to be an insignificant risk and has been excluded from this assessment.

¹⁰ USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

¹¹ HMIP (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes.

¹² USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

5.2.4 Fish consumption

The consumption of locally caught fish has been excluded from the assessment. Whilst fish makes up a proportion of the UK diet, it is not likely that this would be sourced wide-scale from close proximity to the ERF.

It is noted that game fishing may take place along rivers and coasts in the local area. However, the accumulation of pollutants in river systems is not of significant concern, as any pollutants will be washed downstream rather than accumulating, and the extremely small quantity of pollutants deposited in tidal waters would be diluted by the action of tides and currents. Therefore, the fish consumption pathway has been excluded from this assessment.

6 Sensitive Receptors

This assessment considers the possible effects on human health at the point of maximum impact within the modelling domain, and the point of maximum impact on land for annual mean emissions from the ERF. The effects have been considered for the two different receptor types which accounts for the different exposure pathways. Reference should be made to Appendix B which shows the location of these points with respect to the ERF.

Table 3: Sensitive Receptors

ID	Receptor name	Location		Type of receptor
		X	Y	
MAX	Point of maximum impact	321485	175345	Agricultural / Residential
MAX_land	Point of maximum impact on land	321295	175535	Agricultural / Residential

7 IRAP Model Assumptions and Inputs

The following section details the user defined assumptions used within the IRAP model and provides justifications where appropriate.

7.1 Concentrations in soil

The concentration of each chemical in the soil is calculated from the deposition results of the air quality modelling for vapour phase and particle phase deposition. The critical variables in calculating the accumulation of pollutants in the soil are as follows:

- the lifetime of the ERF is taken as 30 years; and
- the soil mixing depth is taken as 2 cm in general and 20 cm for produce.

The split between the solid and vapour phase for the substance considered depends on the specific physical properties of each chemical.

In order to assess the amount of substance which is lost from the soil each year through volatilisation, leaching and surface run-off, a soil loss constant is calculated. The rates for leaching and surface runoff are taken as constant, while the rate for volatilisation is calculated from the physical properties of each substance.

7.2 Concentrations in plants

The concentrations in plants are determined by considering direct deposition and air-to-plant transfer for above ground produce, and root uptake for above ground and below ground produce.

The calculation takes account of the different types of plant. For example, uptake of substances through the roots will differ for below ground and above ground vegetables, and deposition onto plants will be more significant for above ground vegetables.

7.3 Concentrations in animals

The concentrations in animals are calculated from the concentrations in plants, assumed consumption rates and bio-concentration factors. These vary for different animals and different substances, since the transfer of chemicals between the plants consumed and animal tissue varies.

It is also assumed that 100% of the plant material eaten by animals is grown on soil contaminated by emission sources. This is likely to be a highly pessimistic assumption for UK farming practice.

7.4 Concentrations in humans

7.4.1 Intake via inhalation

This is calculated from inhalation rates of typical adults and children and atmospheric concentrations. The inhalation rates used for adults and children as specified within the Environment Agency's document titled, "*Human Health Toxicological Assessment of Contaminants in Soil*" are:

- adults – 20 m³/day; and
- children – 7.2 m³/day.

The calculation also takes account of time spent outside, since most people spend most of their time indoors.

7.4.2 Intake via soil ingestion

This calculation allows for the ingestion of soil and takes account of different exposure frequencies. It allows for ingestion of soil attached to unwashed vegetables, unintended ingestion when farming or gardening and, for children, ingestion of soil when playing.

7.4.3 Ingestion of food

The calculation of exposure due to ingestion of food draws on the calculations of concentrations in animals and plants and takes account of different ingestion rates for the various food groups by different age groups.

For most people, locally-produced food is only a fraction of their diet and so exposure factors are applied to allow for this.

7.4.4 Breast milk ingestion

For infants, the primary route of exposure is through breast milk. The calculation draws on the exposure calculation for adults and then allows for the transfer of chemicals in breast milk to an infant who is exclusively breast-fed.

The only pathway considered for dioxins for a breast-feeding infant is through breast milk. The modelled scenario consists of the accumulation of pollutants in the food chain up to an adult receptor, the accumulation of pollutants in breast milk and finally the consumption of breast milk by an infant.

The assumptions used were as follows:

• Exposure duration of infant to breast milk	1 year
• Proportion of ingested dioxin that is stored in fat	0.9
• Proportion of mother's weight that is stored in fat	0.3
• Fraction of fat in breast milk	0.04
• Fraction of ingested contaminant that is absorbed	0.9
• Half-life of dioxins in adults	2,555 days
• Ingestion rate of breast milk	0.688 kg/day
• Safety factor on total dioxin intake to account for PCBs	1.5

7.5 Estimation of COPC concentration in media

The IRAP-h model uses a database of physical and chemical parameters to calculate the COPC concentrations through each of the different pathways identified. The base physical and chemical parameters have been used in this assessment.

Weather data has been obtained for the period 2020 to 2024 from the Cardiff Airport weather station, as used within the Dispersion Modelling Assessment. However, this does not contain precipitation. As such reference has been made to the long-term climate average datasets from the

Met Office for the closest meteorological site (Cardiff, Bute Park)¹³. This provides the annual average precipitation which can be used to calculate the general IRAP-h input parameters, as presented in Table 4.

Table 4: Site-Specific Properties

Input variable	Assumption	Value (cm/year)
Annual average evapotranspiration	70% of annual average precipitation	84
Annual average irrigation	0% of annual average precipitation	0
Annual average precipitation	100% of annual average precipitation	120
Annual average runoff	10% of annual average precipitation	12
Note: Annual average precipitation for the climate period 1991-2020 from Cardiff Bute Park		

The average wind speed was taken as 4.7 m/s, calculated from the average of the five years of weather data from Cardiff Airport weather station.

A number of assumptions have been made with regard to the deposition of the different phases. These are summarised in Table 5.

Table 5: Deposition Assumptions

Deposition phase	Dry Deposition velocities (m/s)	Ratio dry deposition to wet deposition	
		Dry deposition	Wet deposition
Vapour	0.005	1.0	2.0
Particle	0.010	1.0	2.0
Bound particle	0.010	1.0	2.0

The deposition assumptions have been applied to the annual mean concentrations predicted using the dispersion modelling, to generate the inputs needed for the IRAP modelling. For details of the dispersion modelling methodology refer to the Dispersion Modelling Assessment.

7.6 Modelled emissions

For the purpose of this assessment it is assumed that the ERF operates at the ELV for dioxins within the existing EP for its entire operational life. In reality, the ERF will be shut down for periods of maintenance and will typically operate below the emission limits prescribed in the EP.

The emissions rates of each COPC modelled and the associated emission concentrations which have been used to derive the emission rate are presented in Table 6.

Table 6: COPC Emissions Modelled

COPC	Split of congeners for a release of 1 ng I-TEQ/Nm ³ (1)	Emission conc. (ng/Nm ³)(2)	Emission rate (ng/s)(3)
Sum I-TEQ dioxins(4)	-	0.08 ng I-TEQ/Nm ³	-

¹³ <https://www.metoffice.gov.uk/research/climate/maps-and-data/location-specific-long-term-averages/gcjszmp73>

COPC	Split of congeners for a release of 1 ng I-TEQ/Nm ³ (1)	Emission conc. (ng/Nm ³)(2)	Emission rate (ng/s) (3)
2,3,7,8-TCDD	0.031	0.002	0.174
1,2,3,7,8-PeCDD	0.245	0.015	1.379
1,2,3,4,7,8-HxCDD	0.287	0.017	1.615
1,2,3,6,7,8-HxCDD	0.258	0.015	1.452
1,2,3,7,8,9-HxCDD	0.205	0.012	1.154
1,2,3,4,6,7,8-HpCDD	1.704	0.102	9.591
OCDD	4.042	0.242	22.750
2,3,7,8-TCDF	0.277	0.017	1.559
1,2,3,7,8-PCDF	0.277	0.017	1.559
2,3,4,7,8-PCDF	0.535	0.032	3.011
1,2,3,4,7,8-HxCDF	2.179	0.131	12.264
1,2,3,6,7,8-HxCDF	0.807	0.048	4.542
1,2,3,7,8,9-HxCDF	0.042	0.003	0.236
2,3,4,6,7,8-HxCDF	0.871	0.052	4.902
1,2,3,4,6,7,8-HpCDF	4.395	0.264	24.737
1,2,3,4,7,8,9-HpCDF	0.429	0.026	2.415
OCDF	3.566	0.214	20.071
Total dioxins	20.150	1.2086	113.414
Dioxin-like PCBs(5)	-	0.0092	0.863

Notes:

(1) Split of the congeners taken from Table 7.2a from the HMIP document.

(2) All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.

(3) Emission release rate calculated by multiplying the normalised volumetric flow rate by the emission concentration.

(4) 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 ERF.

(5) Refer to note 5 below this table.

A number of points should be noted for the two groups of COPCs:

1. Dioxins

The split of the different dioxins and furans is based on split of congeners for a release of 1 ng I-TEQ/Nm³ as presented in in Table 6. This data is taken from Table 7.2a from the HMIP document titled "Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes".

To determine the emission rates, this split of the different dioxins factored to the ELV of 0.06 ng I-TEQ/Nm³ has been multiplied by normalised volumetric flow rate to determine the release rate of each congener.

2. Dioxin-like PCBs

There are a total of 209 PCBs, which act in a similar manner to dioxins, are generally found in complex mixtures and also have TEFs.

The UK Environment Agency has advised that 44 measurements of dioxin like PCBs have been taken at 24 MWIs between 2008 and 2010. The following data summarises the measurements, all at 11% reference oxygen content:

- Maximum = 9.2×10^{-3} ng[TEQ]/m³
- Mean = 2.6×10^{-3} ng[TEQ]/m³
- Minimum = 5.6×10^{-5} ng[TEQ]/m³

For the purpose of this assessment, the maximum monitored PCB concentration has been used which has been converted to an emission rate using the volumetric flow.

The IRAP software, and the HHRAP database which underpins it, does not include any data on individual PCBs, but it does include data for take-up and accumulation rates within the food chain for two groups of PCBs, known as Aroclor 1254 and Aroclor 1016. Each Aroclor is based on a fixed composition of PCBs. Since we are not aware of any data on the specification of PCBs within incinerator or co-incinerator emissions, as a worst-case assumption it has been assumed that PCB emissions consist entirely of each of the two Aroclor compositions and the maximum impact of either composition has been presented.

As shown in Table 1, the MDI and TDI for dioxins and dioxin-like PCBs is given in pg WHO-TEQ/kg bw/day. However, the split of congeners shown in Table 6 which are used to calculate the release rate of each dioxin are based on the I-TEFs listed in Annex VI Part II of the IED. To determine the total intake TEQ for comparison with the TDI, the output of the IRAP model has been multiplied by the relevant WHO-TEFs. Two sets of WHO-TEFs have been considered; those values published in 2005, and those published in 2022. The Environment Agency has not published any guidance relating to the publication of the 2022 WHO-TEFs. Correspondence with the EA has confirmed that the 2005 WHO-TEFs can continue being used for the main assessment, and a sensitivity analysis be undertaken using the 2022 WHO-TEFs (refer to section 8.3.1). The I-TEFs and WHO-TEFs are shown in Table 7.

Table 7: Toxic Equivalency Factors for Dioxins and Furans

Congener	IED I-TEF Multiplier ⁽¹⁾	2005 WHO-TEF Multiplier ⁽¹⁾	2022 WHO-TEF Multiplier ⁽²⁾
Dioxins			
2,3,7,8-TCDD	1	1	1
1,2,3,7,8-PeCDD	0.5	1	0.4
1,2,3,4,7,8-HxCDD	0.1	0.1	0.09
1,2,3,6,7,8-HxCDD	0.1	0.1	0.07
1,2,3,7,8,9-HxCDD	0.1	0.1	0.05
1,2,3,4,6,7,8-HpCDD	0.01	0.01	0.05
OCDD	0.001	0.0003	0.001

Congener	IED I-TEF Multiplier ⁽¹⁾	2005 WHO-TEF Multiplier ⁽¹⁾	2022 WHO-TEF Multiplier ⁽²⁾
Furans			
2,3,7,8-TCDF	0.1	0.1	0.07
1,2,3,7,8-PCDF	0.05	0.03	0.1
2,3,4,7,8-PCDF	0.5	0.3	0.01
1,2,3,4,7,8-HxCDF	0.1	0.1	0.3
1,2,3,6,7,8-HxCDF	0.1	0.1	0.09
1,2,3,7,8,9-HxCDF	0.1	0.1	0.2
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.02
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.1
OCDF	0.001	0.0003	0.002

Source: (1) Contaminants in soil: updated collation of toxicological data and intake values for humans, Dioxins, furans and dioxin-like PCBs (Science report: SC050021/TOX 12), Environment Agency, 2009. (2) The 2022 world health organization re-evaluation of human and mammalian toxic equivalency factors for polychlorinated dioxins, dibenzofurans and biphenyls, DeVito et al, 2023.

8 Results

8.1 Assessment against TDI

The following tables present the impact of emissions of dioxins and dioxin-like PCBs from the ERF at the point of maximum impact of emissions from the ERF within the modelling domain and on land. As explained in section 2, the agricultural type receptor type assumes the direct inhalation, and ingestion from soil, drinking water, and home-grown eggs and meat, beef, pork, and milk. This assumes that the person lives at the point of maximum impact and consumes home-grown produce etc. This is considered to be a worst-case scenario.

Table 8: Impact Analysis – Dioxins and Dioxin-Like PCBs

Receptor type	MDI (% of TDI)	Process contribution (% of TDI)	Overall (% of TDI)
Point of maximum impact			
Adult			
Agricultural	35.00%	2.54%	37.54%
Residential	35.00%	0.06%	35.06%
Child			
Agricultural	90.00%	3.61%	93.61%
Residential	90.00%	0.20%	90.20%
Point of maximum impact on land			
Adult			
Agricultural	35.00%	2.17%	37.17%
Residential	35.00%	0.05%	35.05%
Child			
Agricultural	90.00%	3.09%	93.09%
Residential	90.00%	0.17%	90.17%

The TDI is an estimate of the amount of a contaminant, expressed on a bodyweight basis, which can be ingested daily over a lifetime without appreciable health risk. As shown in Table 8, the overall impact (including the contribution from existing dietary intake) is less than the TDI for dioxins and dioxin-like PCBs. Therefore, there would not be an appreciable health risk based on the emission of these pollutants from the operation of the ERF with the increased waste processing capacity.

8.2 Breast milk exposure

The total accumulation of dioxins in an infant resulting from emissions from the ERF, considering the breast milk pathway and based on an adult agricultural receptor at the point of maximum impact of emission from the ERF feeding an infant, is 0.732 pg WHO-TEQ / kg-bw / day which is 36.60% of the TDI. For a residential-type receptor this is 0.014 pg WHO-TEQ / kg-bw / day, which is only 0.70% of the TDI.

Based on an adult agricultural receptor feeding an infant the maximum impact, at the point of maximum impact on land, is 0.627 pg WHO-TEQ / kg-bw / day which is 31.34% of the TDI. For a residential-type receptor this is 0.012 pg WHO-TEQ / kg-bw / day, which is only 0.60% of the TDI.

There are no ingestion pathways besides breast milk ingestion for an infant receptor. As the process contribution is less than the TDI, it is considered that the ERF will not increase the health risks from the accumulation of dioxins in infants significantly.

8.3 Uncertainty and sensitivity analysis

To account for uncertainty in the modelling the impact on human health was assessed for a receptor at the point of maximum impact and also the point of maximum impact on land.

To account for uncertainty in the dietary intake of a person, both residential and agricultural receptors have been assessed. The agricultural receptor is assumed to consume a greater proportion of home grown produce, which has the potential to be contaminated by the COPCs released, than for a residential receptor. In addition, the agricultural receptor includes the pathway from consuming animals grazed on land contaminated by the emission source. This assumes that 100% of the plant materials eaten by the animals is grown on soil contaminated by emission sources. The agricultural receptor at the point of maximum impact is considered to be the upper maximum of the impact of the ERF.

The IRAP software, and the HHRAP database which underpins it, does not include any data on individual PCBs, but it does include data for take-up and accumulation rates within the food chain for two groups of PCBs, known as Aroclor 1254 and Aroclor 1016. Each Aroclor is based on a fixed composition of PCBs. There is no publicly available data on the speciation of PCBs within incinerator or co-incinerator emissions; therefore, as a worst-case assumption it has been assumed that PCB emissions consist entirely of each of the two Aroclor compositions and the maximum impact of either composition has been presented.

IRAP does not include these Aroclors (which are being used as a proxy for dioxin-like PCBs) when determining the intake via mother's milk. Therefore, a safety factor of 1.5 has been applied to the dioxin and dioxin-like PCBs emission rate when considering the impact of the intake via mother's milk.

8.3.1 Sensitivity analysis – WHO-TEFs

As detailed in Table 7, the output from the IRAP model for each congener has been multiplied by the appropriate WHO-TEF for comparison with the TDI. The WHO-TEFs were last updated in 2022, with the previous version being released in 2005. Correspondence with the Environment Agency has confirmed that the 2005 WHO-TEFs can continue being used for the main assessment, and a sensitivity analysis has been undertaken using the 2022 WHO-TEFs.

The split of congeners from the HMIP document has been applied (refer to Table 6). A comparison of the results at the point of maximum impact and the maximum impacted receptor is presented in Table 9.

Table 9: Sensitivity of Results to Choice of WHO-TEFs

Receptor ID	Receptor Type	Impact of emissions from ERF (% of TDI)		
		2005 WHO-TEFs	2022 WHO-TEFs	% Change in impact
Max	Adult - agricultural	2.54%	2.88%	0.34%

Receptor ID	Receptor Type	Impact of emissions from ERF (% of TDI)		
		2005 WHO-TEFs	2022 WHO-TEFs	% Change in impact
	Child - agricultural	3.61%	4.12%	0.51%
	Infant - agricultural	36.60%	19.96%	-16.65%
	Adult - residential	0.06%	0.08%	0.02%
	Child - residential	0.20%	0.26%	0.06%
	Infant - residential	0.70%	0.41%	-0.29%
Max on land	Adult - agricultural	2.17%	2.46%	0.29%
	Child - agricultural	3.09%	3.53%	0.43%
	Infant - agricultural	31.34%	17.09%	-14.26%
	Adult - residential	0.05%	0.06%	0.02%
	Child - residential	0.17%	0.23%	0.05%
	Infant - residential	0.60%	0.35%	-0.24%

As shown in Table 9, the 2022 WHO-TEFs result in a higher impact than using the 2005 WHO-TEFs for all receptor types except infant receptors. However, applying the 2022 WHO-TEFs, for an agricultural child receptor at the point of maximum impact the impact of emissions is 4.12% of the TDI so the total intake is predicted to be 94.12% of the TDI. As this remains below the TDI, no significant effects are predicted based on the predicted impact using either the 2005 or 2022 WHO-TEFs.

9 Conclusions

This Dioxin Pathway Intake Assessment has been undertaken based on the following conservative assumptions:

- the ERF will operate continually at the ELV for dioxins, i.e., at the maximum concentrations which it is expected that the ERF will be permitted to operate at; and
- the hypothetical maximum impacted receptor (an agricultural receptor at the point of maximum impact) only ingests food and drink sourced from the area with the maximum contribution from the ERF.

The results of the assessment show that, for the hypothetical maximum impacted receptor (an agricultural child receptor at the point of maximum impact of emissions from the ERF), the combined intake from the ERF and the existing MDI intake of dioxins and dioxin-like PCBs via inhalation and ingestion is below the TDI. In addition, the ingestion of dioxins by an infant being breast fed by an agricultural receptor at the point of maximum impact of emissions from the ERF is less than the TDI. On this basis, the impact at identified receptor locations will be lower. Therefore, there would not be an appreciable health risk based on the emission of dioxins and dioxin-like PCBs.

In conclusion, the impact of emissions of dioxins and dioxin-like PCBs from the ERF following the proposed increase in capacity on human health is predicted to be not significant.

Appendices

A Detailed Results Tables

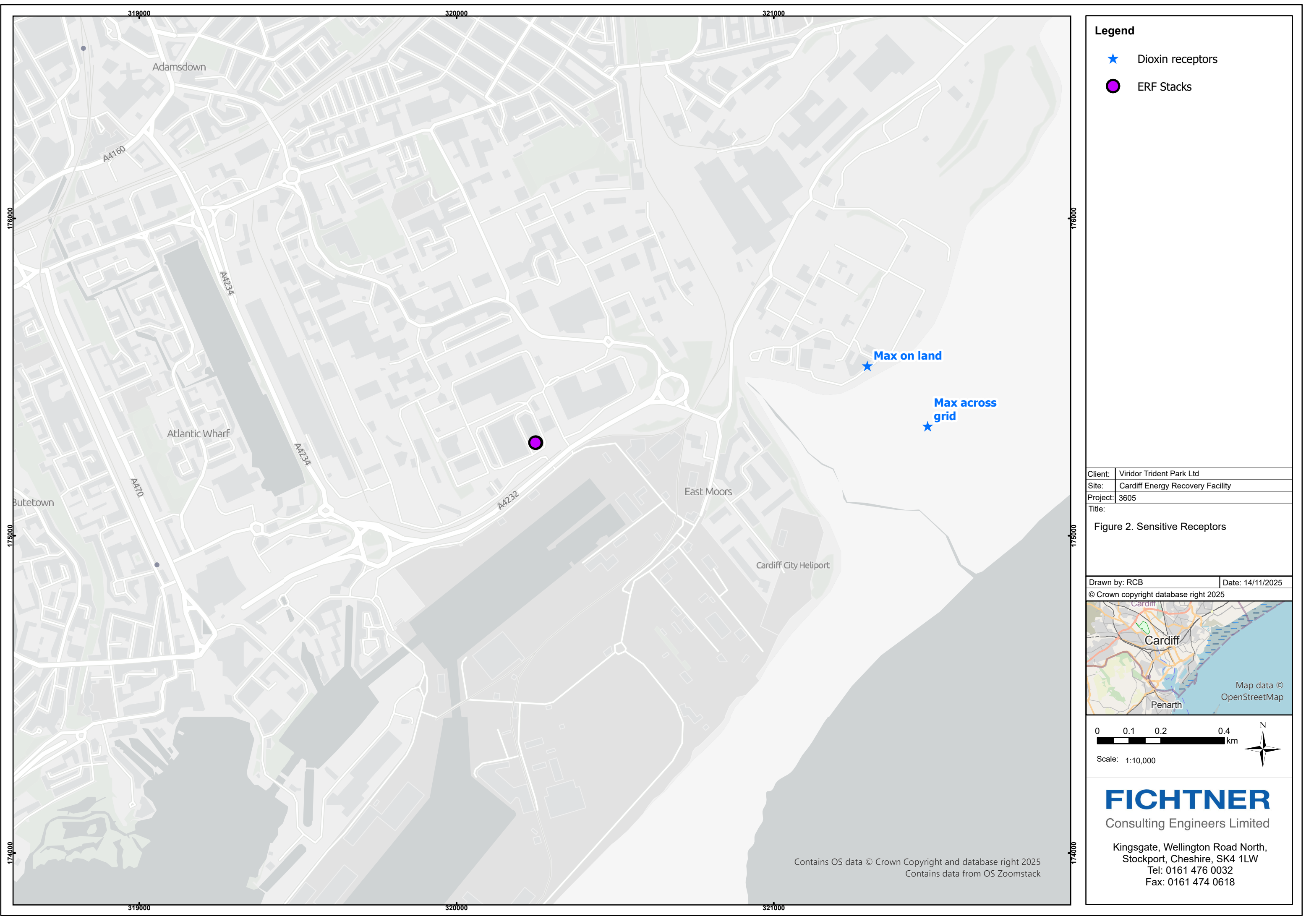
Table 10: Comparison with Total Dioxin and Dioxin-Like PCBs TDI Limits for Adult Receptors

Receptor	Total inhalation, (pg WHO-TEQ kg ⁻¹ bw day ⁻¹)	Total ingestion, (pg WHO-TEQ kg ⁻¹ bw day ⁻¹)	Total uptake, (pg WHO-TEQ kg ⁻¹ bw day ⁻¹)	Comparison (% of TDI)
MDI (% of TDI)				35.00%
Point of maximum impact – agricultural	1.30E-04	5.06E-02	5.07E-02	37.54%
Point of maximum impact – residential	1.30E-04	1.02E-03	1.15E-03	35.06%
Point of maximum impact on land – agricultural	1.12E-04	4.33E-02	4.34E-02	37.17%
Point of maximum impact on land – residential	1.12E-04	8.69E-04	9.81E-04	35.05%

Table 11: Comparison with Total Dioxin and Dioxin-Like PCBs TDI Limits for Child Receptors

Receptor	Total inhalation, (pg WHO-TEQ kg ⁻¹ bw day ⁻¹)	Total ingestion, (pg WHO-TEQ kg ⁻¹ bw day ⁻¹)	Total uptake, (pg WHO-TEQ kg ⁻¹ bw day ⁻¹)	Comparison (% of TDI)
MDI (% of TDI)				90.00%
Point of maximum impact – agricultural	1.64E-04	7.21E-02	7.22E-02	93.61%
Point of maximum impact – residential	1.64E-04	3.84E-03	4.00E-03	90.20%
Point of maximum impact on land – agricultural	1.41E-04	6.17E-02	6.19E-02	93.09%
Point of maximum impact on land – residential	1.41E-04	3.28E-03	3.42E-03	90.17%

B Location of Sensitive Receptors



Legend

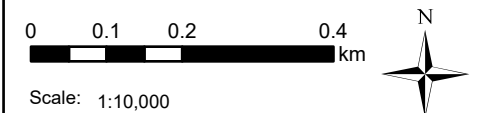
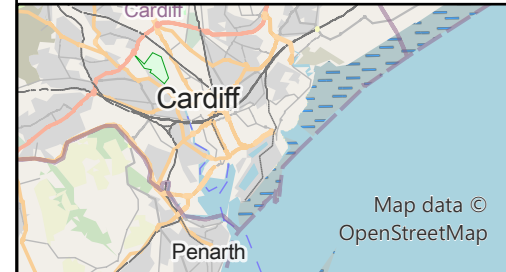
- ★ Dioxin receptors
- ERF Stacks

Client:	Viridor Trident Park Ltd
Site:	Cardiff Energy Recovery Facility
Project:	3605
Title:	

Figure 2. Sensitive Receptors

Drawn by: RCB	Date: 14/11/2025
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Contains data from OS Zoomstack

C Data Source – Mean Daily Intake

congener, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). The TEFs most recently agreed by the World Health Organization (WHO) in 2005 are recommended herein.

When assessing a dioxin-like compound, its toxic equivalence (TEQ) is its exposure dose multiplied by its TEF. The overall TEQ of exposure to a mixture of dioxin-like compounds is the sum of the TEQs for the individual compounds present. It is recommended that TEFs are not directly applied to concentrations of dioxin and dioxin-like compounds in soil to calculate TEQs; instead congener-specific equations should be used as far as possible to account for factors such as fate, transport and availability.

Health Criteria Values and risk assessment

The recommended oral tolerable daily intake (TDI_{oral}) of 2 pg WHO-TEQ kg^{-1} bodyweight (bw) is derived to protect against the induction of developmental effects in humans. As these are the most sensitive effects, the TDI is also expected to protect against all other toxic and carcinogenic effects

No authoritative assessments of the health risks posed by inhalation or dermal exposures to dioxins and dioxin-like PCBs were identified. There is no evidence to suggest that the toxicity of dioxins and dioxin-like PCBs is route-specific, or that there is any notable oral first-pass metabolism. The very limited data on absorption following inhalation suggest that pulmonary absorption may be greater than (in-feed) oral absorption. However, any potential difference is of negligible consequence to the risk assessment of dioxins and dioxin-like PCBs in soil, due to the overwhelming dominance of oral exposure pathways. Consequently, it is recommended that combined exposure from all pathways is compared against the TDI_{oral} in the derivation of SGVs.

Although information on dermal absorption is very limited, what is known suggests a low degree of absorption.

Mean daily intakes from non-soil sources

The adult oral mean daily intake (MDI_{oral}) of dioxins and dioxin-like PCBs from their presence in food and drinking-water is estimated to be about 49 pg WHO-TEQ day^{-1} . The adult inhalation mean daily intake (MDI_{inh}) from ambient air is estimated to be about 0.2 pg TEQ day^{-1} .

TDI and MDI values for dioxins, furans and dioxin-like PCBs

Parameter	Units	Oral (and inhalation combined)
MDI	pg WHO-TEQ day^{-1}	49
MDI for 70-kg adult	pg WHO-TEQ kg^{-1} bw day^{-1}	0.7
MDI for 20-kg child	pg WHO-TEQ kg^{-1} bw day^{-1}	1.8
TDI	pg WHO-TEQ kg^{-1} bw day^{-1}	2

* See Environment Agency (2009a) for details of MDI conversion factors.

Summary of changes to HCV recommendations

The TDI_{oral} of 2 pg WHO-TEQ kg^{-1} bw day^{-1} is the same as was recommended in the 2003 TOX report.

C Abnormal Emissions Assessment

FICHTNER

Consulting Engineers Limited



Cardiff Energy Recovery Facility



Viridor Trident Park Limited

Abnormal Emissions Assessment

Document approval

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1 Introduction

Fichtner Consulting Engineers Ltd (Fichtner) has been engaged to undertake an Abnormal Emissions Assessment to support an application to vary the Environmental Permit (EP) for the proposed increase in capacity to the operational Trident Park Energy Recovery Facility (ERF) (the ERF). The Environmental Permitting Regulations require that abnormal event scenarios are considered.

Article 46(6) of the Industrial Emissions Directive (IED) states that:

“... the waste incineration plant ... shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded.

The cumulative duration or operation in such conditions over 1 year shall not exceed 60 hours.”

Article 47 continues with:

“In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.”

The conditions detailed in Article 46(6) are considered to be “abnormal operating conditions” for the purpose of this assessment applies to the ERF.

This assessment has considered the abnormal operation of the ERF with the proposed increase in throughput – i.e. based on an annual waste processing capacity of 500,000 tonnes per annum (tpa).

2 Identification of Abnormal Operating Conditions

The following are considered to be examples of abnormal operating conditions which may lead to 'abnormal emission levels' of pollutants:

1. Reduced efficiency of the lime injection system such as through blockages or failure of fans leading to elevated acid gas emissions (with the exception of hydrogen chloride);
2. Complete failure of the lime injection system leading to unabated emissions of hydrogen chloride. (Note: this would require the plant to have complete failure of the bag filter system. As a plant of modern design the plant would have shut down before reaching these operating conditions);
3. Reduced efficiency of particulate filtration system due to bag failure and inadequate isolation, leading to elevated particulate emissions and metals in the particulate phase;
4. Reduced efficiency of the Selective Non-Catalytic Reduction (SNCR) system as a result of blockages or failure of the reagent injection system, leading to elevated oxides of nitrogen emissions; and
5. Complete failure of the activated carbon injection system and loss of temperature control leading to high levels of dioxin reformation and their unabated release.

As a modern design, the ERF is operated to a high degree of compliance. Therefore, the identification of plausible abnormal emission levels has been based primarily on the data obtained from modern plants. Where actual data is not available, worst case conservative assumptions have been made.

2.1 Plant start-up and shutdown

Start-up of the ERF from cold is conducted with clean support fuel (low sulphur light fuel oil). During this time the control system will be operation. Waste is not introduced onto the grate unless the temperature is above the minimum requirement (850°C) and other operating parameters (for example, air flow and oxygen levels) are within the range stipulated in the permit. During the warming up period the gas cleaning plant and monitoring systems will become operational .

The same is true during plant shutdown. The waste remaining on the grate is allowed to burn out, the temperature not being permitted to drop below 850°C by the simultaneous introduction of clean support auxiliary fuel. During this period, the gas cleaning equipment, control systems and monitoring equipment will be fully operational. After complete burnout of the waste, the burners are turned off and the plant is allowed to cool.

It should also be noted that start-up and shutdown are infrequent events; the ERF is designed to operate continuously, and ideally only close down for its annual maintenance programme.

In relation to the magnitude of dioxin emissions during plant start-up and shutdown, research has been undertaken by AEA Technology on behalf of the Environment Agency (EA). Whilst elevated emissions of dioxins (within one order of magnitude) were found during shutdown and start-up phases where the waste was not fully established on the grate, the report concluded that:

"The mass of dioxin emitted during start-up and shutdown for a 4-5 day planned outage was similar to the emission which would have occurred during normal operation in the same period. The emission during the shutdown and restart is equivalent to less than 1 % of the estimated annual emission (if operating normally all year)."

There is therefore no reason why such start-up and shutdown operations will affect the long-term impact of the ERF.

3 Plausible Abnormal Emission Levels

The following plausible abnormal emission levels for the ERF have been identified based on the performance of similar plants in the UK. The plausible abnormal emissions concentrations are presented in Table 1, where available, these have been based on measured data from a comparable energy from waste facility.

Table 1: Plausible Abnormal Emissions from an EfW

Pollutant	Permitted Emission Limit, (mg/Nm ³) ⁽¹⁾		Plausible Abnormal Emission, (mg/Nm ³)	% Above Max Permitted Emission
	Daily Average	½ hourly max		
Oxides of nitrogen	180	400	500 ⁽²⁾	25
Particulate matter (PM ₁₀)	5	30	150 ⁽³⁾	400
Sulphur dioxide	40	200	450 ⁽⁴⁾	125
Hydrogen chloride	8	60	900 ⁽⁴⁾	1,400
Hydrogen fluoride	1	4	20 ⁽⁴⁾	400
Dioxins and dioxin-like PCBs	0.08 ng/Nm ³		6 ng/Nm ³	9,900 ⁽⁵⁾
PCBs	0.005 mg/Nm ³ ⁽⁶⁾		0.5 mg/Nm ³	9,900 ⁽⁷⁾

Notes:

⁽¹⁾ All emissions expressed as Nm³ based (dry, 0°C, 11% reference oxygen content).

⁽²⁾ Taken as the upper end of the range of monitored raw flue gas after the boiler from the Waste Incineration BREF (Table 3.6)

⁽³⁾ Taken from the IED maximum permitted level.

⁽⁴⁾ Based on information presented in the Devonport Decision Document (Reference: EPR/WP3833FT).

⁽⁵⁾ Assumes a 99% removal efficiency in lieu of any other information as set out in the Devonport Decision Document.

⁽⁶⁾ The Waste Incineration BREF provides a range of values for PCB emissions to air from European municipal waste incineration plants. This states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). In lieu of other available data, this has been assumed to be the emission concentration for the ERF.

⁽⁷⁾ In lieu of any publicly available information, the plausible emissions multiplier for PCBs is assumed to be the same as for dioxins.

A number of assumptions have been made with regard to the emissions of individual metals, as follows:

- Emission concentration of mercury has been assumed to be 100% of the ELV of 0.02 mg/m³.
- Emission concentration of cadmium has been taken as half the ELV for cadmium and thallium and compounds of 0.02 mg/m³.
- Emission concentration of heavy metals that have a short or long term EAL have been considered (antimony, arsenic, chromium, copper, lead, manganese, nickel, vanadium) and have been taken from the Environment Agency guidance document titled, "Guidance on assessing group 3 metal stack emissions from incinerators" (version 4), which is also appropriate for facilities permitted by Natural Resources Wales (NRW). This guidance summarises the

existing emissions from 18 Municipal Waste Incinerators (MWIs) and Waste Wood Co-incinerators in the UK over a period between 2007 and 2015. The maximum monitored concentration has been applied with the exception of nickel for which the 3rd highest concentration has been applied given the maximum is an outlier.

- The Predicted Abnormal Emission are calculated based on 30 times the emission concentration, as it is assumed that metals are in the particulate phase with the exception of mercury which would be in the vapour phase.
- The Waste Incineration BREF (WI BREF) states that for activated carbon injections systems mercury is absorbed usually to about a 95% efficiency to result in emission to air of below 30 µg/m³ (section 4.5.6.2). Therefore, based on the WI BREF the unabated mercury emission concentration due to a failure of the carbon injection system would be 600 µg/m³. This equates to 2,900% above the modelled emission limit of 20 µg/Nm³ which was used in the dispersion modelling assessment.

The plausible abnormal emissions concentrations for metals are presented in Table 2.

Table 2: Predicted Abnormal Metal Emissions from an EfW

Pollutant	Emission Concentrations (µg/Nm ³)	Predicted Abnormal Emission (µg/Nm ³)	% Above Max Permitted Emission
Antimony	11.5	345	2,900
Arsenic	25	750	2,900
Cadmium	10	300	2,900
Chromium	92	2,760	2,900
Chromium (VI)	0.13	3.9	2,900
Copper	29	870	2,900
Lead	50.3	1,509	2,900
Manganese	60	1,800	2,900
Mercury	20	600	2,900
Nickel	53	6,600	2,900
Vanadium	6	180	2,900

The definition of ‘abnormal operating conditions’ also encompasses periods where the continuous emission monitoring equipment is not operating correctly and data relating to the actual emission concentrations are not available. This assessment has only used data where the concentration of continuously monitored pollutants has been quantified. Furthermore, no data on flow characteristics (flow rate, temperature etc.) during these abnormal operating conditions is available, so for the purposes of this assessment the design flow characteristics have been applied to the plausible emission levels to derive an emission rate and assess impact.

In defining abnormal operating conditions Annex VI, Part 3 (2) notes the total dust concentration must not exceed 150 mg/Nm³ expressed as a half hourly average. As such total dust has been included in this analysis. In addition, this section continues to state that the emission limits prescribed for total organic carbon (TOC) and carbon monoxide (CO) in the IED must not be exceeded. As such there is no potential for the impact of emissions of TOC and CO to be greater than those presented in the Dispersion Modelling Assessment. Therefore, TOC and CO have not been considered within this abnormal emissions assessment.

4 Impact Resulting from Plausible Abnormal Emissions

The ERF consists of two lines which operate individually. For the purpose of this analysis it has been assumed that both lines operate under abnormal operating conditions concurrently. This is a very worst-case assumption.

4.1 Predicted short term impacts

In order to assess the effect on short term ground level concentrations associated with the ERF operating at the identified abnormal emission concentration with the proposed increase in throughput, the calculated ground level concentration has been increased pro-rata. For daily mean impacts it had been assumed that abnormal emission concentrations occur for 4 hours and emissions are at the emission limit for the remaining 20 hours. The impacts for an averaging period of one hour or less are presented in Table 3 and daily mean impacts are presented in Table 4.

Table 3: Hourly and 15 Minute Mean Impacts Resulting from Plausible Abnormal Emissions

Pollutant	AQAL ($\mu\text{g}/\text{m}^3$)	Predicted Impact – Normal Operation		Predicted Impact – Abnormal Emissions	
		Conc. ($\mu\text{g}/\text{m}^3$)	% of AQAL	Conc. ($\mu\text{g}/\text{m}^3$)	% of AQAL
Nitrogen dioxide	200	13.61	6.80%	17.01	8.51%
Sulphur dioxide (1-hour)	350	19.04	5.44%	42.84	12.24%
Sulphur dioxide (15-min)	266	22.07	8.30%	49.67	18.67%
Hydrogen chloride	750	12.58	1.68%	188.70	25.16%
Hydrogen fluoride	160	0.84	0.52%	4.19	2.62%
Pollutant	AQAL (ng/m^3)	Predicted Impact – Normal Operation		Predicted Impact – Abnormal Emissions	
		Conc. (ng/m^3)	% of AQAL	Conc. (ng/m^3)	% of AQAL
Antimony	150,000	2.42	0.002%	72.53	0.05%
Manganese	1,500,000	12.61	0.001%	378.41	0.03%
Mercury	600	4.20	0.70%	126.14	21.02%
Nickel	700	11.14	1.59%	334.26	47.75%
PCBs	6,000	1.05	0.02%	105.11	1.75%

Table 4: Daily Mean Impacts Resulting from Plausible Abnormal Emissions

Pollutant	AQAL ($\mu\text{g}/\text{m}^3$)	Predicted Impact – Normal Operation		Predicted Impact – Abnormal Emissions	
		Conc. ($\mu\text{g}/\text{m}^3$)	% of AQAL	Conc. ($\mu\text{g}/\text{m}^3$)	% of AQAL
Sulphur dioxide	125	1.59	1.27%	4.32	3.45%
Particulate matter (PM ₁₀)	50	0.11	0.21%	0.62	1.25%
Pollutant	AQAL (ng/m ³)	Predicted Impact – Normal Operation		Predicted Impact – Abnormal Emissions	
		Conc. (ng/m ³)	% of AQAL	Conc. (ng/m ³)	% of AQAL
Cadmium	30	466.74	1.56%	2,722.64	9.08%
Chromium	2,000	4.29	0.21%	25.05	1.25%
Copper	50	1.35	2.71%	7.90	15.79%
Mercury	60	0.93	1.56%	5.45	9.08%
Vanadium	1,000	0.28	0.03%	1.63	0.16%

This is considered to be a highly conservative assessment as it assumes that the plausible abnormal emissions occur on both lines and coincide with worst case meteorological conditions. Even with these highly conservative factors, the process contribution is not predicted to exceed any of the short term AQALs. The maximum predicted process contribution (as a % of the applied AQAL) is less than 47% for nickel, with all other pollutants lower.

4.2 Predicted long term impacts

In order to assess the effect on long term ground level concentrations associated with the ERF operating at the identified abnormal emission levels with the proposed increase in throughput, the calculated long term ground level concentrations have been increased pro-rata as presented in Table 5 and Table 6.

This assessment assumes that the ERF operates at the daily average ELVs for 8,700 hours per year and at the plausible abnormal emission levels for 60 hours per year.

Table 5: Long-term Impacts Resulting from Plausible Abnormal Emissions

Pollutant	AQAL ($\mu\text{g}/\text{m}^3$)	Predicted Impact – Normal Operation		Predicted Impact – Abnormal Emissions	
		Conc. ($\mu\text{g}/\text{m}^3$)	% of AQAL	Conc. ($\mu\text{g}/\text{m}^3$)	% of AQAL
Nitrogen dioxide	40	0.83	2.07%	0.84	2.09%
Particulate matter (PM ₁₀)	40	0.03	0.08%	0.04	0.10%
Hydrogen fluoride	16	0.01	0.04%	0.01	0.05%

Pollutant	AQAL (ng/m ³)	Predicted Impact – Normal Operation		Predicted Impact – Abnormal Emissions	
		Conc. (ng/m ³)	% of AQAL	Conc. (ng/m ³)	% of AQAL
Antimony	5,000	0.08	0.002%	0.09	0.002%
Arsenic	6	0.16	2.74%	0.20	3.28%
Cadmium	5	65.75	1.32%	78.81	1.58%
Chromium (VI)	0.25	0.0009	0.34%	0.00	0.41%
Lead	250	0.33	0.13%	0.40	0.16%
Manganese	150	0.39	0.26%	0.47	0.32%
Nickel	20	0.35	1.74%	0.42	2.09%
PCBs	200	0.03	0.02%	0.06	0.03%

The process contribution is not predicted to exceed any of the long term AQALs. The maximum predicted process contribution (as a % of the applied AQAL) is less than 4% for arsenic, with all other pollutants lower.

There is no AQAL for dioxins and dioxin-like PCBs against which the impact can be assessed. Therefore, to assess the impact of dioxins and dioxin-like PCBs, the increase in concentration at the point of maximum impact has been assessed. As can be seen from the results presented in Table 6, the impact of abnormal emissions is to increase in the maximum ground level concentration by 67.81%.

Table 6: Long Term Impacts from Predicted Dioxin Emissions

Pollutant	Predicted Impact – Normal Operation	Predicted Impact –Abnormal Emissions	
	fg/m ³	fg/m ³	% increase
Dioxins and dioxin like PCBs	0.39	0.66	67.81%

Based on the results of the Dioxin Pathway Intake Assessment (DPIA), the highest dose of dioxins and dioxin-like PCBs is predicted to be 3.61% of the TDI. This is based on the ingestion and inhalation of dioxins and dioxin-like PCBs by a child agricultural receptor at the point of maximum impact (noting that this is within the Severn Estuary. Assuming the impact of abnormal operations, it is calculated that the process contribution at this receptor will be $(3.61\% \times 1.6781) = 6.06\%$ of the UK TDI for dioxins and dioxin-like PCBs. Existing sources contribute 90.00% of the TDI, and therefore the total exposure will be 96.71% of the TDI.

In addition, the DPIA considers the impact of the ingestion of dioxins and dioxin-like PCBs by an infant being breast fed by an adult agricultural receptor at the point of maximum impact. The impact is predicted to be 30.60% of the UK TDI for dioxins and dioxin-like PCBs. There are no other significant pathways for infant receptors. Assuming the impact of abnormal operations, the impact at this receptor will be $(30.60\% \times 1.6781) = 51.35\%$ of the UK TDI for dioxins and dioxin-like PCBs.

Therefore, based on the conservative assumptions used within the modelling, there will be no exceedences of the TDI for dioxins and dioxin-like PCBs.

5 Predicted Environmental Concentration – Abnormal Operations

The Environment Agency's Air Emissions Guidance which is also used by NRW includes the following method for identifying which emissions require further assessment by applying the following criteria:

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

Where the impact of abnormal emissions is greater than the above criteria consideration of the background concentration has been made to ensure that the AQAL is not exceeded as a result of abnormal operations.

5.1 Background concentrations

Appendix A outlines the values for the annual average background concentrations that have been used to evaluate the impact of the ERF with the proposed increase in throughput. These are as presented in the Dispersion Modelling Assessment submitted with the EP application.

5.2 Predicted short term impacts

Table 7 presents the predicted impacts of plausible abnormal operations in the short-term at the point of maximum impact and the Predicted Environmental Concentration (PEC) (process contribution plus background) for those pollutants for which the impact presented in Table 3 is greater than 10%.

Table 7: Short Term PEC Resulting from Plausible Abnormal Emissions

Pollutant	AQAL ($\mu\text{g}/\text{m}^3$)	Background Conc.	PC – Abnormal Emissions	PEC – Abnormal Emissions	
		$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	% of AQAL
Sulphur dioxide (1-hour)	350	10.40	42.84	53.24	15.21%
Sulphur dioxide (15-min)	266	10.40	49.67	60.07	22.58%
Hydrogen chloride	750	1.60	188.70	190.30	25.37%
Pollutant	AQAL (ng/m^3)	Background Conc.	PC – Abnormal Emissions	PEC – Abnormal Emissions	
		ng/m^3	ng/m^3	ng/m^3	% of AQAL
Mercury (1-hour)	600	32.00	126.14	158.14	26.36%
Nickel (1-hour)	700	3.00	334.26	337.26	48.18%
Copper (24-hour)	50	30.00	7.90	37.90	75.79%

As shown in Table 7, the PEC is not predicted to exceed the AQAL at the point of maximum impact for any pollutant during abnormal operations.

5.3 Predicted long term impacts

Table 8 presents the predicted impacts of plausible abnormal operations in the long-term at the point of maximum impact, and the PEC. This assessment assumes that the ERF operates with the proposed increase in throughput at the ELVs for 8,700 hours per year and at the plausible abnormal emission levels for 60 hours per year.

Table 8: Long Term PEC Resulting from Plausible Abnormal Emissions

Pollutant	AQAL ($\mu\text{g}/\text{m}^3$)	Background Conc.	PC – Abnormal Emissions ⁽¹⁾	PEC – Abnormal Emission	
		$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	% of AQAL
Nitrogen dioxide	40	20.30	0.84	21.14	52.84%
Pollutant	AQAL (ng/m^3)	Background Conc.	PC – Abnormal Emissions ⁽¹⁾	PEC – Abnormal Emission	
		ng/m^3	ng/m^3	ng/m^3	% of AQAL
Arsenic	6	0.95	0.20	1.15	19.12%
Cadmium	5,000	1.40	78.81	80.21	1.60%
Nickel	20	1.50	0.42	1.92	9.59%
Note: ⁽¹⁾ The ground level impact has been calculated by apportioning the maximum monitored emission concentration for each metal to the total group 3 metal Process Contribution.					

As shown, the PEC is not predicted to exceed the AQAL at the point of maximum impact for any pollutant during abnormal operations.

6 Summary

An assessment of the impact on air quality associated with abnormal operating conditions from the ERF has identified plausible abnormal emissions based on a review of monitoring data from operational facilities of a similar type in the UK. Notwithstanding the low frequency of occurrence of such abnormal operating conditions identified by the review, the potential impact on air quality has been assessed.

The predicted impact on air quality associated with the identified plausible abnormal emissions has been calculated by pro-rating the impact associated with normal operations associated with the increase in capacity by the ratio between the normal and plausible abnormal emission values. With regard to short-term impacts this is considered to be a highly conservative assessment as it assumes that the plausible abnormal emissions occur on both lines concurrently and they coincide with the worst-case meteorological conditions.

Even with these highly conservative factors, there are no predicted exceedences of any of the short term or long-term air quality limits associated with abnormal operation. The maximum predicted short term process contribution (as % of the applied AQAL) is less than 50%; and the maximum predicted long term process contribution (as % of the applied AQAL) is less than 3%. Abnormal emissions from the ERF with the proposed increase in throughput will not cause any exceedences of any AQAL. In addition, there will not be any exceedences of the TDI for dioxins.

It is concluded that during periods of abnormal operation as permissible under the IED (Article 46) is not predicted to give rise to an unacceptable impact on air quality or the environment.

Appendices

A Background Concentrations

Pollutant	Annual Mean Concentration	Units	Justification
Nitrogen dioxide	20.30	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration within 5 km of the Site (2023 Defra MAAQ dataset)
Sulphur dioxide	5.2	$\mu\text{g}/\text{m}^3$	
Hydrogen chloride	0.8	$\mu\text{g}/\text{m}^3$	Maximum monitored concentration across the UK 2011 to 2015
Arsenic	1.0	ng/m^3	Maximum monitored concentration from an urban industrial sites across the UK between 2020 and 2024 (except for Pontardawe Tawe Terrace as discussed in the Dispersion Modelling Assessment)
Cadmium	1.4	ng/m^3	
Copper	15.0	ng/m^3	
Nickel	1.5	ng/m^3	
Mercury	16.0	ng/m^3	Maximum from the latest year of national monitoring 2018.

D Noise Assessment



Post MCR Survey, Cardiff

Viridor Trident Park

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Basis of Report

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Appendices

Appendix A Glossary of Terminology

A.1 Glossary of Terminology

A.2 Acoustic Terminology

Appendix B Survey Photos

Appendix C Weather Data

Appendix D Statistical Analysis

Appendix E Octave Band Data



1.0 Introduction

Viridor has appointed SLR Consulting Ltd. (SLR) to undertake an investigation into the impact of increasing the Maximum Continuous Rating (MCR) of the ID fans at the Viridor Trident Park Site.

Increasing the MCR of the Site will mean that the ID Fans at the Site will be working harder with an increased air flow through the stack. This increase in air flow may result in the noise limit at the fan outlet exceeding the limit of 91.2dBA. .

To determine whether the MCR will have an impact on the nearest noise sensitive receptors, SLR has been instructed to complete a pre and a post increase MCR survey.

A pre MCR survey was undertaken on Monday 7th April 2025 and Tuesday 8th April 2025. The MCR has now been increased and SLR has been instructed to complete a post MCR survey.

This Report presents the results of both surveys and includes:

- A Site description.
- A description of the applicable guidance.
- A description of the Survey Locations.
- The results of the pre-MCR noise survey at the Site.
- The results of the post-MCR noise survey at the Site.
- Comparison between the pre and post MCR survey.

Whilst reasonable effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix A.



2.0 Site Description

2.1 Site

The subject Site is situated in an industrial area of Cardiff. The relative location of The Site in the context of the surrounding area can be seen in Figure 2-1 below.

Figure 2-1 Site Location



3.0 Guidance

Whilst this Report is not presenting a Noise Assessment, guidance relevant to the assessment of noise impact from a Facility of this nature is presented below.

A summary of the requirements outlined by the Welsh Government Noise and soundscape action plan, and the assessment methodology outlined in BS4142:2014+A1:2019 are provided.

3.1 Noise and Soundscape Action Plan 2018-2023

SLR has reviewed the Welsh Government Noise and soundscape action plan. The following relevant text has been identified at Section 8.2.3 onwards:

“The commonly used methodology for assessing the adverse impacts of industrial noise, BS 4142, was updated in 2014. This standard now requires a broader consideration of the adverse impacts of noise and the context within which emissions occur, in particular:

- the absolute level;*
- the character of the noise, in particular whether it is tonal or impulsive,*
- which can be as much a feature in any adverse impact as the level; and*
- the nature of the receptor, for example whether there are particular*
- vulnerabilities, and whether the exposure is time-limited.*

There are a number of ways that potential adverse noise impacts arising from industrial sites can be avoided or at least minimised to such an extent that they do not impact upon people or the natural environment. These include:

- locating new developments, whether noise-generating or noise-sensitive, to avoid noise issues arising in the first instance (in other words, through the planning system);*
- increasing the distance between the source and receptors;*
- preventing noise at source by good design and maintenance;*
- using barriers or enclosures to prevent noise travelling, including through the use of green infrastructure;*
- minimising or containing noise at source by observing good working and management practices; and*
- avoiding noisy operations at certain times, such as at night.”*

In accordance with the Welsh Government Noise and soundscape action plan a BS4142:2014+A1:2019 assessment is required when determining a planning application for a Site of this nature. As stated above, this Report does not present a BS4142 assessment, but the standard is included for information.

3.2 British Standard 4142:2014+A1:2019

British Standard 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* is intended to be used to assess the potential adverse impact of sound, of an industrial and/or commercial nature, at nearby noise-sensitive receptor locations within the context of the existing sound environment.



Where the specific sound contains tonality, impulsivity and/or other sound characteristics, penalties should be applied depending on the perceptibility. For tonality, a correction of either 0, 2, 4 or 6dB should be added and for impulsivity, a correction of either 0, 3, 6 or 9dB should be added. If the sound contains specific sound features which are neither tonal nor impulsive, a penalty of 3dB should be added.

In addition, if the sound contains identifiable operational and non-operational periods, that are readily distinguishable against the existing sound environment, a further penalty of 3dB may be applied.

The assessment of impact contained in BS4142:2014+A1:2019 is undertaken by comparing the sound rating level, i.e. the specific sound level of the source plus any penalties, to the measured representative background sound level immediately outside the noise-sensitive receptor location. Consideration is then given to the context of the existing sound environment at the noise-sensitive receptor location to assess the potential impact.

Once an initial estimate of the impact is determined, by subtracting the measured background sound level from the rating sound level, BS4142:2014+A1:2019 states that the following should be considered:

- typically, the greater the difference, the greater the magnitude of the impact;
- a difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- a difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. It is an indication that the specific sound source has a low impact, depending on the context.

BS4142:2014+A1:2019 notes that:

“Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.”

BS4142:2014+A1:2019 outlines guidance for the consideration of the context of the potential impact including consideration of the existing residual sound levels, location and/or absolute sound levels.

To account for the acoustic character of proposed sound sources, BS4142:2014+A1:2019 provides the following with respect to the application of penalties to account for *“the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention”*.

- **Tonality** – “For sound ranging from not tonal to predominantly tonal the Joint Nordic Method gives a correction of between 0dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible and 6dB where it is highly perceptible;
- **Impulsivity** – A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible;
- **Intermittency** – When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to



the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied; and

- **Other Sound Characteristics** – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied.”

Finally, BS4142:2014+A1:2019 outlines guidance for the consideration of the context of the potential impact, including consideration of the existing residual sound levels, location and/or absolute sound levels.



4.0 Receptor and Survey Locations

4.1 Receptor Locations

The nearest NSRs, as detailed in the 'Viridor Trident Park - Environmental Statement - 402/0036/00306B – Jan 2010', are described below.

- NSR1 – to the north of the site, residential properties off Lewis Road.
- NSR2 – to the north of the site offices off Vanguard Way.
- NSR3 – to the Southwest of the site, residential properties in the Water Quarter.
- NSR4 – to the Southwest of the site, residential properties at Adventurers Quay.

4.2 Survey Locations for both the Pre and Post MCR Surveys

Sound levels were measured at the following locations:

Unattended:

- L1 – Site Location – to the east of the Site, just outside of the Fans.

Attended:

- L2 – to the north of the Site, representative of the residential properties off Lewis Road.
- L3 – to the north of the Site, representative of the offices off Vanguard Way.
- L4 – to the Southwest of the Site, representative of residential properties in the Water Quarter.
- L5 – to the Southwest of the site, representative of residential properties at Adventurers Quay.

Photographs of each survey position during the post MCR survey can be seen in Appendix B. Photographs of each survey position during the pre-MCR survey can be seen in Appendix B of the Pre-MCR Survey report.

The survey locations and the nearest NSR locations are shown in Figure 4-1. GPS coordinates of the monitoring positions for latitude and longitude are given in Table 4-1.



Figure 4-1: Monitoring Locations

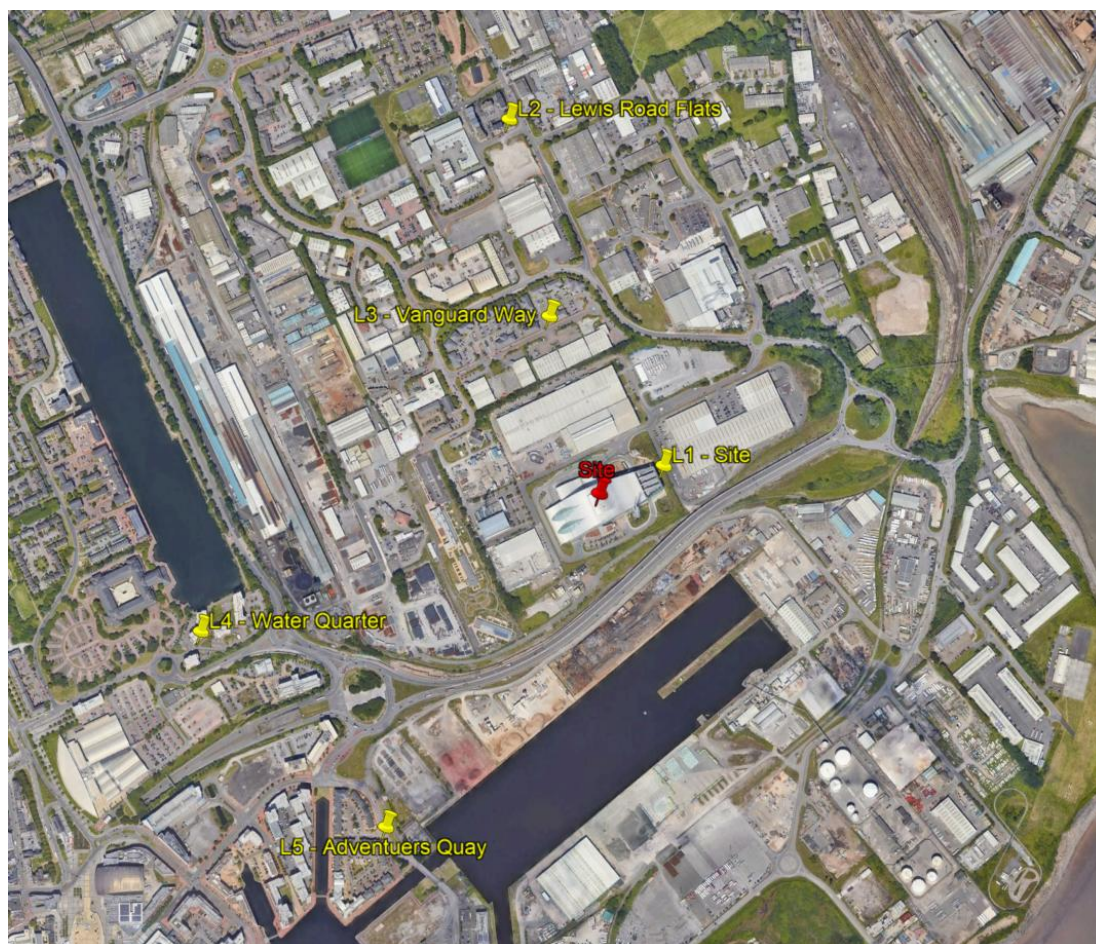


Table 4-1: GPS coordinates for monitoring positions

Monitoring Position	Description	GPS coordinates (latitude, longitude)
L1	Site	51.471907°, -3.148869°
L2	Lewis Road Flats	51.477031°, -3.153805°
L3	Vanguard Way	51.473705°, -3.152389°
L4	Water Quarter	51.468922°, -3.160420°
L5	Adventurers Quay	51.466585°, -3.155078°

At the survey locations for both surveys, the microphone was placed at approximately 1.5m above the local ground level in free-field conditions, i.e. at least 3.5m from the nearest vertical, reflecting surface. The following noise level indices were recorded:

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period.
- L_{A90} : The A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe background noise.
- L_{A10} : The A-weighted noise level exceeded for 10% of the measurement period. This parameter is often used to describe road traffic noise.
- L_{AFmax} : The maximum A-weighted noise level during the measurement period.



5.0 Summary of Pre-MCR Survey

The pre MCR survey was undertaken to determine the pre MCR noise levels in the vicinity of the ID fans and the pre MCR noise levels at the nearest Noise Sensitive Receptors (NSRs) to the Site, a noise survey was undertaken between Monday 7th April 2025 and Tuesday 8th April 2025.

This section presents a summary of the noise levels measured.

5.1 Site Sound Levels

From a review of the On-Site data at Location 1, the following pre MCR sound levels presented in Table 5-1 may be considered representative.

Table 5-1: L1 Site – Pre MCR Ambient, dB

Measurement Details			Ambient Sound Level $L_{Aeq,T}$	
Date Range	Period	Time HH:MM	Range	Average
Mon 07/04/2025 - Tue 08/04/2025	Day	07:00 - 23:00	60 - 68	65
	Night	23:00 - 07:00	57 - 66	62

5.2 Off-Site Measured Sound Levels

The following pre MCR sound levels presented in Table 5-2 to Table 5-5 may be considered representative.

Table 5-2: L2 Lewis Road Flats – Pre MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Mon 07/04/2025	Day	15:15 – 16:15	47 - 71	59	44 - 52	49
Mon 07/04/2025	Night	23:15 – 12:45	44 - 53	48	43 - 48	45

Table 5-3: L3 Vanguard Way – Pre MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Mon 07/04/2025	Day	16:30 – 17:30	47 - 83	66	46 - 58	49
Tues 08/04/2025	Night	00:00 – 00:30	45 - 51	47	44 - 46	45



Table 5-4: L4 Water Quarter – Pre MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Tues 08/04/2025	Day	13:15 – 14:15	56 - 67	62	55 - 63	57
Tues 08/04/2025	Night	00:45 – 01:15	49 - 59	52	47 - 50	48

Table 5-5: L5 Adventurers Quay Pre MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Tues 08/04/2025	Day	11:30 – 12:30	57 - 73	67	51 - 61	54
Tues 08/04/2025	Night	01:30 – 02:00	48 - 68	55	46 - 49	47



6.0 Post MCR Sound Survey

6.1 Survey Date

To determine the post MCR noise levels in the vicinity of the ID fans and the the nearest Noise Sensitive Receptors (NSRs) to the Site, a noise survey was undertaken between Thursday 9th October 2025 and Friday 10th October 2025.

6.2 Equipment

The noise survey equipment used during the survey is detailed in Table 6-1. All measurement instrumentation was calibrated before and after the measurements. No significant drift was observed. The calibration chain is traceable via the United Kingdom Accreditation Service to National Standards held at the National Physical Laboratory.

Table 6-1: Survey Equipment

Location	Unique Identifier	Type	Description	Serial Number
Attended Measurements C14	C14-CAL	CR:515	Sound Calibrator	99960
	C14-SLM	CR:171B	Sound Level Meter	G400059
	C14-MIC	MK:224	½" Condenser Microphone	216587D
	C14-PRE	MV:200F	Microphone Pre-Amplifier	12872F
Unattended Measurements C11	C11-CAL	CR:515	Sound Calibrator	94806
	C11-SLM	CR:171B	Sound Level Meter	G302667
	C11-MIC	MK:224	½" Condenser Microphone	217661A
	C11-PRE	MV:200F	Microphone Pre-Amplifier	11288F
	C11-OUT	MK172	Outdoor Kit	o957

6.3 Soundscape

The soundscape at the monitoring locations during both daytime and night-time during the post MCR noise survey is detailed in Table 6-2.

Table 6-2: Soundscape

Location	Period	Description
1 - Site	Day	- ID Fans - Distant Road traffic
2- Lewis Road Flats	Daytime	- Site is not audible at this location. - Construction noise from the Morgan Sindal Site is the dominant noise source: including impacts, squeaks, excavator, roller compactor. - Road Traffic: - Lewis Road: Approx. 1 vehicle/20 seconds. - Forgeside Close: Occasional cars.



Location	Period	Description
		- Distant road traffic audible when other noise subsides.
	Night-time	- Site is not audible at this location. - Road Traffic: • Lewis Road: Occasional cars. • Distant road traffic audible. - Extract fans from nearby buildings - Distant Dog Barking
3 – Vanguard Way	Daytime	- Site is not audible - Road Traffic: • Vanguard Way: Cars/vans/lorries (approximately once every minute). • Distant: Consistent. - Mechanical Sounds • Nearby Offices: Fans and air conditioning units audible. • Opposite Warehouse: Distant fan noise heard (source uncertain). • Site: Distant fan noise heard (source uncertain).
	Night-time	- Site fans potentially heard (source uncertain). - Road Traffic: • Occasional loud vehicles • Distant: Consistent. - Mechanical Sounds • Opposite Warehouse: Distant fan noise heard (source uncertain). • Site: Distant fan noise heard (source uncertain). - Construction Sounds • Impact Sounds • Squealing
4 – Water Quarter	Daytime	- Site is not audible. - Road Traffic: • Distant: Consistent • Galleon Way: Occasional Cars - Mechanical Sounds • Opposite Warehouse: Fans and Exhausts - Construction: Piling to the South, Diggers and Cranes to the West
	Night-time	- Site is not audible - Road Traffic: • Distant: Consistent



Location	Period	Description
		- Mechanical Sounds Warehouse: Fans and Exhausts
5- Adventurers Quay	Daytime	- Site is not audible. - Road Traffic: - Distant: Consistent - Tyneside Road: Cars/vans/lorries (approximately once every 10 seconds+) - Construction: Consistent low rumble, generators.
	Night-time	- Site is not audible. - Road Traffic: - Distant: Consistent - Tyneside Road: Cars/vans/lorries (infrequent) - Construction: Consistent low rumble, generators.

6.4 Weather Conditions

During the survey period between Thursday 9th October and Friday 10th October 2025 the weather conditions included temperature highs around 13-15°C and lows around 9-12°C. Winds were mostly light and below 5 m/s with shifting directions.

A summary of the weather conditions for the duration of the noise survey during daytime and night-time periods can be seen in Appendix C.

6.5 Site Sound Levels

From a review of the On-Site data at Location 1, the following post MCR sound levels presented in Table 6-3 may be considered representative.

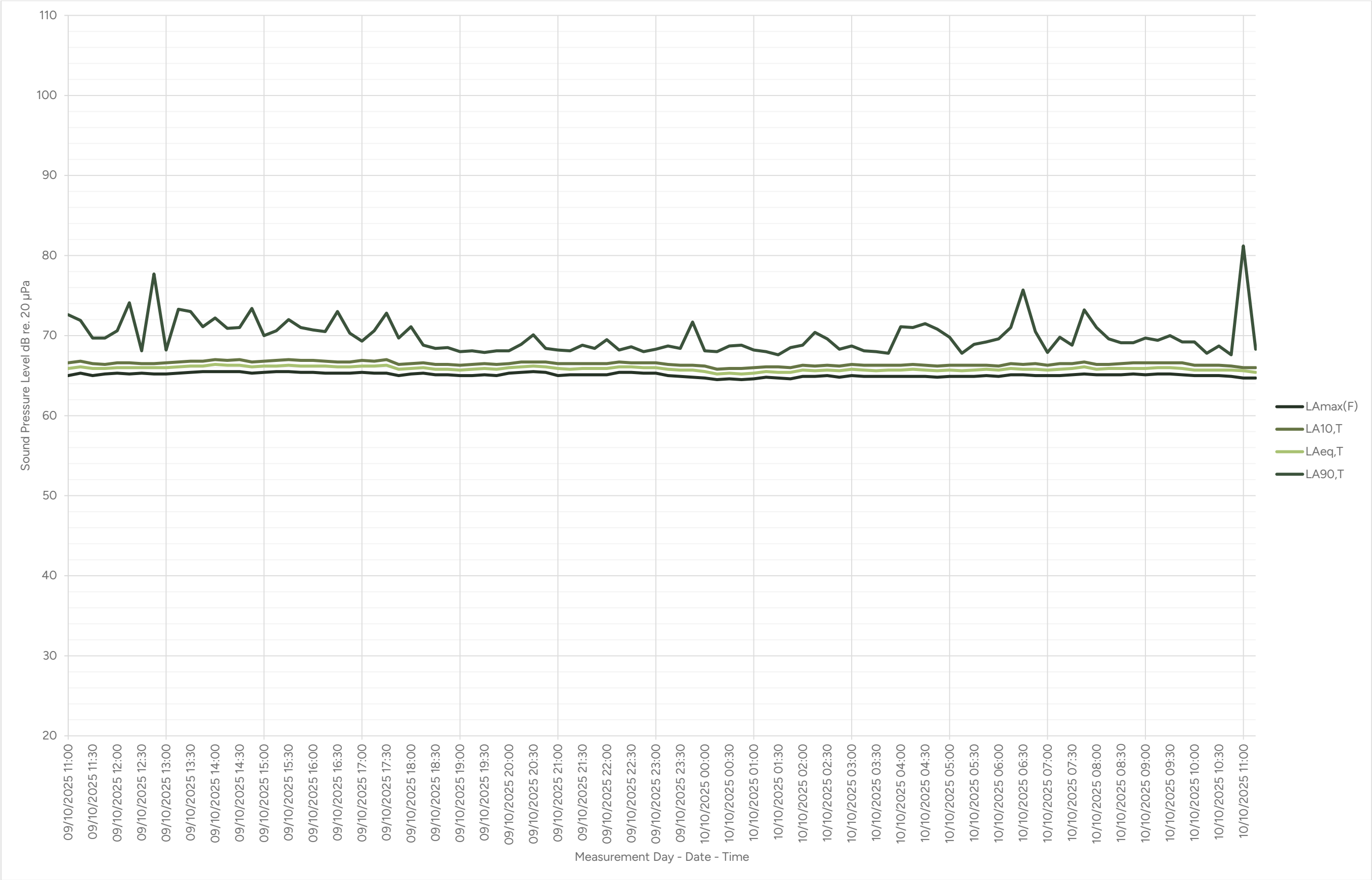
Table 6-3: L1 Site – Post MCR Ambient, dB

Measurement Details			Ambient Sound Level $L_{Aeq,T}$	
Date Range	Period	Time HH:MM	Range	Average
Thurs 09/10/2025 - Fri 10/10/2025	Day	07:00 - 23:00	65 - 66	66
	Night	23:00 - 07:00	65 - 66	66

A graph of the measured data at Location 1 can be seen in Figure 4-2.



Figure 6-1: Location 1 - Site



Graphs of the off-site daytime and night-time sound levels at all locations can be seen in Appendix D. The following post MCR sound levels presented in Table 6-4 to Table 6-7 may be considered representative.

Table 6-4: L2 Lewis Road Flats – Post MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Thurs 09/10/2025	Day	15:15 – 16:15	50 - 71	65	46 - 67	52
Mon 07/04/2025	Night	23:15 – 12:45	32 - 49	41	31 - 36	32

Table 6-5: L3 Vanguard Way – Post MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Thurs 09/10/2025	Day	16:30 – 17:30	47 - 67	60	44 - 55	47
Fri 10/10/2025	Night	00:00 – 00:30	38 - 54	43	38 - 42	39

Table 6-6: L4 Water Quarter – Post MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Thurs 09/10/2025	Day	13:15 – 14:15	55 - 71	61	52 - 65	56
Fri 10/10/2025	Night	00:48 – 01:18	46 - 52	48	45 - 47	46

Table 6-7: L5 Adventurers Quay Post MCR Ambient and Background Sound Levels, dB

Measurement Details			Ambient sound level $L_{Aeq,T}$		Background sound level $L_{A90,T}$	
Date Range	Period	Time HH:MM	Range	Average	Range	Median
Thurs 09/10/2025	Day	11:30 – 12:30	51 - 76	67	47 - 58	49
Fri 10/10/2025	Night	01:33 – 02:03	46 - 65	53	45 - 48	46



7.0 Survey Comparison

7.1 Survey Results Comparison

The following Tables presents a comparison between the pre ad post MCR surveys.

Table 7-1: Site Comparison, dB

Measurement Period	Typical Ambient Sound Level, $L_{Aeq,T}$		
Period	Pre MCR Average	Post MCR Average	Difference
Day Time	65	66	+1
Night-Time	62	66	+4

Table 7-2: L2 Lewis Road Flats – Comparison, dB

Measurement Period	Ambient sound level $L_{Aeq,T}$		
	Pre MCR Average	Post MCR Average	Difference
Day Time	59	65	+6
Night-Time	48	41	-7

Table 7-3: L3 Vanguard Way Flats – Comparison, dB

Measurement Period	Ambient sound level $L_{Aeq,T}$		
	Pre MCR Average	Post MCR Average	Difference
Day Time	66	60	-6
Night-Time	47	43	-4

Table 7-4: L4 Water Quarter Flats – Comparison, dB

Measurement Period	Ambient sound level $L_{Aeq,T}$		
	Pre MCR Average	Post MCR Average	Difference
Day Time	62	61	-1
Night-Time	52	48	-4

Table 7-5: L5 Adventurers Quay Flats – Comparison, dB

Measurement Period	Ambient sound level $L_{Aeq,T}$		
	Pre MCR Average	Post MCR Average	Difference
Day Time	67	67	0
Night-Time	55	53	-2

7.2 Discussion

As demonstrated in Table 7-1, with the increase of the Maximum Continuous Rating (MCR), on-site noise levels from the ID Fans have increased by 1dB during the daytime and 5 dB during the night-time.

Table 7-2 to Table 7-5 demonstrate that, following the increase of the Maximum Continuous Rating (MCR), noise levels at the majority of receptors remained equal to or below the pre-



increase measurements. With the exception of Lewis Road, where an increase in noise levels was measured.

However, as the ID fans are not audible at any of the noise-sensitive receptors, the change in noise levels is likely attributable to other external factors. It is therefore concluded that the MCR increase has had a negligible effect on the nearest noise-sensitive receptors.



8.0 Conclusion

Viridor appointed SLR Consulting Ltd. (SLR) to investigate the acoustic impact of increasing the Maximum Continuous Rating (MCR) of the ID fans at the Trident Park Site. This investigation involved two noise surveys: a pre-MCR increase survey (7th and 8th April 2025) and a post-MCR increase survey (9th and 10th October 2025).

The post-MCR survey confirmed that the increase in the Maximum Continuous Rating resulted in an increase in on-site ID Fan operational noise levels (1 dB(A) during the daytime and 5 dB(A) during the night-time).

However, the survey comparison demonstrates that the ambient and the background noise levels at the majority of noise-sensitive receptors remained equal to or below the pre-increase measurements with the exception of Lewis Road.

Notably, the ID fans are not audible at any of the noise-sensitive receptor locations. As such, the measured change in ambient noise, including the increase at Lewis Road, is likely attributable to other external factors and unrelated to the site's MCR increase.

It is therefore concluded that the MCR increase has had a negligible impact on the nearest noise-sensitive receptors.



9.0 Closure

The assessment has required a suitable level of technical ability and has been undertaken by a Suitably Qualified Person (SQP). An individual with all the following credentials has been considered a SQP for this assessment:

- Has a minimum of three years' verifiable experience (within the last five years) of providing noise impact assessments in planning. Such experience has clearly demonstrated a practical understanding of factors affecting acoustics in relation to the proposed development use and in the built environment in general, including acting in an advisory capacity to provide recommendations and design advice in planning, and;
- Holds a recognised acoustic qualification and membership of an appropriate professional body. The primary professional body for acoustics in the UK is the Institute of Acoustics.

This assessment has been led and managed by a SQP as defined above.

Where some elements of the assessment (e.g. measurements) have been carried out by an acoustician who does not meet the requirements above, this has been undertaken with the direct guidance and supervision of a SQP who has reviewed, agreed and overseen the measurement methodology and any results obtained.

The SQP confirms that the relevant measurements and calculations:

- Represent good industry practice in accordance with available guidance.
- Are appropriate given the development being assessed and scope of works proposed.
- Avoid invalid, biased and exaggerated claims.

The checker and author of this document confirm that they both comply with the definition of a SQP defined in this Section.

Regards,

SLR Consulting Limited



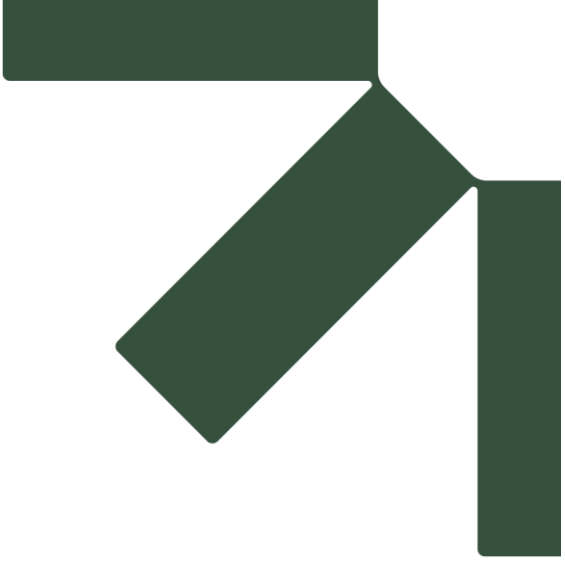
Claire Bye, BSc. (Hons) AMIOA
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Appendix A Glossary of Terminology

A.1 Glossary of Terminology

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A-1: Sound Levels Commonly Found in the Environment

Sound Level	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside factory
100 to 110 dB(A)	Burglar alarm at 1m away
110 to 130 dB(A)	Jet aircraft on take off
140 dB(A)	Threshold of Pain

A.2 Acoustic Terminology

dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (of 20 μ Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq, T}$	$L_{Aeq, T}$ is defined as the notional steady sound level which, over a stated period T, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
$L_{A10, T}$ & L_{A90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
$L_{Amax(F)}$	$L_{Amax(F)}$ is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.





Appendix B Survey Photos

Location 1 - Site



Location 2 – Lewis Road Flats

Daytime



Location 2 – Lewis Road Flats

Night-time



Location 3 – Vanguard Way

Daytime



Location 3 – Vanguard Way

Night-time



Location 4 – Water Quarter

Daytime



Location 4 – Water Quarter

Night-time



Location 5 – Adventurers Quay

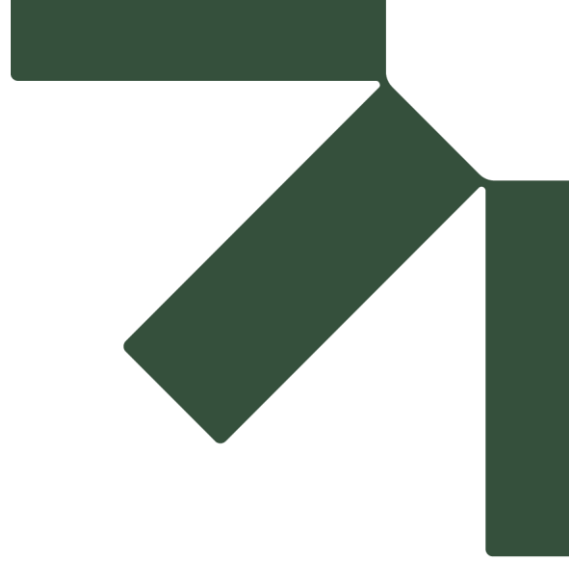
Daytime



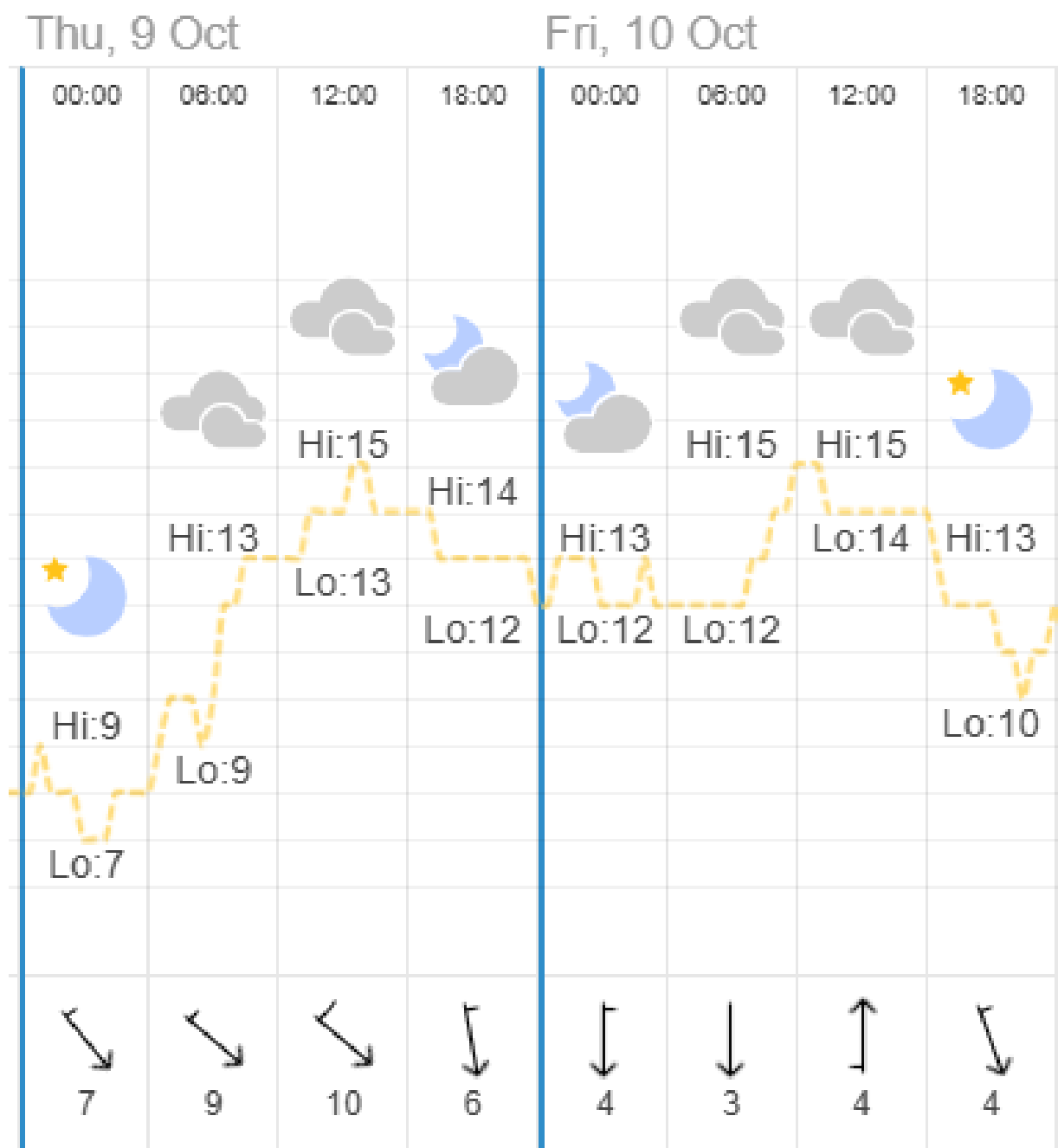
Location 5 – Adventurers Quay

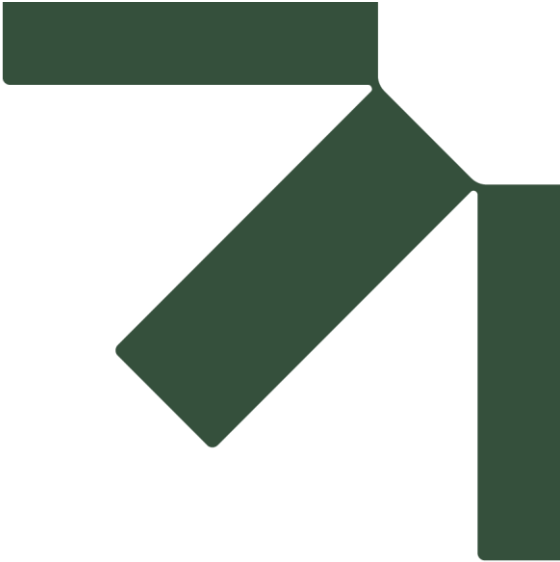
Night-time





Appendix C Weather Data

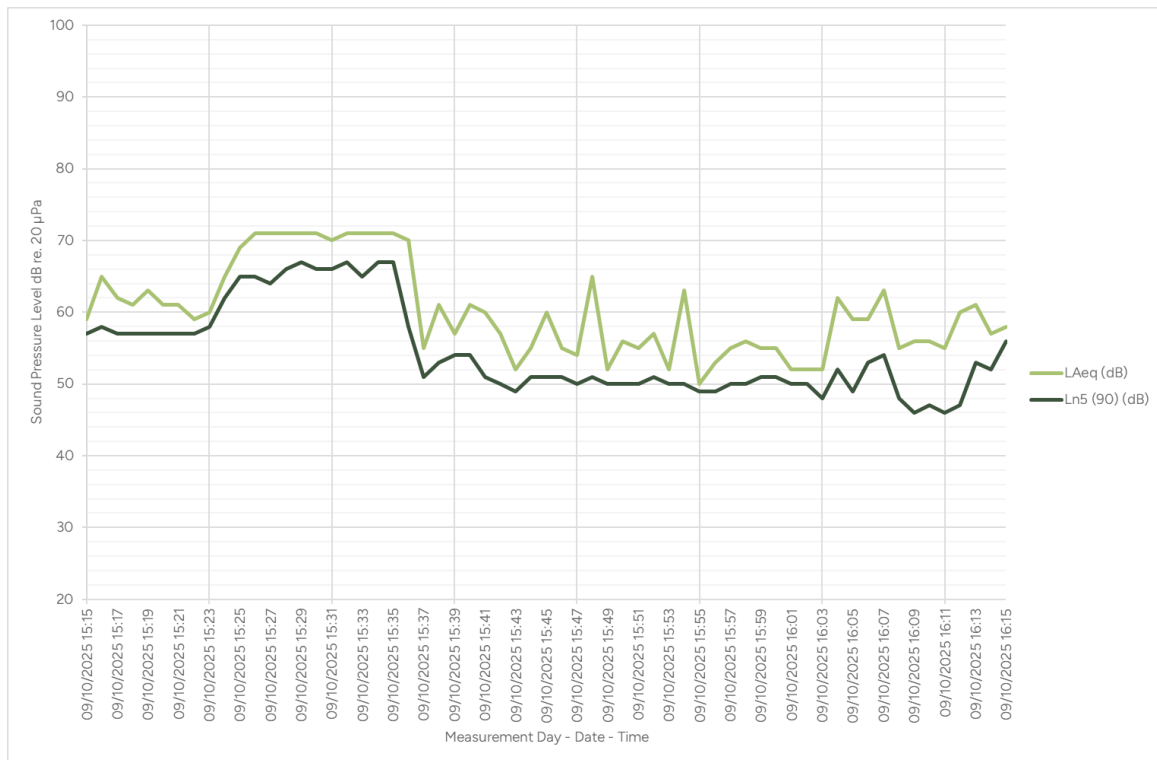




Appendix D Statistical Analysis

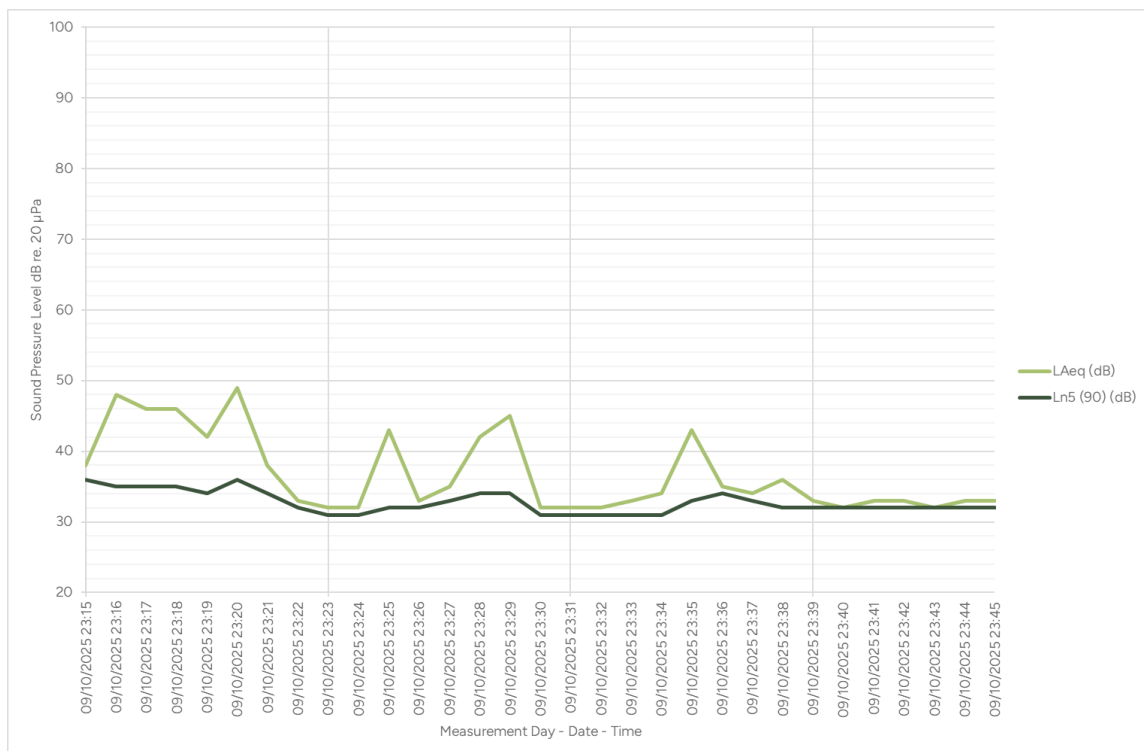
Location 2 – Lewis Road Flats

Daytime



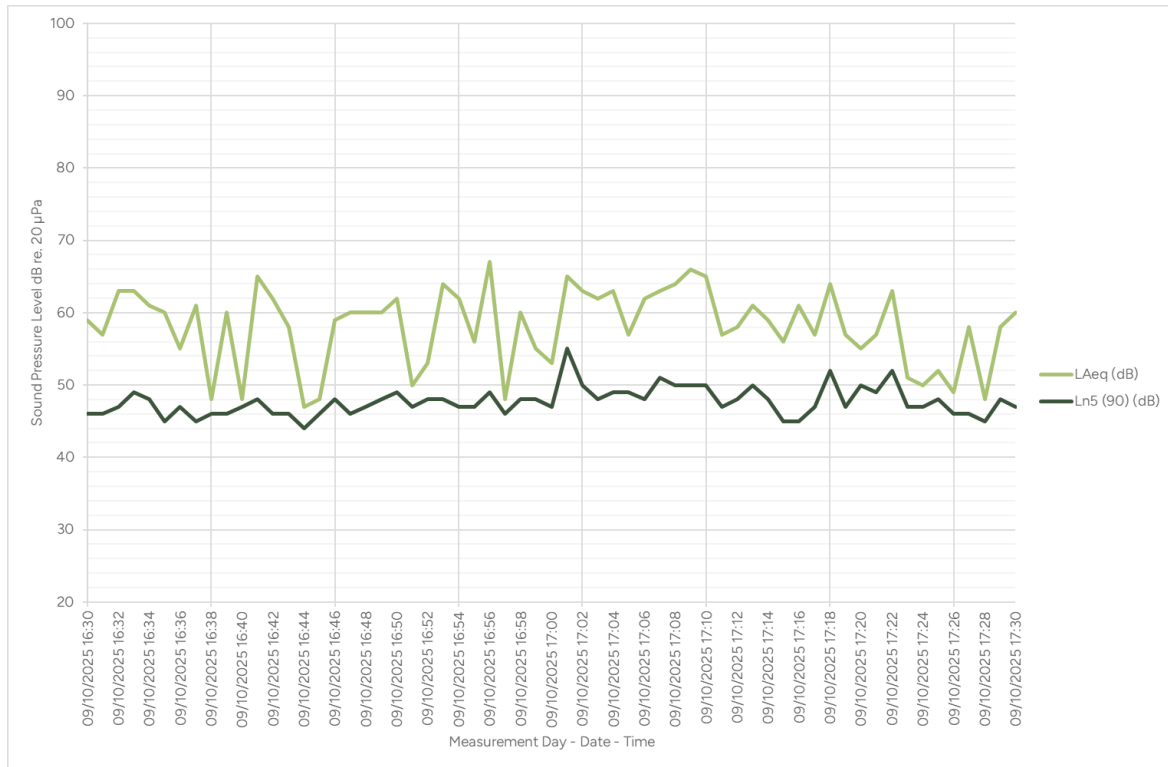
Location 2 – Lewis Road Flats

Night-time



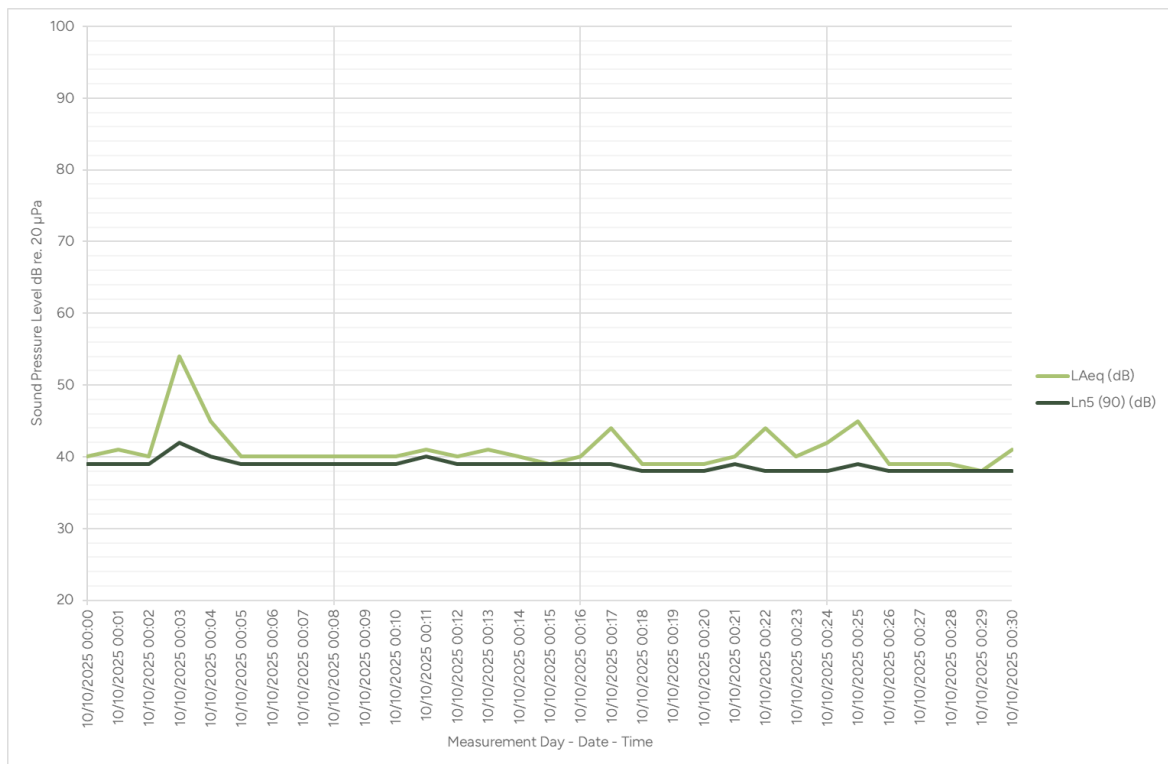
Location 3 – Vanguard Way

Daytime



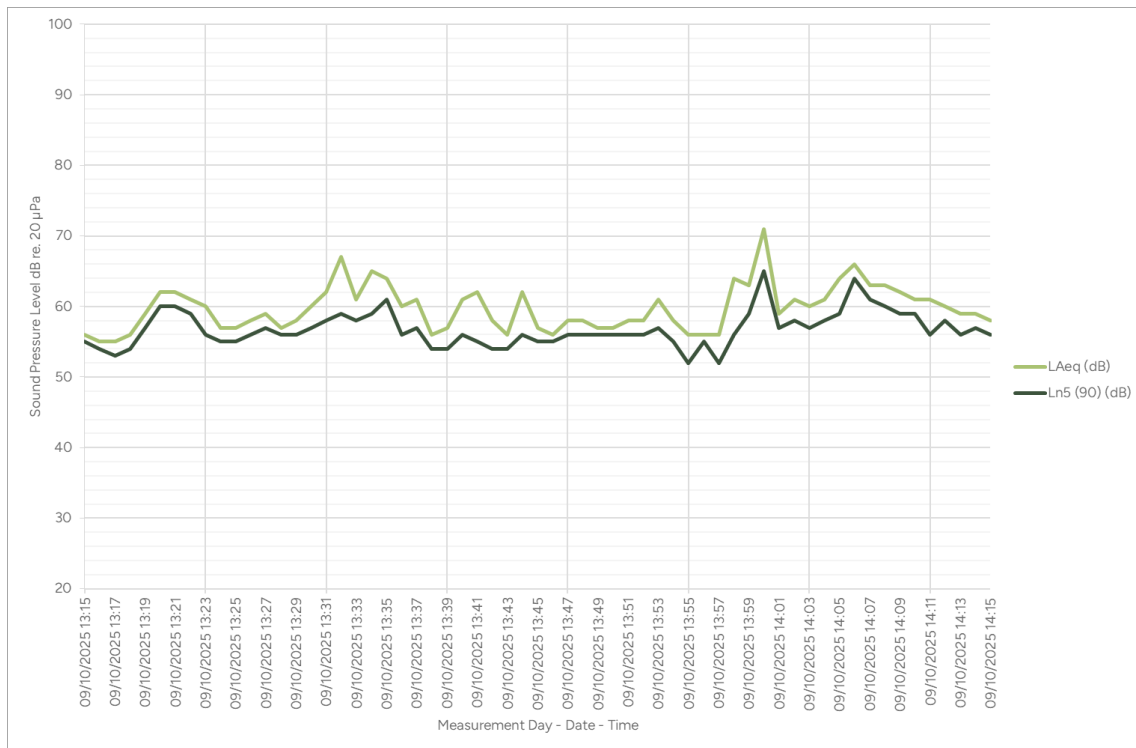
Location 3 – Vanguard Way

Night-time



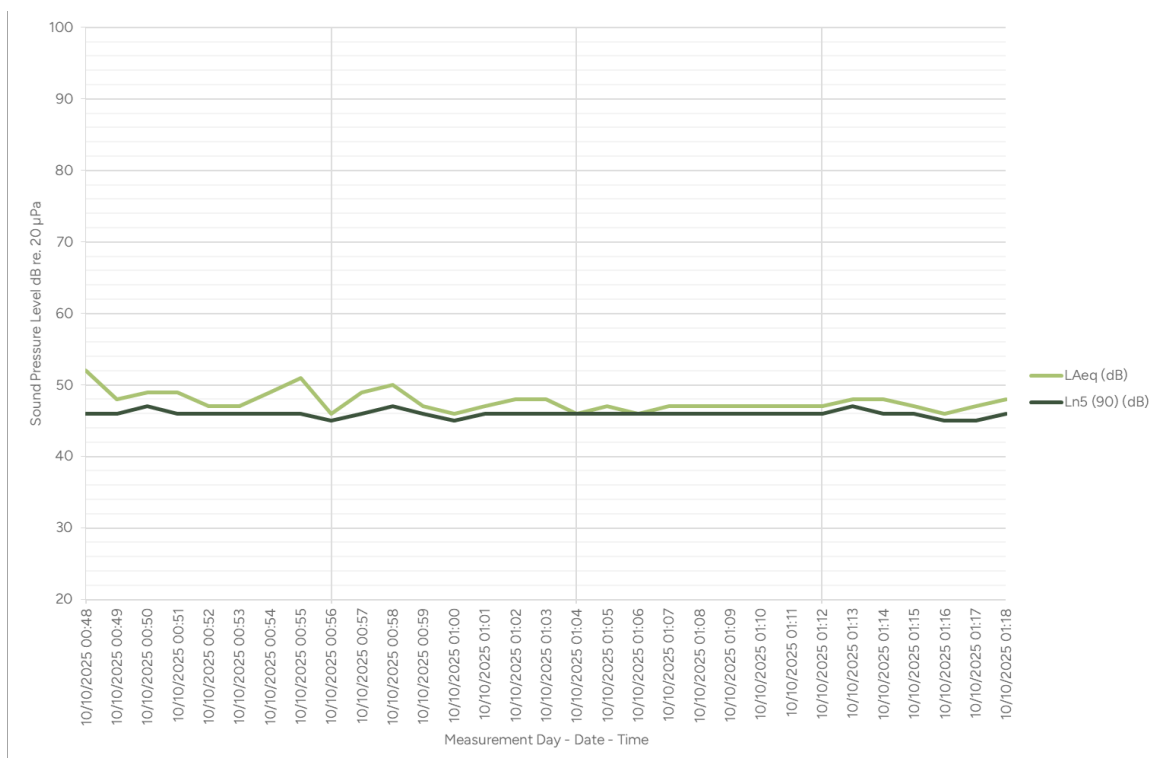
Location 4 – Water Quarter

Daytime



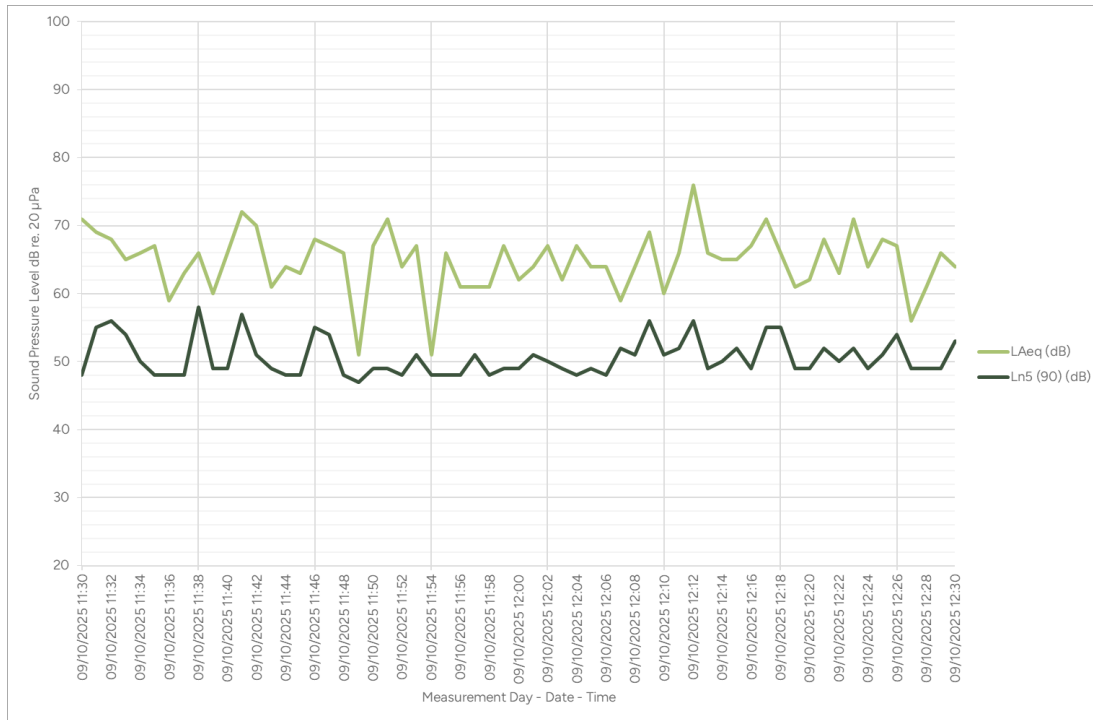
Location 4 – Water Quarter

Night-time



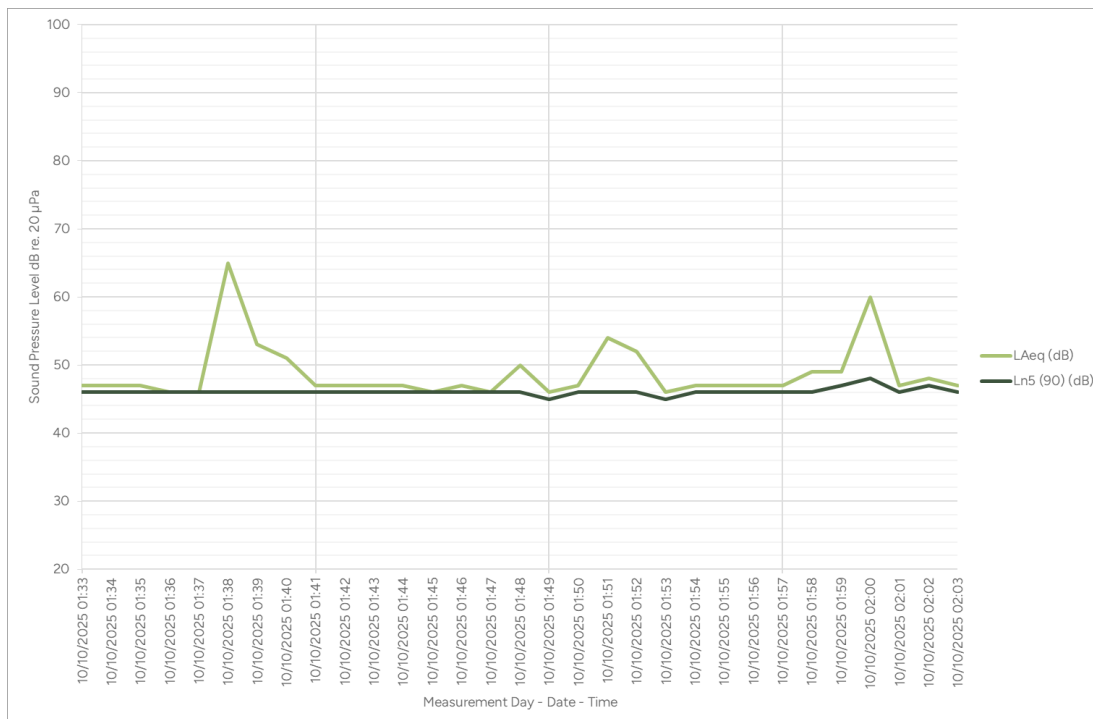
Location 5 – Adventurers Quay

Daytime



Location 5 – Adventurers Quay

Night-time





Appendix E Octave Band Data

Unattended Site Location

Date & Time	Frequency (Hz), dB									
	31.5	63.0	125.0	250.0	500.0	1k	2k	4k	8k	16k
09/10/2025 11:00	82.6	73.6	69.3	66.3	65.4	60.8	54.4	48.3	42.9	39.6
09/10/2025 11:15	82.8	73.7	69.5	66.3	65.8	61.0	54.8	48.4	40.1	39.1
09/10/2025 11:30	82.4	73.5	69.3	65.9	65.8	60.8	54.1	47.5	38.9	38.9
09/10/2025 11:45	82.7	73.7	69.6	65.9	65.9	60.8	54.2	47.6	38.8	38.8
09/10/2025 12:00	82.7	73.9	69.5	65.9	66.0	60.9	54.3	47.6	38.6	38.7
09/10/2025 12:15	82.7	73.7	69.5	65.9	66.1	60.9	54.4	47.7	39.2	38.5
09/10/2025 12:30	82.6	73.7	69.3	65.9	66.2	60.8	53.8	47.3	38.6	38.6
09/10/2025 12:45	82.7	73.9	69.6	65.9	66.2	60.8	53.9	47.1	38.4	38.5
09/10/2025 13:00	82.9	73.9	69.6	65.9	66.1	60.9	54.0	47.3	38.6	38.6
09/10/2025 13:15	82.8	73.7	69.6	66.0	66.2	60.9	54.1	47.3	38.6	38.5
09/10/2025 13:30	82.8	73.9	69.7	66.0	66.2	61.2	54.7	48.3	39.0	38.5
09/10/2025 13:45	82.8	73.9	69.7	66.0	66.2	61.3	54.6	47.8	38.8	38.7
09/10/2025 14:00	82.7	73.9	69.6	66.0	66.3	61.5	55.1	48.0	38.8	38.6
09/10/2025 14:15	82.8	73.9	69.7	66.0	66.3	61.5	54.8	47.9	38.9	38.6
09/10/2025 14:30	82.7	73.9	69.5	65.9	66.3	61.5	54.8	47.9	38.8	38.5
09/10/2025 14:45	82.8	73.9	69.8	65.9	66.1	61.1	54.5	47.7	38.7	38.5
09/10/2025 15:00	82.9	73.8	69.7	66.0	66.0	61.2	54.7	48.2	39.1	38.7
09/10/2025 15:15	82.8	73.9	69.7	66.0	66.2	61.3	54.8	48.5	39.3	38.8
09/10/2025 15:30	82.8	73.9	69.7	66.0	66.3	61.4	55.0	48.2	39.0	38.7
09/10/2025 15:45	82.8	73.7	69.6	66.0	66.2	61.3	54.7	47.8	38.9	38.6
09/10/2025 16:00	82.8	73.6	69.6	66.0	66.3	61.3	54.6	48.1	38.8	38.6
09/10/2025 16:15	82.7	73.6	69.4	65.8	66.2	61.2	54.6	47.7	38.7	38.5
09/10/2025 16:30	82.4	73.1	69.0	65.7	66.2	61.1	54.4	47.6	39.4	38.9
09/10/2025 16:45	82.5	73.0	69.0	66.0	66.2	60.9	54.2	47.4	39.4	39.2



Date & Time	Frequency (Hz), dB									
	31.5	63.0	125.0	250.0	500.0	1k	2k	4k	8k	16k
09/10/2025 17:00	82.4	73.2	69.1	65.8	66.3	61.3	54.6	47.7	39.2	38.7
09/10/2025 17:15	82.4	73.2	69.1	66.1	66.1	61.0	54.7	47.7	39.6	39.3
09/10/2025 17:30	82.5	73.2	69.2	66.3	66.1	61.2	54.9	47.8	39.4	39.2
09/10/2025 17:45	82.4	73.3	69.1	66.3	65.9	60.2	53.5	46.9	38.5	38.5
09/10/2025 18:00	82.7	73.5	69.4	66.8	66.0	60.2	53.4	46.9	38.8	38.7
09/10/2025 18:15	82.6	73.4	69.3	66.6	66.0	60.5	53.8	47.2	39.0	38.8
09/10/2025 18:30	82.3	73.2	69.0	66.1	65.9	60.5	53.7	47.1	38.8	38.9
09/10/2025 18:45	82.4	73.4	69.1	66.6	65.9	60.2	53.7	47.1	38.9	38.8
09/10/2025 19:00	82.4	73.4	69.1	66.3	65.8	60.2	53.5	47.0	38.8	38.9
09/10/2025 19:15	82.5	73.3	69.3	66.5	65.8	60.2	53.5	47.1	38.8	38.9
09/10/2025 19:30	82.6	73.4	69.4	66.6	66.0	60.2	53.5	47.1	38.9	38.8
09/10/2025 19:45	82.6	73.4	69.3	66.8	65.9	59.8	53.2	46.9	38.7	38.7
09/10/2025 20:00	82.7	73.6	69.5	66.8	66.0	60.3	53.5	47.1	39.2	39.0
09/10/2025 20:15	82.8	73.8	69.6	66.8	66.1	60.5	53.6	47.4	39.6	39.1
09/10/2025 20:30	82.8	73.9	69.7	66.8	66.1	60.7	53.8	47.6	39.8	39.1
09/10/2025 20:45	82.7	73.8	69.5	66.7	66.1	60.6	53.7	47.6	39.8	39.1
09/10/2025 21:00	82.8	73.6	69.5	66.7	65.9	60.2	53.5	47.2	39.4	39.2
09/10/2025 21:15	82.6	73.5	69.5	66.8	65.8	60.1	53.5	47.3	39.2	39.3
09/10/2025 21:30	82.7	73.7	69.6	66.9	65.8	60.0	53.3	47.1	39.4	39.1
09/10/2025 21:45	82.7	73.8	69.6	67.0	65.8	59.8	53.2	47.2	39.2	39.0
09/10/2025 22:00	82.6	73.8	69.6	67.1	65.8	59.9	53.2	47.3	39.2	38.8
09/10/2025 22:15	83.1	73.9	69.8	66.9	66.0	60.4	53.6	47.5	39.8	39.2
09/10/2025 22:30	83.0	73.9	69.8	67.0	66.0	60.2	53.5	47.4	39.7	39.2
09/10/2025 22:45	82.9	73.9	69.6	66.8	66.0	60.3	53.4	47.3	39.6	39.1
09/10/2025 23:00	82.8	73.9	69.6	67.0	66.0	60.2	53.4	47.3	39.4	39.1



Date & Time	Frequency (Hz), dB									
	31.5	63.0	125.0	250.0	500.0	1k	2k	4k	8k	16k
09/10/2025 23:15	82.8	73.8	69.5	66.9	65.8	59.8	53.1	47.0	39.2	38.9
09/10/2025 23:30	82.6	73.7	69.5	66.8	65.8	59.6	53.0	46.9	38.8	38.6
09/10/2025 23:45	82.8	73.7	69.4	66.8	65.7	59.7	53.1	46.9	38.8	38.7
10/10/2025 00:00	82.5	73.7	69.4	66.7	65.5	59.5	52.9	47.0	38.9	38.6
10/10/2025 00:15	82.3	73.6	69.2	66.1	65.3	59.3	52.7	46.5	38.5	38.4
10/10/2025 00:30	82.4	73.8	69.3	66.4	65.2	59.5	52.9	46.8	38.7	38.4
10/10/2025 00:45	82.4	73.7	69.2	66.3	65.2	59.4	52.8	46.8	38.7	38.3
10/10/2025 01:00	82.5	73.7	69.2	66.4	65.4	59.4	52.8	46.9	38.7	38.5
10/10/2025 01:15	82.5	73.7	69.3	66.3	65.6	59.9	53.1	47.0	38.9	38.6
10/10/2025 01:30	82.5	73.8	69.3	66.4	65.4	59.7	53.0	47.2	38.8	38.6
10/10/2025 01:45	82.4	73.7	69.2	66.0	65.6	59.6	52.8	46.8	38.8	38.4
10/10/2025 02:00	82.5	73.7	69.4	66.4	65.6	60.0	53.3	47.2	44.0	38.7
10/10/2025 02:15	82.5	73.5	69.4	66.6	65.5	59.8	53.2	47.4	41.6	38.9
10/10/2025 02:30	82.7	73.6	69.5	66.8	65.6	59.7	53.1	47.4	41.8	39.0
10/10/2025 02:45	82.5	73.4	69.4	66.2	65.7	59.9	53.2	47.3	44.0	38.9
10/10/2025 03:00	82.5	73.4	69.4	66.1	66.1	60.2	53.5	47.4	40.4	38.9
10/10/2025 03:15	82.4	73.4	69.3	66.0	66.0	60.0	53.3	47.6	41.1	38.8
10/10/2025 03:30	82.3	73.3	69.1	65.8	65.8	60.3	53.5	47.7	44.2	38.6
10/10/2025 03:45	82.4	73.3	69.3	65.9	65.8	60.4	53.5	47.5	39.7	38.6
10/10/2025 04:00	82.4	73.3	69.2	65.9	65.8	60.4	53.6	48.3	43.0	38.8
10/10/2025 04:15	82.3	73.6	69.2	65.9	66.1	60.4	53.5	47.4	39.6	38.5
10/10/2025 04:30	82.4	73.4	69.3	65.9	65.9	60.4	53.5	47.2	40.7	38.3
10/10/2025 04:45	82.3	73.4	69.3	65.9	65.8	60.1	53.3	47.4	44.5	38.6
10/10/2025 05:00	82.6	73.5	69.3	65.9	65.8	60.3	53.5	47.6	41.6	38.8
10/10/2025 05:15	82.4	73.5	69.3	66.0	65.7	60.3	53.5	47.5	41.2	38.8



Date & Time	Frequency (Hz), dB									
	31.5	63.0	125.0	250.0	500.0	1k	2k	4k	8k	16k
10/10/2025 05:30	82.5	73.8	69.3	65.9	65.8	60.3	53.6	47.7	46.2	38.8
10/10/2025 05:45	82.8	73.9	69.5	65.9	65.8	60.5	53.7	47.6	40.1	38.8
10/10/2025 06:00	82.9	74.0	69.5	65.9	65.6	60.4	53.7	47.5	39.6	38.6
10/10/2025 06:15	82.4	73.7	69.3	65.9	65.8	60.9	53.9	47.8	39.6	38.8
10/10/2025 06:30	82.6	73.7	69.2	65.9	65.7	60.8	54.0	47.8	39.8	38.7
10/10/2025 06:45	82.5	73.5	69.1	65.7	65.6	60.8	53.9	50.6	47.1	38.9
10/10/2025 07:00	82.5	73.6	69.3	66.0	65.5	60.7	53.8	47.5	40.8	38.6
10/10/2025 07:15	82.6	73.6	69.2	66.0	65.6	60.8	54.1	47.9	39.8	38.6
10/10/2025 07:30	82.3	73.5	69.2	65.9	65.7	61.0	54.2	48.0	41.2	38.7
10/10/2025 07:45	82.5	73.6	69.3	66.2	65.8	61.2	54.6	48.1	39.4	38.6
10/10/2025 08:00	82.5	73.5	69.2	66.0	65.6	60.8	54.1	47.8	39.4	38.8
10/10/2025 08:15	82.6	73.6	69.4	66.2	65.6	60.7	54.0	47.6	39.2	38.9
10/10/2025 08:30	82.4	73.6	69.3	65.9	65.7	61.0	54.1	47.7	39.4	38.8
10/10/2025 08:45	82.6	73.8	69.5	66.3	65.8	60.8	54.1	47.7	39.6	39.0
10/10/2025 09:00	82.7	73.8	69.5	66.5	65.8	60.6	53.9	47.5	39.6	39.1
10/10/2025 09:15	82.8	73.8	69.5	66.5	65.8	60.6	54.0	47.7	39.4	39.0
10/10/2025 09:30	82.8	73.8	69.5	66.5	65.8	60.7	54.2	47.8	39.3	39.0
10/10/2025 09:45	82.7	73.7	69.5	66.5	65.8	60.5	53.9	47.4	39.1	38.9
10/10/2025 10:00	82.7	73.9	69.5	66.5	65.4	60.2	53.6	47.3	39.4	38.8
10/10/2025 10:15	82.6	73.7	69.4	66.7	65.4	60.1	53.5	47.1	38.9	38.6
10/10/2025 10:30	82.6	73.8	69.4	66.5	65.6	60.1	53.5	47.1	39.1	38.6
10/10/2025 10:45	82.6	74.0	69.4	66.3	65.5	60.2	53.4	47.0	38.7	38.3
10/10/2025 11:00	82.7	73.9	69.2	65.8	65.4	60.5	54.0	47.2	38.9	38.2
10/10/2025 11:15	83.2	74.1	69.6	65.8	65.3	60.2	53.3	47.3	38.5	38.4





Making Sustainability Happen

E Letter of Authorisation

10 July 2023

To whom it may concern,

Permit Applications, Variations, Transfers and Surrender

I confirm that:

Aleks Dragicevic

Ian John

who are employed by the company, are authorised to sign EA, NRW and SEPA application form declarations on behalf of Viridor Limited's companies.

Yours sincerely,



Kevin Bradshaw
Chief Executive Officer



Omar Khan
Chief Financial Officer

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