Sofidel UK Limited

Baglan Paper Mill - Emergency Generator Study

Air Quality Assessment for Permitting

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Abbreviations and Acronyms

Abbreviation or Acronym	Definition
AQA	Air quality assessment
AQMA	Air Quality Management Area
ASR	Annual Status Report
BAT	Best Available Techniques
CL	Critical Load
CLF	Critical Load Functions
CO	Carbon Monoxide
EA	Environment Agency
EALs	Environmental Assessment Levels
EU	European Union
HC	Hydrocarbons
HVO	Hydrogenated Vegetable Oil
IED	Industrial Emissions Directive
LAQM	Local Air Quality Management
LWS	Local Wildlife Site
MCPD	Medium Combustion Plant Directive
MW	Megawatt
NGR	National Grid Reference
NNR	National Nature Reserve
NRW	Natural Resources Wales
NOx	Oxides of nitrogen
NO_2	Nitrogen Dioxide
NPTCBC	Neath Port Talbot County Borough Council
NRW	Natural Resource Wales
OS	Ordinance Survey
PC	Process Contribution
PEC	Predicted Environmental Concentration
PM_{10}	Particulate matter less than 10 microns in diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
SAC	Special Areas of Conservation
SO_2	Sulphur Dioxide
SSSI	Site of Special Scientific Interest
UK	United Kingdom

Executive Summary

This report contains the air quality assessment for the use of temporary emergency generators at the existing Intertissue facilty in Baglan. The air quality assessment supports the Environmental Permit Variation, as part of a Permit Application under the Industrial Emissions Directive (IED) (2010/75/EU)[1].

The air quality assessment has been based on the potential impact from mobile temporary diesel generators using Hydrogenated Vegetable Oil (HVO) and gas generators installed on site.

Operating scenarios provided by the generator supplier Aggreko have been considered and assessed to reflect the required power demand on-site. This includes the number and array of generators most likely to be utilised to maintain the required 7.5MWe power demand needed as a minimum to support the site operations. This expected operational scenario includes the use of three gas generators and five HVO fuelled generators.

It has examined the predicted changes in air pollutant concentrations at nearby receptors, including the potential effect on workplace exposure limits, designated ecological sites and on human health.

The assessment has considered those pollutants included in the Medium Combustion Plant Directive (MCPD) and those included within EU and UK quality standards, namely:

- Oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2);
- Fine particulate matter (PM_{10} and $PM_{2.5}$);
- Sulphur Dioxide (SO_2); and
- Carbon Monoxide (CO).

The assessment has been based on assumed operational hours across whole calendar years (8760 hours).

The primary scenario considered what is installed on-site and predicted exceedances of the air quality standards for hourly mean NO_2 (99.79th percentile) at two receptors, located at the adjacent former Baglan Power Plant and also the adjacent permissive path to the west of the site.

As there is no public access to the Power Plant site, there will be no public exposure and therefore no significant impacts are likely to occur at this location. Similarly, it has been recommended that the permissive path is shut temporarily during the period that the generators are running; this was agreed with Neath Port Talbot County Borough Council on 09/03/2022. As such, no significant impacts to human health are likely to occur at this location either.

[1] Directive 2010/75/EU of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

For the assessment of impacts on sensitive habitats, the potential impacts of NO_x have been assessed, both through the impacts directly to air and through deposition of acidic compounds and nutrient nitrogen.

It is understood that there are a number of Local Wildlife Sites (LWS) in the vicinity of the site, however these data are not publicly available so have not all been included in this assessment. The nearest LWS (Baglan Bay) adjacent to the generators has been included, where the NOx annual and 24 hour mean critical levels are both predicted to be exceeded, representing potentially significant impacts at this location.

A number of Ancient Woodland sites are predicted to exceed the 1% process contribution and 70% predicted environmental concentrations criteria for nutrient nitrogen and acid deposition. However, in all cases the existing background deposition levels exceed the relevant critical loads and therefore it is considered that the increase in deposition will results in no significant impacts.

In summary, no significant impacts to human health are predicted however potentially significant impacts on the adjacent ecologically designated Baglan Bay LWS are predicted.

This is as a result of the extensive design interactions and mitigation measures which have been included on-site to minimise the potential impact from emissions to air, whilst maintaining operational functionality. The proposed design with the 3m stacks on the HVO and gas generators is therefore considered to be BAT as the 12m stacks to fit on the HVO generators are currently not available.

1 Introduction

Ove Arup and Partners Ltd (Arup) has been commissioned by Sofidel to prepare an air quality assessment (AQA) for the use of temporary emergency generators at the existing Intertissue facility in Baglan. The Sofidel site has a direct power connection to the Baglan Power Station however the Power Station was placed into receivership in March 2021.

The temporary generators are needed on-site to ensure business continuity whilst an alternative national grid connection is made. It is expected the temporary generators will be in use for approximately six months.

The air quality assessment will support the Environmental Permit Variation, as part of a Permit Application under the Industrial Emissions Directive (IED) (2010/75/EU)[2]. The combustion element of the site will be permitted under the Medium Combustion Plant Directive (MCPD)[3], for plants with a rated thermal input equal to or greater than 1 Megawatt (MW) and less than 50 MWth.

The air quality assessment has considered the likely changes in air quality that would arise as a result of the use of the temporary generators on-site. It has examined the changes in air pollutant concentrations including the potential effect on workplace exposure limits, designated ecological sites and on human health. Given the emergency nature and emission rates for the temporary generators given in the generator specifications, detailed modelling was undertaken rather than completing the H1 assessment.

1.1 Project Description

The current electrical supply at Sofidel Intertissue is at 11kV and is provided by the Calon Energy Baglan Bay Power Station via a private wire network. This private wire network will be isolated is the coming weeks (date to be determined) and as such a new independent, resilient power supply is required from the local Western Power Distribution network. This power supply would be via a 33kV dual circuit connection from Western Power's Baglan primary substation. Given the existing infrastructure at Sofidel Intertissue is provided at 11kV a new 33kV Intertissue owned substation is required to accommodate this circuit connection.

The proposed standby generators on-site will consist of nine mobile diesel generators (using hydrogenated vegetable oil (HVO)) and three gas generators. There are two types of HVO generators on site, however only one has been modelled; the KTA50G3. This generator has higher pollutant emission rates, therefore gives the worst-case scenario. It was decided to only model one type of HVO generator to account for different maintenance operating scenarios. Each HVO generator has a thermal input of 2.18MWth and each gas generator 3.67MWth. The air quality assessment has been assessed following a

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[2] Directive 2010/75/EU of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
[3] Directive (EU) 2015/2193 of the European Parliament and the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants

containerised emergency generator modelling scenario example from Aggreko, using HVO fuel.

All generators (HVO and gas) currently have 3m stacks on top of the containerised units. There is an option for 12m stacks to be added to the HVO generators at a later date once available, but this is not confirmed. Both scenarios have been modelled for permitting.

This section details the method used for the assessment of air quality effects for the use of five temporary HVO generators and three temporary gas generators at the existing Intertissue facility in Baglan.

The electrical load and associated generator running profile deemed to be necessary for the plant to function effectively is outlined in Table 1.

Table 1 Generator Running Profile

Load (MWe)	**Generator running and loading (%)**											
	GG1	GG2	GG3	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9
7.5	100	100	100	63.5	63.5	63.5	63.5	63.5	-	-	-	-
Maintenance generator running and loading (%)												
7.5	100	100	-	66	66	66	66	66	66	66	-	-

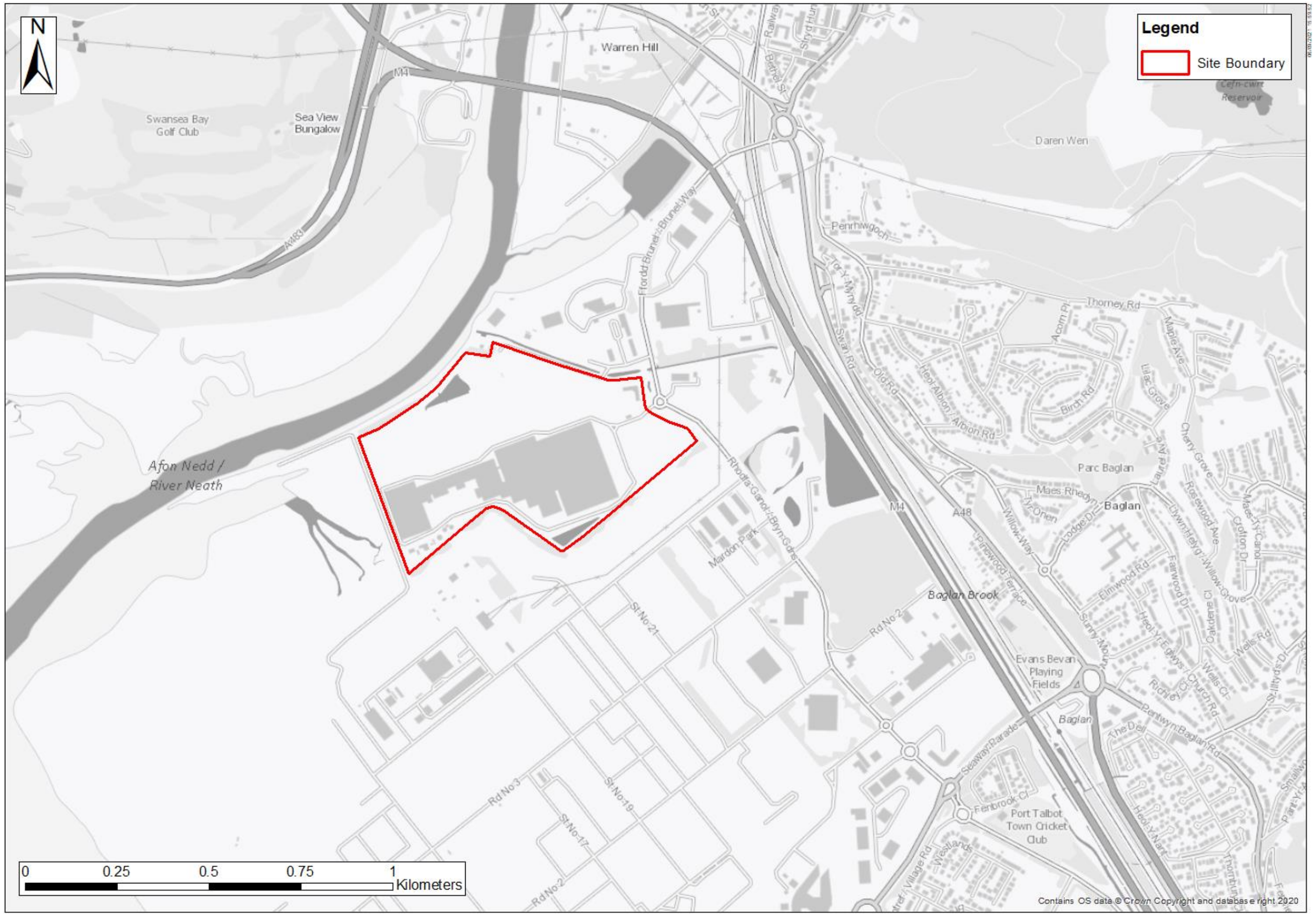
A maintenance scenario has also been modelled. As outlined by Aggreko, during maintenance, the load will remain at 7.5MWe however generator numbers would change, where the nine HVO generators operating would cycle to balance out running hours and cover maintenance of all generators on site. The maintenance scenario modelled was an example given by Aggreko where two gas generators would operate at 100% and seven HVOs would operate at 66%. The maintenance scenario has been modelled for both a 3m and 12m stack. Results of the maintenance scenario can be found in Section 5.2.

1.2 Site location

The site is under the administration of Neath Port Talbot County Borough Council (NPTCBC) and located in Baglan Energy Park. The site is situated to the West of the M4, just outside the town of Port Talbot, South Wales. Figure 1 shows the extent of the site boundary.

The Baglan Energy Park site was redeveloped in 2004, following the closure of BP's Baglan Bay plant in 2004. The Energy Park currently comprises of Baglan Bay Power station and purpose-built light industrial site/manufacturing units with ancillary office accommodation. The Energy Park is also home to the headquarters for Neath Port Talbot County Council's service response centre and Abertawe Bro Morgannwg University Health Board, amongst other occupiers.

Figure 1: Site Boundary



1.3 Scope of assessment

Air quality studies are concerned with the presence of airborne pollutants in the atmosphere. This air quality assessment accompanies the Environmental Permit Application Variation submitted to Natural Resources Wales (NRW).

This assessment outlines relevant air quality management policy and legislation, describes the existing air quality conditions in the vicinity of the site, outlines the nature of the combustion sources and addresses any air quality issues associated with their operation. Mitigation measures are also proposed where necessary which would be implemented to reduce the likely effect of the proposals on air quality, as far as practicable.

2 Air quality standards and legislation

2.1 Legislation

2.1.1 European air quality management

In 1996 the European Commission published the Air Quality Framework Directive on ambient air quality assessment and management (96/62/EC)[4]. This Directive defined the policy framework for 12 air pollutants known to have harmful effects on human health and the environment. Limit values (pollutant concentrations not to be exceeded by a certain date) for each specified pollutant are set through a series of Daughter Directives, including Directive 1999/30/EC (the 1st Daughter Directive)[5] which sets limit values for sulphur dioxide (SO_2), NO_2 and (nitrogen oxide) NO_x, particulate matter (PM_{10}) and lead (Pb) in ambient air.

In May 2008 the Directive 2008/50/EC[6] on ambient air quality and cleaner air for Europe came into force. This Directive consolidates the above (apart from the 4th Daughter Directive, which will be brought within the new Directive at a later date), provides a new regulatory framework for very fine particulate matter ($PM_{2.5}$) and makes provision for extended compliance deadlines for NO_2 and PM_{10}.

The Directives were transposed into national legislation in Wales by the Air Quality Standards Regulations 2010 (amended in 2016)[7]. The Secretary of State for the Environment has the duty of ensuring compliance with the air quality limit values.

[4] Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management.
[5] Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air.
[6] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.
[7] The Air Quality Standards (Amendment) Regulations 2016

2.1.2 Environment Act 2021

The Environment Bill became an Act[8] (law) in November 2021. The Environment Act 2021 amends the Environment Act 1995[9]. It also amends the Clean Air Act 1993[10] to give local authorities more power in reducing local pollution, particularly that from domestic burning. It also amends the Environmental Protection Act 1990[11] to reduce smoke from residential chimneys by extending the system of statutory nuisance to private dwellings.

The following sections of the Environment Act 1995 have been transposed into the Environment Act 2021:

For the Secretary of State to develop, implement and maintain an Air Quality Strategy. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of local air quality management and declare an AQMA where pollutant concentrations exceed the national air quality objectives. Where an AQMA is declared, the local authority needs to produce an Air Quality Action Plan (AQAP), which outlines the strategy for improving air quality in these areas.

The Act will implement key parts of the government's Clean Air Strategy and include targets for tackling air pollution in the UK.

The following points are relevant to air quality[12]:

- For the Secretary of State to set long-term legally binding targets on air quality. These targets must be of at least 15 years in duration, and be proposed by late 2022;
- For the Secretary of State to publish a report reviewing the Air Quality Strategy every five years;
- For the government to set two targets by October 2022: the first on the amount of $PM_{2.5}$ pollutant in the ambient air (the figure and deadline for compliance remain unspecified) and a second long-term target set at least 15 years ahead to encourage stakeholder investment;
- For the Office for Environmental Protection to be established[13] to substitute the watchdog function previously exercised by the European Commission;
- For local authorities' powers to be extended under the current Local Air Quality Management framework, including responsibilities to improve local air quality and to reduce public exposure to excessive levels of air pollution;

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[8] Environment Act 2021. Available at: https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted. [Accessed February 2022]
[9] Environment Act 1995, Chapter 25, Part IV Air Quality
[10] Clean Air Act 1993. Available at: https://www.legislation.gov.uk/ukpga/1993/11/contents. [Accessed February 2022]
[11] Environmental Protection Act 1990. Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents. [Accessed February 2022]
[12] Environment Act 2021. Part 4 Air Quality and Environmental Recall.
[13] Environment Act 2021. Chapter 2. The Office for Environmental Protection.

- For “air quality partners” to have a duty to share responsibility for dealing with local air pollution among public bodies; and
- Introduces a new power for the government to compel vehicle manufacturers to recall vehicles and non-road mobile machinery if they are found not to comply with the environmental standards that they are legally required to meet.

2.1.3 Air quality objectives and limit values

Air quality limit values and objectives are quality standards for clean air. Some pollutants have standards expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment (i.e. effects occur (long-term) after a prolonged period of exposure to elevated concentrations) and others have standards expressed as 24-hour, 1-hour or 15-minute average concentrations (short-term) due to the acute way in which they affect health or the natural environment (i.e. after a relatively short period of exposure). Some pollutants have standards expressed in terms of both long-term and short-term concentrations.

The air quality objectives and limit values set out in Table 2 are the air quality standards used in this assessment for human health. They will be referred to as Environmental Assessment Levels (EALs).

Table 2 Air quality standards for human health

Pollutant	Averaging period	Environmental standards
For the protection of human health		
Nitrogen dioxide (NO_2)	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year (99.79th percentile)
	Annual mean	40µg/m^3
Fine particulates (PM_{10})	24-hour mean	50µg/m^3, not to be exceeded more than 35 times a year (90.41st percentile)
	Annual mean	40µg/m^3
Very fine particulates ($PM_{2.5}$)	Annual mean	20 µg/m^3
Carbon monoxide (CO)	8-hour mean	10,000µg/m^3
Sulphide dioxide (SO_2)	15-minute	266µg/m^3, not to be exceeded more than 35 times a year (99.9th percentile)
	24-hour mean	125µg/m^3, not to be exceeded more than 3 times a year (99.18th percentile)
	1-hour mean	350µg/m^3, not to be exceeded more than 24 times a year (99.73rd percentile)

2.1.4 Ecological legislation

European Council Directive 92/43/EEC[14] (Habitats Directive) requires member states to introduce a range of measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations 2010[15] transposes the Directive into law in England and Wales.

The Habitats Directive requires the competent authority first to evaluate whether operation of the site is likely to give rise to a significant effect on the European site (Habitats Regulation Assessment screening). Where this is the case, it has to carry out an 'appropriate assessment' in order to determine whether the Project would adversely affect the integrity of the European site.

2.1.4.1 Critical Levels

There are specific objective pollutant concentrations for vegetation called 'critical levels', which are shown in Table 3. These are concentrations below which harmful effects are unlikely to occur. The critical levels apply to locations more than 20km from towns with more than 250,000 inhabitants or more than 5km from other built-up areas, industrial installations or motorways.

The objectives in the legislation are used to assess the potential impacts upon any sensitive ecosystems. They will be referred to as EALs in the remainder of this report.

Table 3 Critical levels for the protection of ecosystems

Pollutant	Averaging period	Standard
Nitrogen oxides (expressed as NO_2)	Annual mean*	30µg/m^3
	Daily mean	75µg/m^3
SO_2 (for ecosystems where lichens and bryophytes are present)	Annual mean	10µg/m^3
SO_2 (for all other ecosystems)	Annul mean	20µg/m^3

2.2 Policy context

2.2.1 Air emissions risk assessment for your environmental permit

NRW guidance on air quality assessments for permit applications is web-based[16], with the latest revision date being that of the 3rd September 2021. This guidance

[14] European Council Directive (92/43/EEC) of 21 May 1992, on the conservation of natural habitats and of wild fauna and flora
[15] UK The Conservation of Habitats and Species Regulations (2010) No. 490
[16] NRW (2021) Air emissions risk assessment for your environmental permit
Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit. Accessed August 2021

sets out the full process for assessing air quality for an environmental permit and has been followed in this assessment.

2.2.2 Local Air Quality Management Policy Guidance and Technical Guidance

LAQM (PG16) [17] provides guidance on the links between air quality and the land-use planning system. The accompanying technical guidance, Technical Guidance (TG16),[18] although designed to support local authorities in carrying out their duties to review and assess air quality in their area, contains general advice on dispersion modelling assessments of air quality impacts. This guidance has been used where relevant in this assessment.

2.2.3 National planning policy

Well-being of Future Generations (Wales) Act 2015

The Act[19] has well-being goals and objectives to achieve through implementation of sustainable development. Changes in air quality can have an impact on the health of ecological habitat and humans. As such, the goals to create '*a resilient Wales*' and *'a healthier Wales'* are applicable.

In order for Welsh Ministers to understand the progress being made to achieving the well-being goals, national indicators have been set. One of these national indicators relates to levels of NO_2 in the air. The Act aims to reduce pollution exposure by assessing a weighted population average to NO_2 on an annual basis.

Planning Policy Wales, Edition 11, February 2021

The 11th edition of Planning Policy Wales[20] (PPW11) was published in February 2021. It sets out land-use and planning policy for Wales. The new planning policy incorporates principles derived from the Well-being of Future Generations (Wales) Act 2015.

The policy document is set out in themes, with air quality predominantly addressed in the Distinctive and Natural Places theme. Air Quality and Soundscape section of PPW11 highlights the importance that air quality has in a positive experience of place, public health, amenity and well-being. Specific reference is made to the contribution the planning system should make to achieving a healthier Wales through reducing population exposure to air pollution, whilst also tackling high pollution hotspots. Additionally, preventing the creation of any new or worsening of existing air quality pollution problems is important.

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[17] Defra (2016) Local Air Quality Management Policy Guidance, PG16
[18] Defra (2016) Local Air Quality Management Technical Guidance, TG16
[19] Wellbeing of Future Generations (Wales) Act 2015
[20] Welsh Government (2018) Planning Policy Wales Edition 10 (PPW10)

Future Wales: The national plan 2040

The Future Wales national plan 2040[21] is a national development framework, setting the direction for development in Wales to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of communities.

The framework provides clear direction related to air quality and how that should be managed and improved through existing policy (eg Planning Policy Wales) and sets out how air quality should be improved within the regional plans.

The Clean Air Plan for Wales

The Welsh Government, The Clean Air Plan for Wales, Healthy Air, Healthy Wales[22] plan was published in August 2020 and sets targets for improving air quality across the country. It includes actions for reducing emissions from various sources, such as transport, domestic activities, farming and industry. There is also a long-term target for reducing population exposure to $PM_{2.5}$ concentrations to meet the World Health Organisation's (WHO) target of 10µg/m^3 as an annual mean. In particular, the Clean Air Plan states the Welsh Government will:

"Develop a Clean Air Act to enhance existing legislation and bring forward new legislation to deliver air quality improvements in Wales. The aim of the Act will be to deliver this commitment and reduce the burden of poor air quality on human health, our economy, biodiversity and natural environment. The Act could also support wider actions to address the climate emergency."

2.2.4 Local planning policy

Neath Port Talbot County Borough Council Local Development Plan

Neath Port Talbot County Borough Council (NPTCBC) adopted their Local Development Plan (LDP)[23] in January 2016 with it covering the years 2011-2026. The LDP recognises the importance of good air quality for health, quality of life and amenity. Policies relevant to air quality include:

SP16 Environmental Protection – *"Air, water and ground quality and the environment generally will be protected and where feasible improved through the following measures: … Ensuring that proposals have no significant adverse effects on water, ground or air quality and do not significantly increase pollution levels; Ensuring the developments do not increase the number of people exposed to different levels of pollution."*

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[21] Future Wales: The national plan 2040 [Available at: https://gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf]
[22] Welsh Government (2020) The Clean Air Plan for Wales, Healthy Air, Healthy Wales [Available at: https://gov.wales/sites/default/files/publications/2020-08/clean-air-plan-for-wales-healthy-air-healthy-wales.pdf]
[23] Neath Port Talbot County Borough Council Local Development Plan 2011-2026

EN 8 Pollution and Land Stability – *"Proposals which would be likely to have an unacceptable adverse effect on health, biodiversity and/or local amenity or would expose people to unacceptable risk die to the following will not be permitted: … Air pollution.*

EN 9 Developments in the Central Port Talbot Area – *"Developments in the central Port Talbot Area that could result in breaches of air quality objectives during their construction phase, will be required to be undertaken in accordance with a Construction Management Plan submitted as part of the planning process and agreed by the council.*

Pollution: Supplementary Planning Guidance

This guidance[24] provides details about pollution issues in NPTCBC and sets out the relevant matters that will need to be taken into consideration when developments are being planned in the County Borough. Concerns about air quality relate to two main areas: direct impacts on human health and amenity and ecological impacts affecting natural habitats and species.

AIRWISE Clean Air for Everyone (2013) – Neath Port Talbot County Borough Council

Airwise is NPTCBC's Strategy for improving air quality. The aims of the Airwise Strategy are:

- To ensure air quality in Neath Port Talbot allows residents and visitors to enjoy time outdoors without risking their health;
- To ensure air quality throughout the Council Borough is better than the standards required by UK legislation;
- To achieve consistently good air quality in Port Talbot so that the local authority can revoke the Air Quality Management Area status by compliance with LAQM air quality objectives;
- To better inform the public on issues relating to air quality; and
- To reduce nuisance dust and thereby improve quality of life.

[24] Pollution (Supplementary Planning Guidance) 2016

3 Methodology

This section details the method used for the assessment of air quality effects for the use of five temporary HVO fuelled generators and three temporary gas generators at the existing Intertissue facility in Baglan.

The assessment has examined the changes in air pollutant concentrations in the surrounding area that will result from the operation of the generators.

Sensitivity testing was also undertaken to help identify Best Available Technique (BAT); results of this testing can be found in Appendix A.

The assessment method takes into account all relevant policy and guidance presented in Section 2.

The overall approach to the air quality assessment comprised:

- A review of the existing air quality conditions at and in the vicinity of the site;
- A review of human and ecological receptors in the vicinity of the site;
- Sensitivity testing of modelling options;
- An assessment of the impact on air quality from the operation of the temporary generators;
- Assessment of the significance of the potential impact; and
- Formulation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised.

3.1 Pollutants assessed

The assessment of air quality effects has considered those pollutants included in the MCPD and those included within EU and UK quality standards, namely:

- Nitrogen oxides (NO_x) and nitrogen dioxide (NO_2);
- Fine particulate matter (PM_{10} and $PM_{2.5}$);
- Sulphur Dioxide (SO_2); and
- Carbon Monoxide (CO).

The assessment has been based on assumed operational hours across whole calendar years (8760 hours).

For the assessment of impacts on sensitive habitats, the potential impacts of NO_x have been assessed, both through the impacts directly to air and through deposition of acidic compounds and nutrient nitrogen.

Due to HVO being a sulphur-free fuel and there being negligible quantities in natural gas, emissions of sulphur dioxide (SO_2) have not been included in the generator emissions within main air quality assessment. Potential emissions of SO_2 have however been included where existing on-site combustion sources have been considered in combination.

3.2 Methodology of baseline assessment

Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment. These are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

A desk-based review of the following data sources has been undertaken to determine baseline conditions of air quality in this assessment:

- Local authority review and assessment[25,];
- Defra UK Air Information Resource website[26]; and
- Natural Resource Wales website[27]

This section contains full details of the background monitoring data and assumptions made to determine the likely background concentrations at the site for the pollutants named in Section 3.1 above.

Background data have been obtained from a variety of sources and these are outlined in the following sections. Two times the annual mean background concentrations have been used for short term background concentrations in the assessment following Environment Agency (EA) guidance[28] (which is also relevant in Wales).

3.3 Method of operational assessment

3.3.1 Assessment of point source emissions

The assessment has examined the changes in air pollutant concentrations in the surrounding area that would result from the operation of the site at reduced capacity, where five diesel/HVO generators and three gas generators are in operation. The generators will be run using HVO fuel which reduces NO_x and PM_{10} emissions by approximately 40% and contains no sulphur. Supporting information around these reported emissions reductions has been provided as part of the wider Permit Variation Application submitted to NRW. Appendix A provides details of assessments with different operating conditions.

Emissions data for the point sources assessed are shown in Section 3.3 along with details of selected receptors, model inputs and sensitivity testing.

3.3.2 Sensitive receptors

Modelling has been undertaken to predict impacts at discrete and gridded receptors. The discrete receptors relevant to the assessment include residential

[25] Neath Port Talbot County Borough Council 2020 Air Quality Progress Report
[26] Defra (2017) https://uk-air.defra.gov.uk/data/ Accessed October 2021.
[27] Natural Resource Wales website; https://naturalresources.wales/?lang=en. Accessed August 2021

properties, schools, care homes as well as other sensitive locations and facilities in the area, such as designated ecological sites and protected ecological sites.

Discrete human receptors have been selected based on relevant sensitive receptors in the vicinity of the site, these are shown in Figure 2 and detailed in Table 4. Original modelling was completed for Receptors 1-19. Receptors 20-26 were added at a later stage for the final modelling scenario after consultation with NRW. None of the discrete human receptors have been identified as tall buildings (such as flats, where exposure may be several metres above ground level), therefore all human receptors will be modelled at a height of 1.5m, representative of the breathing zone of a human receptor standing on the ground.

The assessment from the stacks of the generators has been predicted at locations over a cartesian grid of 5km by 5km, for contour plotting of the results and identification of the point of maximum impact on the modelled grid. The grid area has used the proposed stack locations as the central point. The grid has been plotted at a height of 1.5m and with a resolution of 50m. The modelled grid extent is: National Grid Reference (NGR) (270547, 195174) to (275547, 190174). The model grid area is shown in Figure 3.

Table 4 Human receptors

ID	Name	NGR (m)	Height (m)		Distance to site (m) and (direction)
		x	y		
1	Ysgol Gymraeg Bro Dur	274083	191433	1.5	1608 (S)
2	Ysgol Bae Baglan	274079	191745	1.5	1380 (S)
3	Ysgol Gynradd Baglan Primary School	274913	192638	1.5	1863 (E)
4	Baglan Lodge Care Home	274264	193494	1.5	1470 (NE)
5	Woodside House Nursing Home	274300	193620	1.5	1573 (NE)
6	All Born Curious Day Nursery	274251	192133	1.5	1314 (SE)
7	Miles of Smiles Day Nursery	275129	192174	1.5	2136 (SE)
8	Residential Dwelling: Handel Avenue	273819	191466	1.5	1425 (S)
9	Residential Dwelling: Afandale	274136	191541	1.5	1563 (S)
10	Residential Dwelling: Westlands	274466	191862	1.5	1628 (SE)
11	Residential Dwelling: Burrows Road	274592	192555	1.5	1546 (E)
12	Residential Dwelling: Swan Road	274237	193203	1.5	1303 (E)
13	Residential Dwelling: Ocean View 1	271416	193798	1.5	1935 (NW)
14	Residential Dwelling: Ocean View 2	271644	193908	1.5	1824 (NW)
15	Residential Dwelling: Bethel Street	274020	193945	1.5	1604 (NE)

ID	Name	NGR (m)	Height (m)		Distance to site (m) and (direction)
		x	y		
16	Residential Dwelling: Swan Road 2	274353	193035	1.5	1355 (E)
17	Residential Dwelling: Brahms Avenue	273658	191321	1.5	1475 (S)
18	Residential Dwelling: Parry Road	273487	191156	1.5	1570 (S)
19	Residential Dwelling: Travelling Community	273480	193620	1.5	1034 (N)
20	Covid Testing Centre	273648	192631	1.5	599 (SE)
21	Baglan Power Plant 1	273087	192583	1.5	90 (S)
22	Baglan Power Plant 2	273164	192463	1.5	232 (S)
23	Patisserie	273872	192794	1.5	832 (SE)
24	Tai Tarian Housing Association	273751	193142	1.5	848 (E)
25	Waterside Medical Practice	273626	193265	1.5	832 (E)
26	Permissive Path	273002	192656	1.5	12.5 (W)

Figure 2 Human receptors

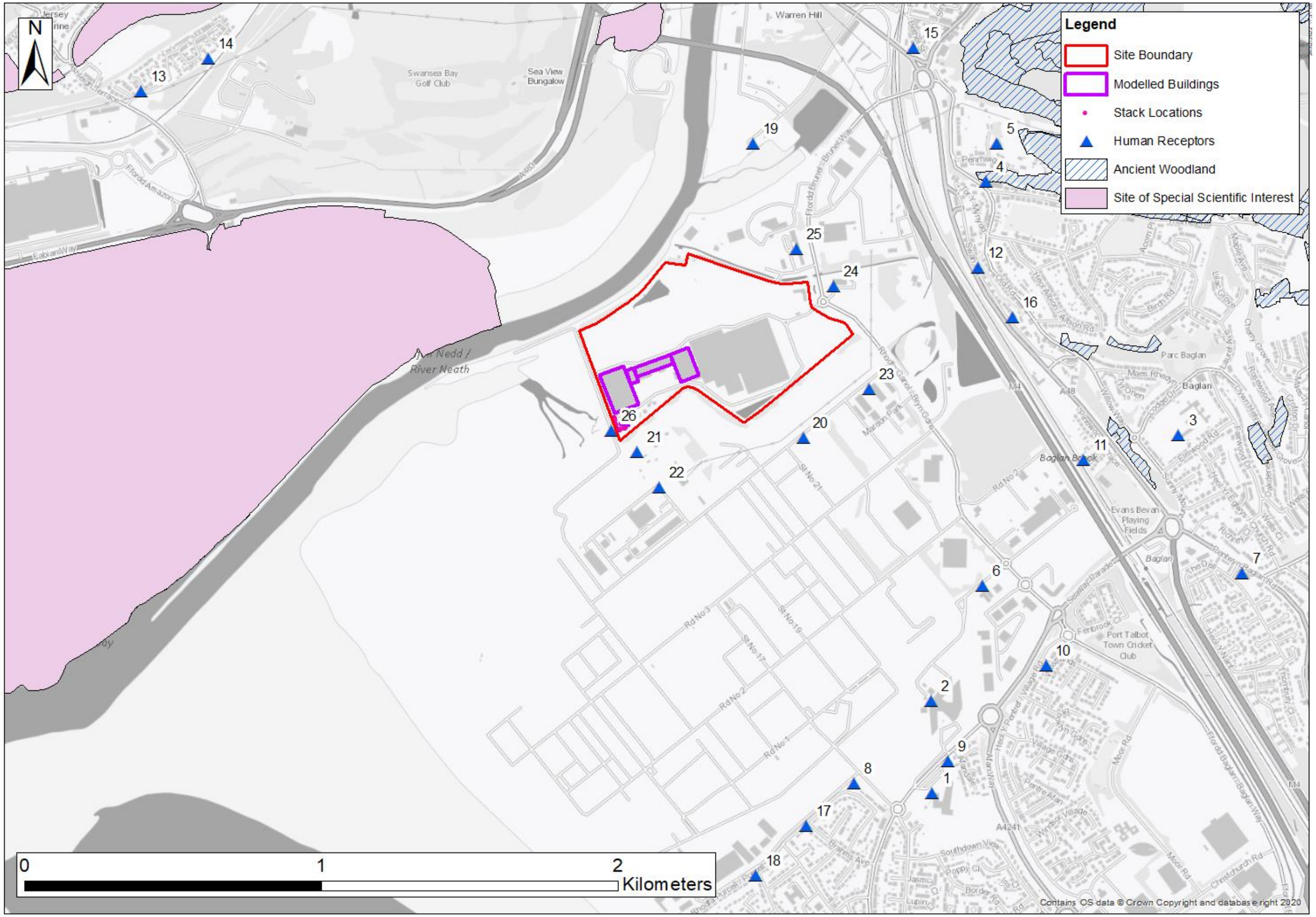
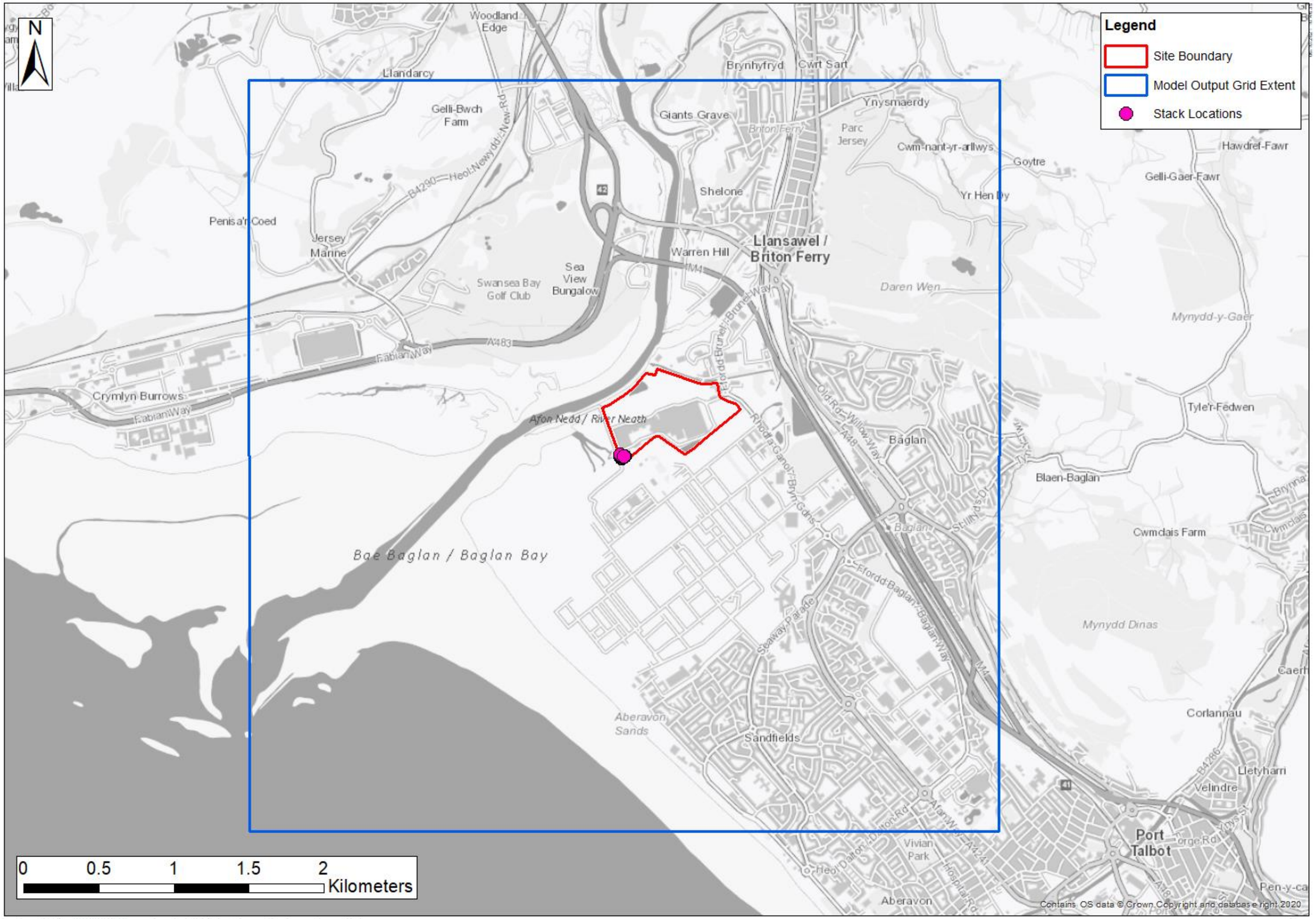


Figure 3 Model output grid domains



Ecological receptors have been reviewed within 15km of the site, in accordance with EA guidance. This review has identified a number of designated sites that have been included in the assessment. The nearest ecological sites, within 2km of the site have been identified as:

- Crymlyn Bog/Cors Crymlyn (Ramsar/Special Areas of Conservation (SAC)/Site of Special Scientific Interest (SSSI)/National Nature Reserve (NNR));
- Crymlyn Burrows (SSSI);
- Pant-Y-Sais (Local Nature Reserve (LNR)/SSSI/NNR);
- Earlswood Road Cutting and Ferryboat Inn Quarries (SSSI); and
- Several parcels of ancient woodland sites within 2km of the site.

Receptors were placed at the closest locations of the ecological designation to the proposed stacks. Ecological receptors are described in Table 5 and shown in Figure 4.

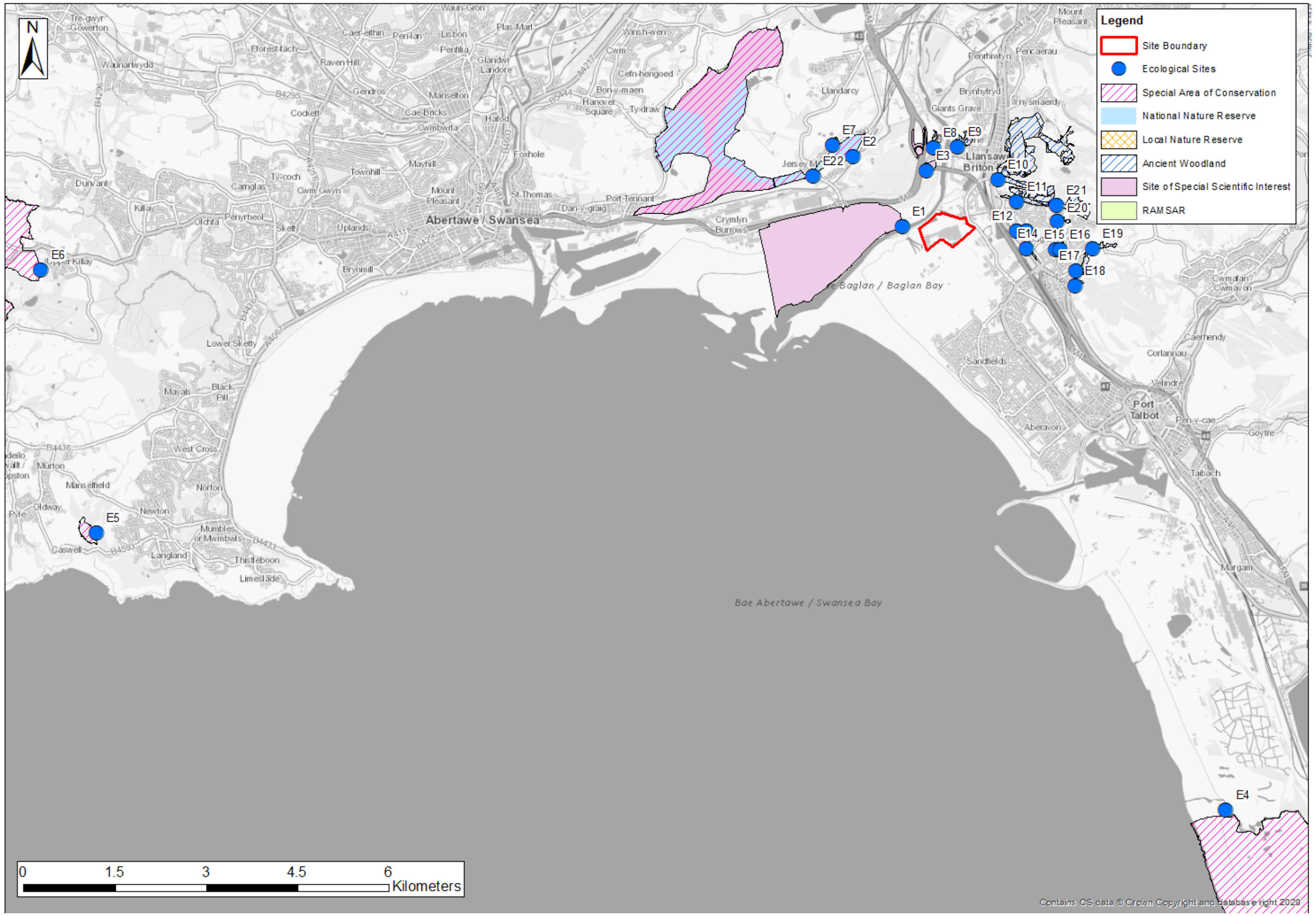
Ecological receptors have been modelled at a height of 0m, representative of ground level.

Table 5 Ecological receptors

ID	Name	NGR (m)		Height (m)	Distance to site (m) and (direction)
		x	y		
E1	Crymlyn Burrows	272625	193013	0	268 (W)
E2	Pant-Y-Sais/Crymlyn Bog/Cors Crymlyn	271818	194171	0	1596 (NW)
E3	Earlswood Road Cutting and Ferryboat Inn Quarries	273026	193935	0	722 (N)
E4	Kenfig/Cynffig	277946	183430	0	10289 (S)
E5	Gower Ash Woods / Coedydd Ynn Gwyr	259384	187978	0	14408 (SW)
E6	Gower Commons / Tiroedd Comin Gwyr	258470	192307	0	14438 (W)
E7	Ancient Woodland 1	271476	194352	0	1964 (NW)
E8	Ancient Woodland 2	273139	194316	0	1071 (NW)
E9	Ancient Woodland 3	273540	194317	0	1102 (N)
E10	Ancient Woodland 4	274203	193789	0	832 (N)
E11	Ancient Woodland 5	274511	193426	0	828 (NE)
E12	Ancient Woodland 6	274512	192946	0	700 (E)
E13	Ancient Woodland 7	274670	192947	0	858 (E)
E14	Ancient Woodland 8	274671	192656	0	917 (E)
E15	Ancient Woodland 9	275149	192633	0	1381(E)

ID	Name	NGR (m)		Height (m)	Distance to site (m) and (direction)
		x	y		
E16	Ancient Woodland 10	275214	192642	0	1441 (E)
E17	Ancient Woodland 11	275478	192282	0	1806 (SE)
E18	Ancient Woodland 12	275471	192034	0	1909 (SE)
E19	Ancient Woodland 13	275753	192649	0	1969 (E)
E20	Ancient Woodland 14	275170	193099	0	1362 (E)
E21	Ancient Woodland 15	275163	193362	0	1403 (E)
E22	Cors Crymlyn SSSI	271159	193844	0	1931 (NW)
E23	Baglan Bay LWS*	273002	192656	1.5	12.5 (W)
This receptor not identified in the Figure 4 was highlighted after initial submission, so the modelled human receptor 26 (the permissive path) in Table 4 has been used as a proxy (assumed 1.5m height rather than 0m).					

Figure 4 Ecological Receptors



3.3.3 Dispersion model and set up

For the assessment of emissions from the chimney of the proposed development, the latest ADMS atmospheric dispersion model (version 5.2.2.0) has been used. This is a well-established model originally developed on behalf of a number of UK bodies. The model can take into account the relevant information on the plant design and operations, local meteorological data, terrain and local building dimension information. ADMS has been used to predict long-term and short-term concentrations, at discrete receptors and across a gridded domain, and results have been compared with the relevant objectives.

The assessment has been based on assumed operational hours across whole calendar years (8760 hours), to take into account potential variations in meteorological conditions throughout the year and not limit operations.

The following sections detail the inputs and processes used in this assessment.

3.3.3.1 Meteorological data

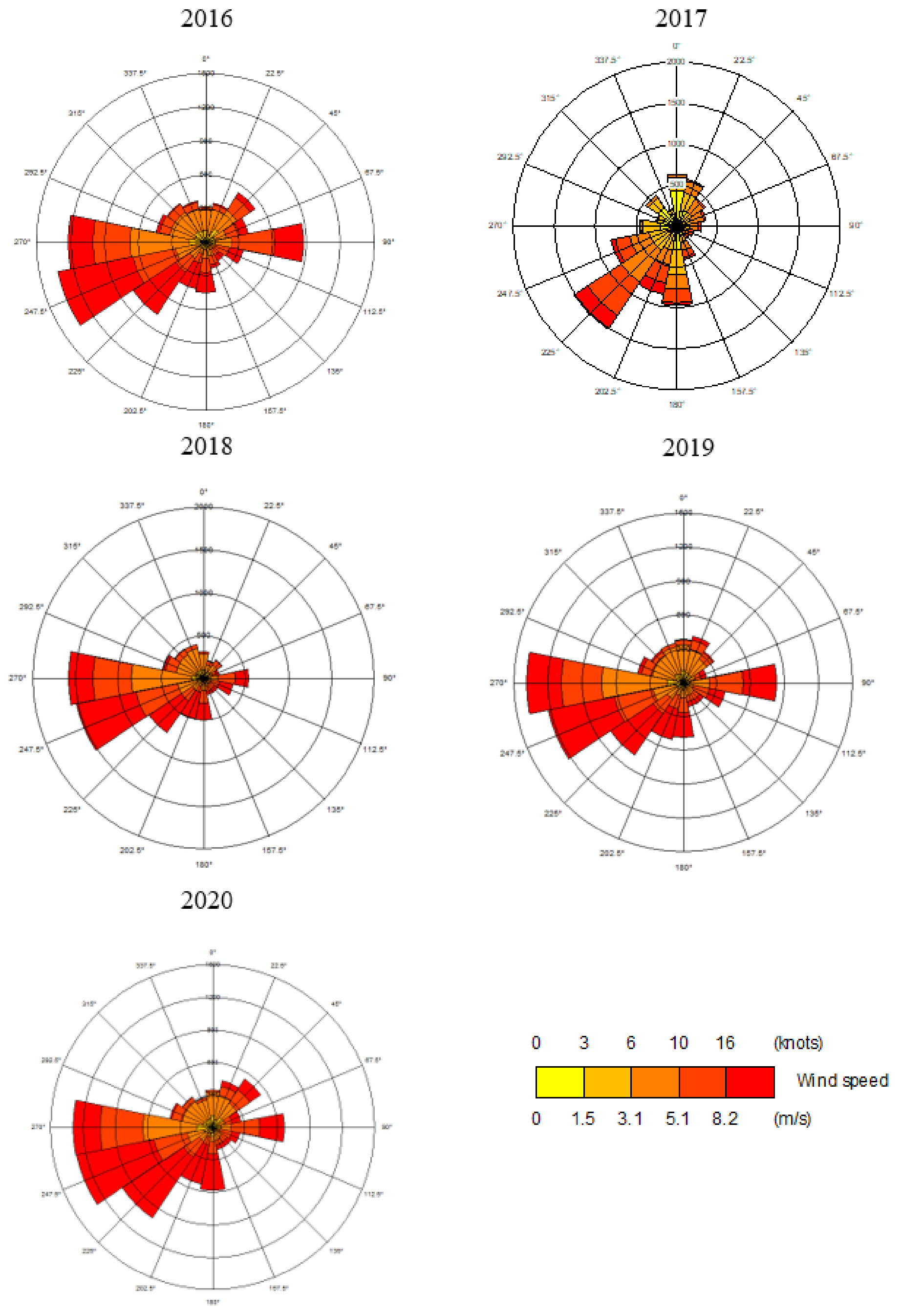
Meteorological data will be taken from the Mumbles Head monitoring station, which lies approximately 11km to the south-west of the site, across Swansea Bay. The latest five years of data (2016-2020) will be used to carry out sensitivity testing and examine the variation in predicted concentrations for this period and to determine which year of data should be used for the assessment (likely the year which produces the most pessimistic results). Wind roses for Mumbles Head for 2016-2020 can be found in Figure 5.

Comparison between another meteorological site, Rhoose, was also undertaken, however it was considered that Mumbles Head is more representative of the coastal site and was therefore taken forward for the assessment.

In order for the modelling exercise to be representative of local conditions and to predict long-term averages, the dispersion model requires representative meteorological data. Most dispersion models cannot make predictions during calm wind conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. The default option within ADMS for treating calm conditions has been implemented, by setting the minimum wind speed to 0.75m/s. LAQM.TG16 guidance recommends that the meteorological data file is tested within a dispersion model and the relevant output log file checked to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. The guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably 90%.

The datasets for 2016-2020 all had usable hours greater than 90% (2016: 99%; 2017: 93%; 2018: 95%; 2019: 92%; and 2020: 96%), and therefore the data meets the requirements of the Defra guidance and is adequate for use in dispersion modelling.

Figure 5 Windroses for Mumbles Head, 2016 to 2020



3.3.3.2 Surface roughness and minimum Monin-Obukhov length

The extent of mechanical turbulence (and hence, mixing) in the atmosphere is affected by the surface/ground over which the air is passing. Typical surface roughness values range from 1.5m (for cities, forests and industrial areas) to 0.0001m (for water or sandy deserts). In this assessment, the general land use in the local study area can be described as open moorland with some small towns and industrial areas, therefore surface roughness of 0.3m has been applied. Another model parameter is the minimum Monin-Obukhov length, which describes the minimum stability of the atmosphere. For this assessment it is proposed that a length of 10m is used representing “small towns”.

3.3.3.3 Terrain effects

Terrain effects will play a role in the dispersion of pollutants in this geographic area. The site is located in a wide valley which limits the risk of inversions trapping pollutants (which can be an issue in deep steep sided valleys). To determine whether terrain has an effect, sensitivity analysis has been carried out using terrain data as an input into the ADMS model. Terrain data has been obtained from the Ordinance Survey (OS).

Given the topography of the local area, terrain effects are likely to play an important role in the dispersion of pollutants. The site is located approximately 1km from the coast of Swansea Bay, adjacent to the River Neath. It also lies approximately 1.5km to the east of an area of wooded hills that form valleys, extending into the foothills of the Black Mountains. Terrain data will be included in the model to understand any variation in the dispersion of pollutants.

Following all the modelling sensitivity tests, results were compared, and those inputs generating realistic worse case outcomes have been taken forward. The results from these sensitivity tests are presented in section 3.4.

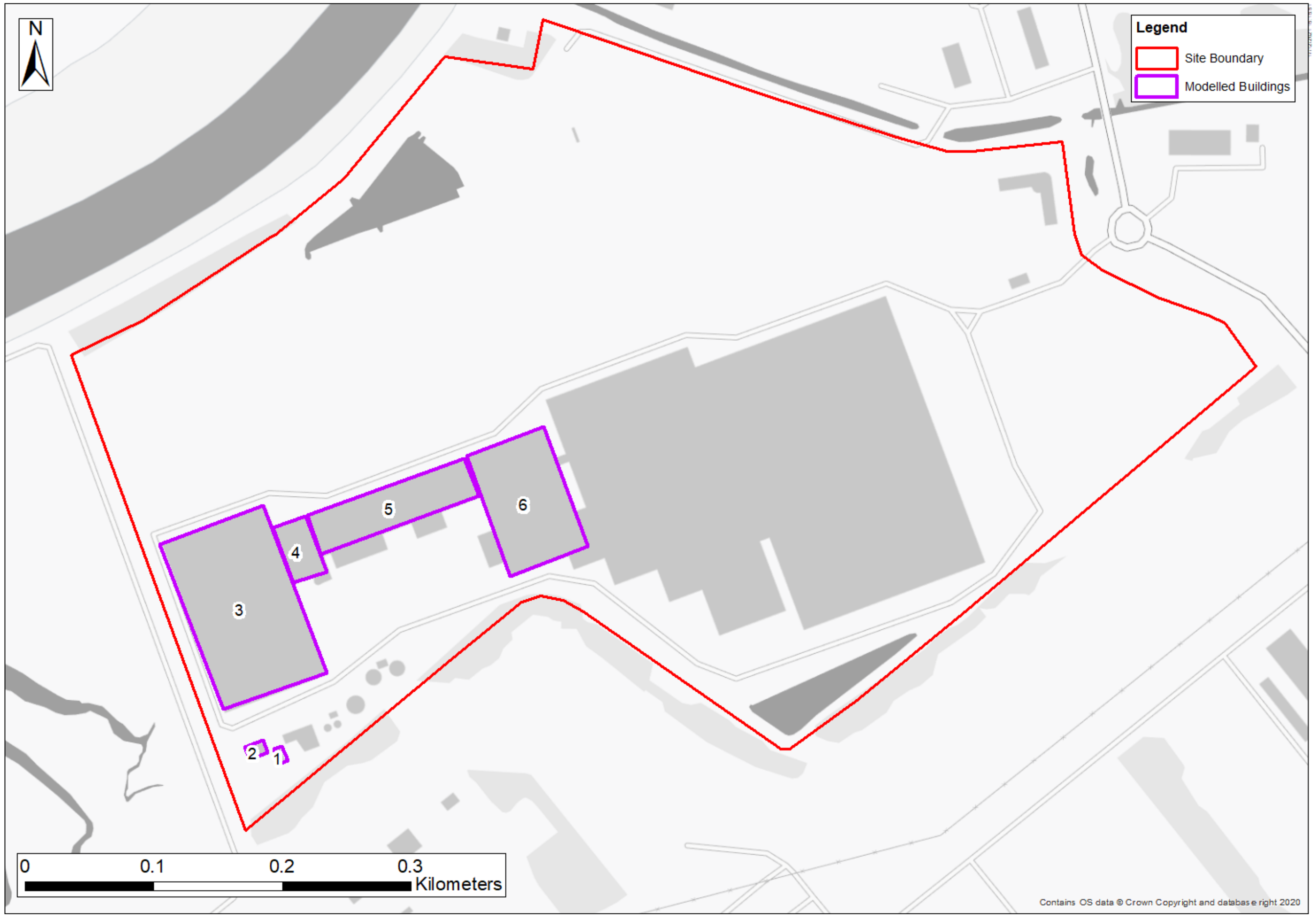
3.3.3.4 Buildings

Buildings can have a significant effect on the dispersion of pollutants and will be included within the model. Building input geometries are shown in Table 6 and Figure 6. The complex building geometry has been simplified so as to be included within the model which only accepts rectangular or circular building shapes.

Table 6 Building geometries

Building name	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	x	y				
1	273054.8	192679.5	5	6.7	12.1	69.4
2	273035.9	192683.6	6	15.3	10.3	69.7
3	273025.9	192793.3	8	86.1	139.2	69.2
4	273068.9	192838.9	9	27.4	45.4	72.5
5	273142.1	192872.4	19	131.2	31.9	69.8
6	273246.9	192876.7	8	64.8	98.4	67.6

Figure 6 Modelled buildings



3.3.3.5 Generator parameters and emissions

The proposed generators will be installed for a temporary emergency purpose whilst a new connection is installed to the existing Intertissue facility. Details for the temporary generators have been provided by Aggreko (generator supplier). The parameters for the generators are presented in Table 7 and location is shown in Figure 7 Stack locations.

Table 7 Generator stack parameters

Parameter	**Unit**	**HVO fuelled generators**	**Gas generators**
Modelled Engine	-	Cummins Diesel KTA 50 G3	GE Jenbacher 420C612
Stack location	NGR (m)	DG1: 273049, 192665 DG2: 273046, 192663 DG3: 273042, 192662 DG4: 273032, 192659 DG5: 273028, 192657 DG6: 273025, 192656 DG7: 273017, 192670 DG8: 273015, 192674 DG9: 273014, 192678	GG1: 273009, 192698 GG2: 273010, 192694 GG3: 273012, 192690
Exhaust flue diameter	m	0.305	0.330
Exhaust height (from ground)	m	2.6	5.2
Current stack height (from ground)	m	5.6	8.2
Future stack height (after 2 months)	m	14.6	8.2

Flue gas efflux velocity		m/s	54.3	27
Efflux temperature		°C	460	415
Emission concentrations	NOx	mg/Nm^3	974	95
	PM		11.6	-
	HC		11.5	-
	CO		226	375
Volumetric flow rate		m^3/s	3.96	2.34
Moisture and oxygen content at stack exit		(%)	10	10
Reference conditions	O_2	(%)	15	15
	H_2O	(%)	0	0

3.3.3.6 Generator running scenarios

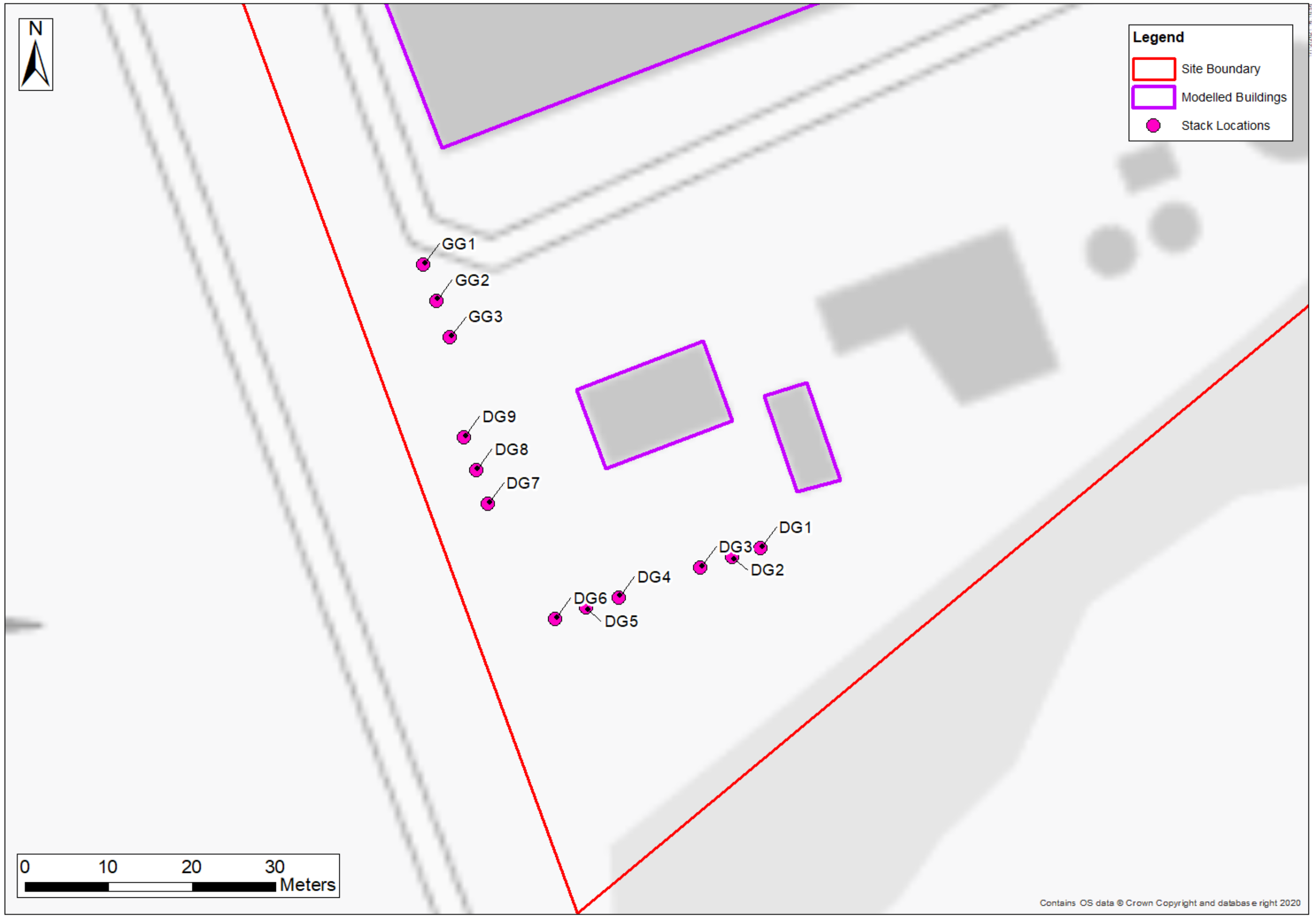
The air quality assessment has assessed a modelling scenario using a containerised emergency generator scenario provided by Aggreko, for the required power demand on-site. This is provided in Table 8.

Table 8 Generator running scenario and associated emission rates

7.5MWe demand loading (%)	**GG1**	**GG2**	**GG3**	**DG1**	**DG2**	**DG3**	**DG4**	**DG5**	**DG6**	**DG7**	**DG8**	**DG9**
	100	**100**	**100**	**63.5**	**63.5**	**63.5**	**63.5**	**63.5**	**-**	**-**	**-**	**-**
NOx emission rate (g/s)	0.49	0.49	0.49	1.51	1.51	1.51	1.51	1.51	-	-	-	-
PM emission rate (g/s)	-	-	-	0.01	0.01	0.01	0.01	0.01	-	-	-	-
HC emission rate (g/s)	-	-	-	0.02	0.02	0.02	0.02	0.02	-	-	-	-
CO emission rate (g/s)	-	-	-	0.35	0.35	0.35	0.35	0.35	-	-	-	-
Maintenance scenario												
	100	**100**	**-**	**66**	**66**	**66**	**66**	**66**	**66**	**66**	**-**	**-**
NOx emission rate (g/s)	0.49	0.49		2.61	2.61	2.61	2.61	2.61	2.61	2.61	-	-
PM emission rate (g/s)	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-

HC emission rate (g/s)	-	-	-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-	-
CO emission rate (g/s)	-	-	-	0.36	0.36	0.36	0.36	0.36	0.36	0.36	-	-

Figure 7 Stack locations



3.3.3.7 Short-term background concentrations

For many pollutants there are short-term air quality limits and EALs, such as the 15-minute mean limit for SO_2 and the 24-hour mean limit for PM_{10}. The limits are given as a permitted annual number of exceedances of a threshold concentration which can be expressed as an equivalent percentile. For instance, the SO_2 15-minute mean limit can be expressed as the 99.9th percentile of the predicted environmental concentration, that is, the sum of the contribution from the process and the background concentration.

99.9th percentile 15-minute mean SO_2 concentrations due to the process (running of the generators) were obtained as a direct output from the ADMS model. The modelled concentrations of substances emitted from the generators are combined with background concentrations of the substances present in the environment for comparison with air quality standards. In the case of long-term mean concentrations, the long-term mean concentration contributions from the generator emissions could be added directly to long-term mean background concentrations. It is not possible to add short-term peak background concentrations and process concentrations in the same way. This is because the conditions which give rise to peak ground-level concentrations of substances from an elevated source at a particular location and time are likely to be different from the conditions which give rise to peak concentrations due to emissions from other sources.

This point is addressed in EA's guidance[28] which advises that an estimate of the maximum combined pollutant concentration can be obtained by adding the maximum short-term concentration due to emissions from the source to twice the annual mean background concentration.

The same method has been applied for short-term PM_{10} concentrations and for all other pollutants with short-term limits/EALs.

3.3.3.8 NO_x to NO_2 conversion for point sources

The air quality model predicts concentrations of NO_x which is a mixture of NO_2 and nitric oxide (NO). Both gases react in the atmosphere, particularly with ozone. In general, NO_x is mainly emitted as NO and this converts to NO_2 in the atmosphere. The air quality standard has been set for NO_2 and therefore it is important that an appropriate conversion rate is used to calculate ambient NO_2 concentrations at the receptors that result from the modelled NO_X emissions. It is proposed that the EA advice on conversion rates is used, which suggests a ratio of 35% for short-term (i.e. hourly average) and 70% for long-term (i.e. annual mean) concentrations[29]. In practice, these ratios represent conditions some distance away from a release source. Close to an industrial source, the proportion of NO_2 in NOx

[28] EA (2016) Air emissions risk assessment for your environmental permit
Available at: [https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit]

[29] These proportions differ slightly from the EA guidance which suggests 100% of long-term NO_x as NO_2 and 50% of short-term NO_x as NO_2, however the proposed method is considered to be more realistic and has been agreed with the EA AQMU.

is typically much lower than this. Applying these ratios will therefore provide a conservative assessment.

3.4 Sensitivity analysis of modelling methods

In order to define the method used to undertake the assessment a number of sensitivity analyses were undertaken to determine which modelling options should or should not be included in the main assessment. Emissions from the site were used and the effect of changing elements of the modelling methodology were examined. Each is discussed in detail and the results are presented in the following sections;

- selection of met year from Mumbles Head met station (5 years examined); and
- consideration of surface roughness.

The impact on ground level concentrations for a range of pollutants and averaging periods was examined using the maximum predicted impact on the grid of receptors.

It should be noted that sensitivity testing was modelled based on a previous generator set up, using ten diesel generators. Due to time constraints, sensitivity testing could not be modelled with the generators in their current set up, however the sensitivity analysis is still considered to be relevant as it assessed the different parameters in isolation.

3.4.1 Sensitivity analysis: Selection of meteorological year

The effect of using each of the five years (2016-2020) of meteorological data from Mumbles Head on the ground level concentrations was examined for each of the following pollutants/averaging period/statistic combinations:

- maximum 15-minute mean SO_2 for each year;
- maximum 1-hour mean and annual mean NO_2 for each year; and
- maximum 24 hour mean PM_{10} for each year.

It is not necessary to carry out a sensitivity test for each pollutant as the sensitivity to meteorological year will be the same for each averaging time/statistic combination. The maximum concentration from the modelled grid is presented in Table 9 (bold indicates the maximum value in the series). The terrain model option was included.

Table 9 Sensitivity of ambient concentrations for choice of met year (µg/m^3)

Maximum concentration (µg/m^3)	**2016**	**2017**	**2018**	**2019**	**2020**
99.9th p-tile 15 min SO_2	5769.8	4779.7	5059.1	5022.8	**6665.0**
99.79th p-tile 1 hour NO_2	9565.9	9242.9	9400.9	9746.0	**13794.8**
90.41th p-tile 24 hour PM_{10}	105.8	**113.9**	96.7	105.9	109.5
Annual Mean NO_2	2693.1	2897.4	2632.7	2579.4	**2991.2**

The results show that for 15-minute, 1 hour and annual mean results, 2020 gives the highest concentrations for pollutants, therefore 2020 has been used as the meteorological year for further modelling. For one hour NO_2, 2020 data can be seen to be significantly higher (31%) than the average maximum using 2016-2019.

After consultation with NRW[30], given the difference in maximum impacts using 2020 data compared to other years, it was decided that the use of a less pessimistic met data year, such the median value of 2016 would be appropriate for use as the met year for air quality dispersion modelling.

3.4.2 Sensitivity analysis: surface roughness

The effect on pollutant concentration on surface roughness was investigated for surface roughness values of 0.5m and 0.3m, using 2016 meteorological data and a 3m stack height. The results indicate the use of 0.5m gives the highest concentrations. However, the local area can be described as open moorland with some small towns and industrial areas, therefore the use of 0.3m is considered to be more appropriate.

Table 10 Sensitivity of ambient concentrations for surface roughness (µg/m^3)

Maximum concentration (µg/m^3)	**Met year**	**0.5m**	**0.3m**
99.79th p-tile 1 hour NOx	2016	**2459.8**	2403.1
90.41th p-tile 24 hour PM_{10}	2016	**4.2**	4.0
Annual Mean NOx	2016	**305.9**	273.3

3.5 Nutrient nitrogen deposition and acid deposition

With regard to nitrogen and acid deposition, site and habitat specific critical loads and existing deposition rates have been taken from the APIS website[31]. Predicted

[30] Agreed during engagement with NRW air quality specialists during the pre-application modelling discussions in December 2021 and January 2022.
[31] http://www.apis.ac.uk/srcl

deposition at ecological receptors has been compared against the lowest critical loads to provide a worst-case assessment.

The assessment has looked at the Critical Load Functions (CLFs) for acidity using the graphs on the APIS website. The CLF graphs for the most sensitive species in each designated area have been used to estimate the worst-case impact where the impacts have not been screened out as less than 1%.

The information on the critical loads and the most sensitive habitat for each designated for vegetation of nutrient nitrogen and acidity are given in Section 5.3.1.7.

Acid deposition is assessed in terms of the CLFs for acidity, which are a function of nitrogen (N) and sulphur (S) deposition. The critical load functions are site and feature/habitat specific. Total nitrogen (N) deposition has been derived from the addition of ammonia and nitrogen dioxide deposition results. Due to HVO fuel being used, sulphur has not been accounted for.

The CLFs comprise two lines on a graph, which represent two envelopes of safety (reflecting the present uncertainty in the scientific knowledge and evidence-base on the effects of acidic air pollution on sensitive species). If the total acid deposition rate falls above the higher ‘maximum CL’ line, it is likely that there are harmful effects on the relevant habitat/features arising from the current level of acid deposition. If the total acid deposition level is below the lower ‘minimum CL’ line, it is unlikely that the feature/habitat is being harmed. If the current total acid (due to both nitrogen and sulphur) deposition level lies between the lower and upper CLFs, it is not possible to be certain that harm is occurring.

The dry deposition flux for each receptor location has been calculated based on recommended deposition velocities as shown in Table 11.

Table 11 Recommended dry deposition velocities

Chemical species	**Recommended deposition velocity, m/s**	
NO_2	Grassland	0.0015
	Forest	0.003

Conversion factors are used to convert dry deposition flux from units of µg/m^2/s to kg/ha/yr are shown in Table 12.

Table 12 Conversion factors to change units from µg/m^2/s of chemical species X to kg of X/ha/yr

Chemical species	**Conversion factor µg m^2/s of species X to kg/ha/year**	
NO_2	of N:	96

The unit of ‘equivalents’ is also used for acidification purposes, rather than a unit of mass. Essentially it means ‘moles of charge’ i.e. it is a measure of how acidifying the chemical species can be. It is denoted by ‘keq’.

To convert kg/ha/yr to keq/ha/yr, the conversion factors shown in Table 13 have been used.

Table 13 Conversion factors to alter units from kg of N or S ha/yr to keq of N or S ha/yr

Species	Conversion factor kg/ha/year to keq/ha/year
N	0.071428

3.6 Assessment of significant effects

Human receptors

The EA's Air Emissions Risk Assessment[28] provides the screening criteria to determine significance of emissions associated with industrial premises. To screen out a Process Contribution (PC), the PC must meet both of the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard
- The long-term PC is less than 1% of the long-term environmental standard

If both criteria are met, the potential impacts are considered to be insignificant. If criteria are not met, a second stage of screening is needed to determine the impact of the Predicted Environmental Concentration (PEC).

In the second stage of screening, the potential impacts are considered to be insignificant if the following requirements are met:

- The short-term PC is less than 20% of the sort-term environmental standards minus twice the long-term background concentration
- The long-term PEC is less than 70% of the long-term environmental standards

Should all of these criteria be exceeded however, it does not mean that significant impacts are predicted; rather that an assessment needs to be undertaken as to whether there is the potential for significant impacts.

Ecological receptors

Similarly, to the above process, the following criteria have been adopted in this assessment in respect to potential impacts at ecological sites:

- For SPAs, SACs, Ramsar sites for SSSIs:
    - The long-term PC is less than 1% of the long-term environmental standard for protected conservation area;
    - The short-term PC is greater than 1% but the PEC is less than 70% of the long-term environmental standards.
- For local nature sites (including Ancient Woodland):
    - The long-term and short-term PC is less than 100% of the environmental standards

Predicted PC or PEC that meet the above criteria are deemed to be insignificant. When impacts cannot be screened out as being negligible using the thresholds above, the evaluation of the significance of results requires advice from an ecologist.

3.6.1 Limitations and assumptions

Air quality dispersion modelling has inherent areas of uncertainty, including:

- simplification in model algorithms and empirical relationships that are used to stimulate complex physical and chemical processes in the atmosphere;
- spatial variability of model background concentrations;
- spatial variability of meteorological data;
- effects of terrain; and
- emissions concentrations due to varied raw material inputs.

To reduce uncertainty, sensitivity testing has been carried out as detailed within this chapter. A number of conservative assumptions have also been made and are detailed throughout this report. The methodology used within this assessment is designed to provide a robust assessment, reducing uncertainty caused by the above limitations.

4 Baseline Assessment

4.1.1 Sources of air pollution

The main sources of air pollution near the proposed development are road traffic emissions from vehicles using the M4 and existing industrial sites.

4.1.1.1 Industrial processes

Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases to the environment are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A(1), A(2), Part B or Medium Combustion Plant (MCP) processes, regulated through the Pollution Prevention and Control (PPC) system[32,33]. The larger more polluting processes are regulated by the Natural Resources Wales (NRW). The larger, more polluting processes are regulated by NRW and the smaller, less polluting ones by the local authorities. Local authorities tend to regulate only for emissions to air, whereas NRW regulates emissions to air, water and land.

The site sits within Baglan Energy Park, as outlined in Figure 8. There is one regulated Part A(1) industrial installation within the energy park (Baglan power station) listed on the NRW website within 2km of the site as shown in Table 14 and Figure 8. However, in March 2021, the Baglan Energy Park power station was placed into Official Receivership.

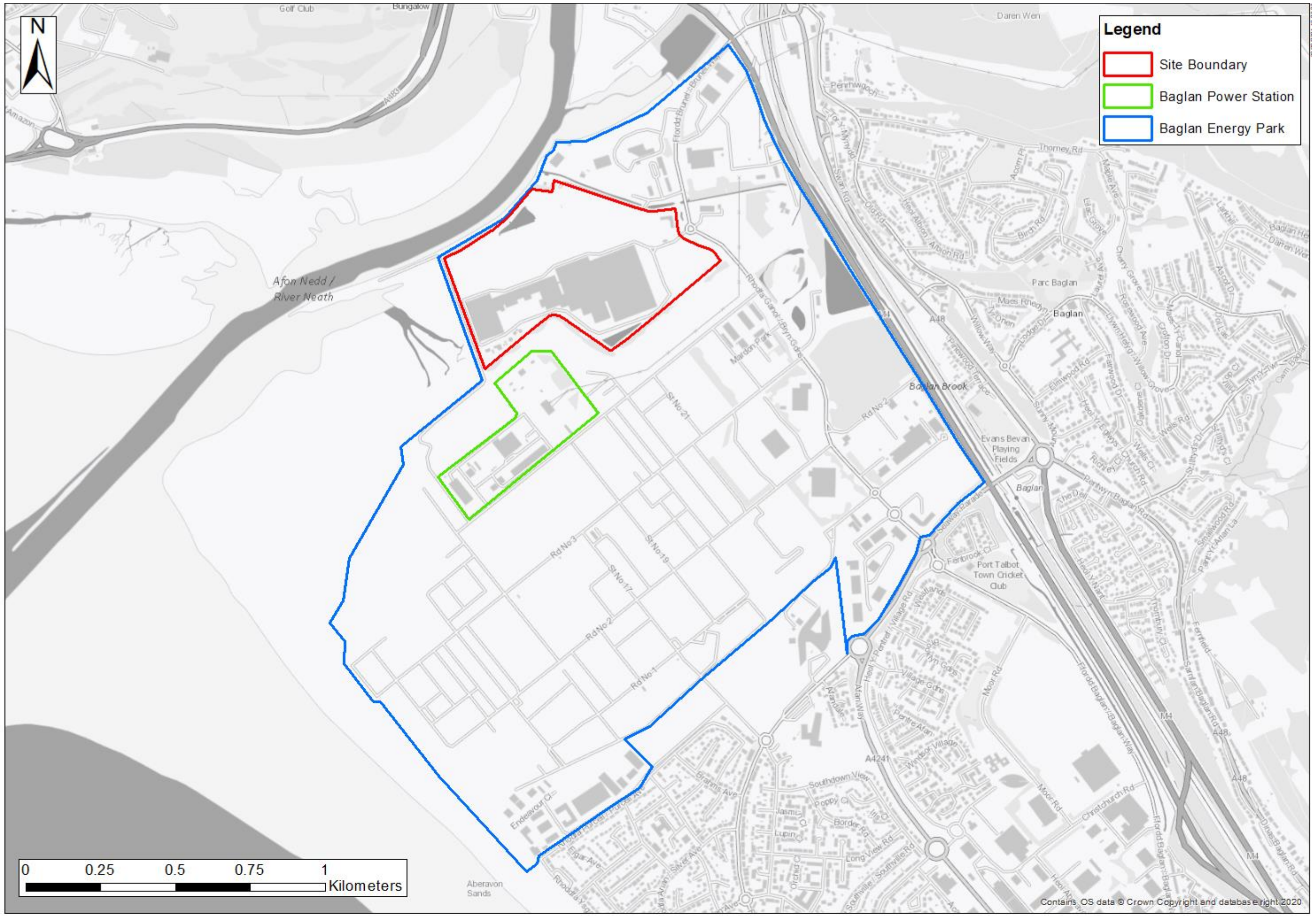
The contribution of all industrial processes to local air quality are assumed to be included in the background concentrations presented it this section.

Table 14 Industrial sources within 2km of the site

Site ID	Permit number	Name of operator	OS coordinates (X, Y)	Type of industry	Distance from proposed scheme (m)
1	BJ7891IT	Baglan Operations Limited	273110, 192370	Power Station	100

[32] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).
[33] The Environmental Permitting (England and Wales) Regulations 2016, SI 2016/1154.

Figure 8 Industrial sources within 2km of the site



4.1.1.2 Local air quality

The Environment Act 1995[9] required local authorities to review and assess air quality with respect to the objectives for seven pollutants specified in the National Air Quality Strategy. Local authorities are required to carry out an assessment and an Annual Status Report (ASR). If the ASR identifies potential hotspot areas likely to exceed air quality objectives, then a detailed assessment of those areas is required. Where objectives are predicted not to be met, local authorities must declare the area as an AQMA. In addition, local authorities are required to produce an AQAP which includes measures to improve air quality within the AQMA.

There are no AQMAs within 2km of the Site. The closest AQMA are the Neath Port Talbot AQMA Taibach/Margam and Swansea AQMA, located approximately 6.5km to the southeast and west of the Site, respectively, and would not be affected by the Site.

4.1.2 Local air quality monitoring

A review of local air quality monitoring within the vicinity of the Intertissue site has been carried out and shows that NPTC carried out passive diffusion tube monitoring in the vicinity of the site (within 2km). Details of the nearest monitoring locations are outlined in section 4.1.2. The locations of the monitoring sires are shown in Figure 9,

Annual mean NO_2 concentrations for 2015 to 2019 are shown in Table 17 NPTC NO_2 monitoring data. Results show that concentrations were well below the 40µg/m^3 objective at all monitoring locations in all years.

4.1.3 Defra estimated background concentrations

Background concentrations refer to the existing levels of pollution in the atmosphere, produced by a variety of stationary and non-stationary sources, such as roads and industrial processes. The Defra website includes estimated background pollutant concentrations for NOx, NO_2, PM_{10}, $PM_{2.5}$ and SO_2 for each 1km-by-1km OS grid square in the UK.

Due to the Covid-19 pandemic in 2020, background pollutant concentrations for the background year of 2019 have been obtained to represent more normal conditions. Concentrations have been obtained for the four grid squares in which the site is located, these are shown Table 15. It can be observed that the annual mean background concentrations are well below the relevant air quality standards for all pollutants.

Table 15 Defra background concentrations in 2019 around the site

OS grid square		**Average annual mean concentrations (µg/m^3)**					
X	**Y**	**NOx**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**SO_2***	**CO**
273500	193500	18.4	13.7	12.5	7.9	2.8	0.1

OS grid square		Average annual mean concentrations (µg/m^3)					
X	Y	NOx	NO_2	PM_{10}	$PM_{2.5}$	SO_2*	CO
273500	192500	14.1	10.6	11.0	7.0	2.8	0.1
273500	192500	14.1	10.6	11.0	7.0	2.8	0.1
272500	192500	9.0	7.1	10.4	6.7	n/a	0.1
Average		13.9	10.5	11.2	7.2	2.8	0.1

Note: * Year adjustment factors for SO_2 are no longer provided by Defra as background levels near industrial sites would change very little, i.e. the factor would be close to 1.
n/a: Data not available from Defra.

4.1.4 Nitrogen dioxide (NO_2)

Neath Port Talbot County Borough Council (NPTC) only carries out passive diffusion tube monitoring within the vicinity of the site. Details of the nearest monitoring locations are provided in Table 16 and Table 17. The site locations are also presented in Figure 9.

Annual mean NO_2 concentrations for 2015 to 2019 are shown in Table 17. Results show that concentrations were well below the 40µg/m^3 objective at all monitoring locations in all years.

Table 16 NPTC NO_2 monitoring sites, within 2km of the site

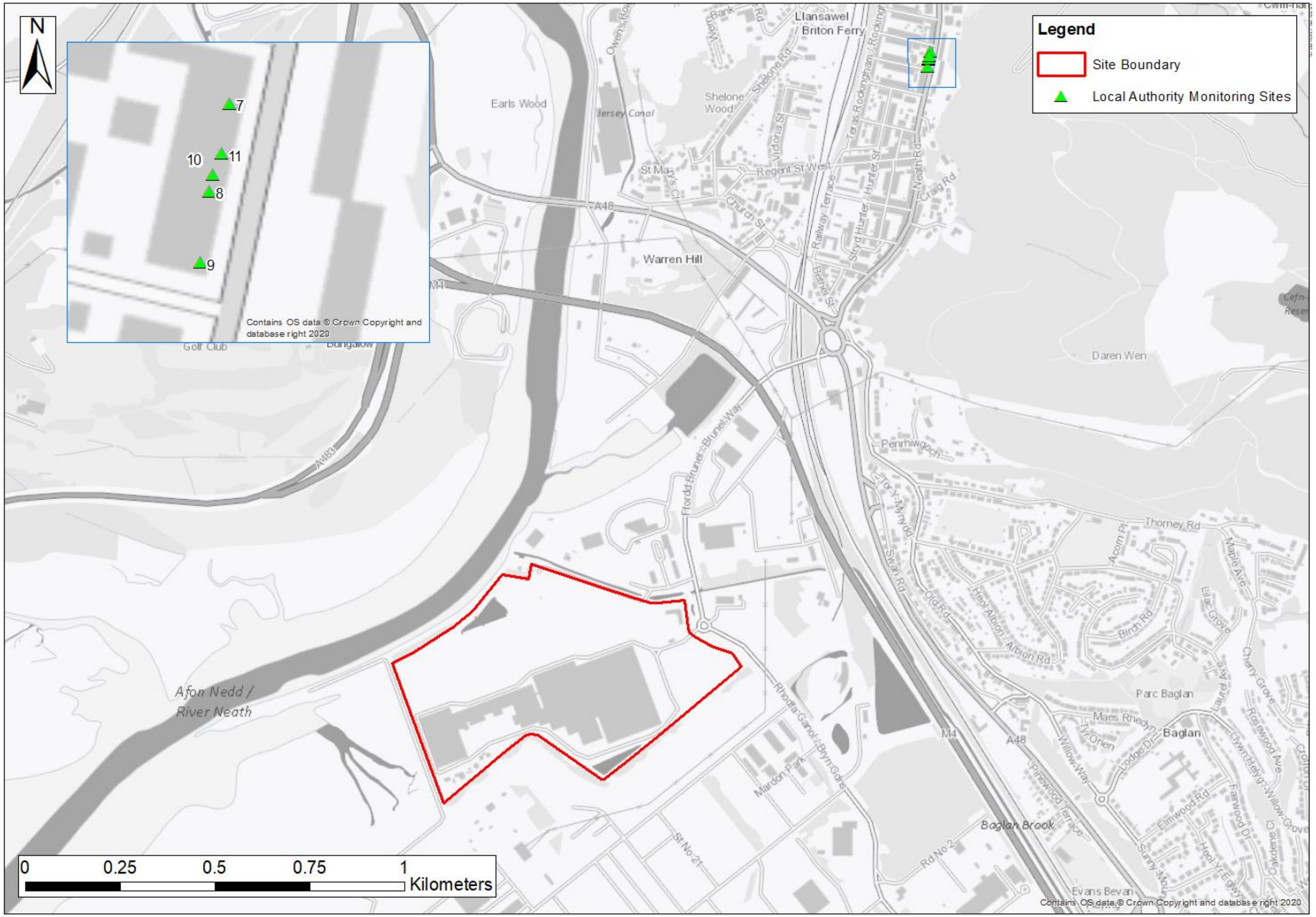
Site ID	Site name	Site type	Collected with a continuous analyser?	OS grid reference	
				x	y
7	Moby's, Neath Road, Briton Ferry	Roadside	N	274312	194601
8	185 Neath Road, Briton Ferry	Roadside	N	274307	194580
9	179 Neath Road, Briton Ferry	Roadside	N	274305	194563
10	187 Neath Road, Briton Ferry	Roadside	N	274308	194584
11	189 Neath Road, Briton Ferry	Roadside	N	274310	194589

Table 17 NPTC NO_2 monitoring data

Site ID	Site name	Site type	NO_2 concentration (µg/m^3)				
			2015	2016	2017	2018	2019
7	Moby's, Neath Road, Briton Ferry	Roadside	27.9	27.6	30.2	24.5	26.3
8	185 Neath Road, Briton Ferry	Roadside	28.1	27.5	29.0	24.9	23.9
9	179 Neath Road, Briton Ferry	Roadside	28.6	26.3	28.3	23.5	25.1

Site ID	Site name	Site type	NO_2 concentration (µg/m^3)				
			2015	2016	2017	2018	2019
10	187 Neath Road, Briton Ferry	Roadside	28.0	26.1	28.9	24.6	26.1
11	189 Neath Road, Briton Ferry	Roadside	28.1	27.3	29.2	23.8	26.1

Figure 9 Local authority monitoring locations



4.1.5 Sulphur dioxide (SO_2)

SO_2 is monitored within NPTC at Neath Port Talbot Fire Station, details of the monitoring site can be found in Table 18. NPTC records the exceedances of SO_2 at the monitoring station. There were no exceedances of the 15-minute average, 1-hour mean or the daily mean for 2015-2019.

Table 18 NPTC SO_2 monitoring site

Site ID	Site name	Site type	OS grid reference	
			X	Y
PT2	Port Talbot Fire Station	Urban Industrial	277388	188733

NPTC has not recorded the maximum SO_2 concentrations therefore concentrations have been taken from the relevant Defra 1km by 1km OS grid squares. Estimated background concentrations for the existing baseline year of 2019 have been obtained from four grid squares in which cover the site boundary and surrounding areas, as shown in Table 19.

Table 19 Defra 2019 SO_2 data

Grid square		SO_2 concentration (ug/m^3)	
X	Y	Annual mean	15 min/ 1 hour/ 24 hour mean
273500	193500	2.78	5.56
273500	192500	2.76	5.52
273500	192500	2.76	5.52
272500	192500	n/a	n/a
Note: n/a indicates that no background data is available for SO_2 at this grid square Year adjustment factors for SO_2 are no longer provided by Defra as SO_2 background levels near industrial sources would change very little, i.e., the factor would be close to 1.			

4.1.6 Fine particulate matter (PM_{10})

PM_{10} is monitored within the NPTC administrative area. Details of the monitoring locations where PM_{10} and $PM_{2.5}$ is monitored are shown in Table 20.

Table 20 NPTC PM monitoring locations

Site ID	Site name	Site type	Pollutants monitored	OS grid reference	
				X	Y
PT2	Port Talbot Fire Station	Industrial	PM_{10}, $PM_{2.5}$	277388	188733
DS1	Dyffryn School	Industrial	PM_{10}	278700	187387
TW1	Twll-yn-y Wal Park	Industrial	PM_{10}	278196	187891

Site ID	Site name	Site type	Pollutants monitored	OS grid reference	
				X	Y
LW1	Port Talbot Little Warren	Industrial	PM_{10}	275313	188879
PS2	Prince St.	Industrial	PM_{10}, $PM_{2.5}$	277689	188235

The monitoring data for PM_{10} in 2015-2019 has been reviewed and presented in Table 21. PM_{10} concentrations are below the relevant standards of 40µg/m^3 for annual mean and 50µg/m^3 for the 24-hour mean for 2015-2019.

Table 21 NPTC PM_{10} concentrations for annual mean and 24-hour mean

Site ID	PM_{10} annual mean (µg/m^3)					PM_{10} 24-hour mean (µg/m^3)				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
PT2	27	22	23	23	21	28	8	17	11	12
DS1	20	18	21	-	22	5	0	2	n/a	2
TW1	26	24	21	21	21	10	4	3	9	10
LW1	24	21	21	21	20	15	9	16	9	9
PS2	n/a	23	25	23	20	n/a	9	18	12	8

The monitoring data for $PM_{2.5}$ has been reviewed for 2015-2019 and is presented in Table 22 $PM_{2.5}$ concentrations are below the relevant standard of 25µg/m^3 from 2015-2019.

Table 22 NPTCBC $PM_{2.5}$ concentrations for annual mean

Site ID	$PM_{2.5}$ annual mean (µg/m^3)				
	2015	2016	2017	2018	2019
PT2	10	9	10	11	11
PS2	10	10	10	9	9

Due to the location of the monitoring sites being over 2km from the site, PM_{10} and $PM_{2.5}$ concentrations have been taken from the relevant Defra 1km by 1km OS grid squares. Estimated background concentrations for the existing baseline year of 2019 have been obtained from four grid squares in which cover the site boundary and surrounding areas. They are shown in Table 23. Both PM_{10} and $PM_{2.5}$ concentrations are below the relevant air quality objectives.

Table 23 Defra 2019 annual mean concentrations for PM_{10}

Grid square		PM_{10} concentration (µg/m^3)	$PM_{2.5}$ concentration (µg/m^3)
X	Y		
273500	193500	12.36	7.71
273500	192500	11.04	6.86
273500	192500	11.04	6.86
272500	192500	10.40	6.60

4.1.7 Carbon Monoxide (CO)

CO is monitored within NPTC at Neath Port Talbot Fire Station, details of the monitoring site can be found in Table 24. NPTC records the exceedances of CO at the monitoring station. There were no exceedances of the 8-hour average of 10 mg/m^3 during 2019.

Table 24 NPTC CO monitoring site

Site ID	Site name	Site type	OS grid reference	
			X	Y
PT2	Port Talbot Fire Station	Urban Industrial	277388	188733

Due to the distance of the CO monitoring site from the site, and that NPTC have not recorded maximum CO concentrations, estimated background concentrations have been taken from the relevant 1km by 1km OS grid squares. Estimated background concentrations for the existing baseline year of 2019 have been obtained from four grid squares in which cover the site boundary and surrounding areas, as shown in Table 25.

Table 25 Defra 2019 CO data

Grid square		CO concentration (ug/m^3)
X	Y	Annual mean
273500	193500	0.1018
273500	192500	0.1005
273500	192500	0.1005
272500	192500	n/a
Note: n/a indicates that no background data is available for CO at this grid square An adjustment factor of 0.439 has been used to project 2001 reference year background concentrations of CO.		

5 Assessment of operation effects

5.1 Human receptors

5.1.1 Temporary Generator Emissions Only

This section presents the predicted impacts of process contribution (PC) and predicted environmental concentration (PEC) resulting under the operation of the temporary generators.

As seen in Table 26 and Table 27, predicted hourly mean NO_2 concentrations (99.79th %ile) and annual NO_2 show exceedances at individual receptors, 21 and 26 (the former Baglan Power Plant and permissive path respectively) for both the 3m stack option. All exceedances are resolved with a 12m stack for all pollutants.

These potential impacts however are not considered to be significant. In-line with the definition of what should be considered as a sensitive receptor as part of Local Air Quality Management and the Air Quality Standards Regulations, a sensitive receptor relevant to the assessment includes residential properties, schools and care homes, for example. Most importantly however, it is where members of the public could reasonably be exposed to pollutant concentrations for durations matching the averaging periods within the Air Quality Standards (1-hour being the shortest for NO_2). As there is no public access to the former Bagan Plant site, there will be no public exposure and therefore no significant impacts are likely to occur at this location.

With regard to the permissive path, following discussion with NPTC, it has been agreed that the path will be temporarily closed for the duration of the generators operating to protect the health of the public. This was agreed via email with Jon Griffiths on 09/03/2022. Again, as there will be no public exposure no significant impacts are likely to occur at this location.

NO_x emissions were reduced by 40% in the HVO model runs compared to using traditional diesel fuel. There is evidence that HVO also reduces PM_{10}, $PM_{2.5}$ and CO. PM reductions of 30% have been applied and 35% for CO. HVO is also a sulphur free fuel, therefore sulphur has not been modelled as it will have negligible impacts on human receptors.

Detailed results at each receptor for all pollutants are provided below in Table 26 to Table 31 for 3m and 12m stacks on the HVO generators respectively.

It was identified in the BAT assessment that the hourly mean NO_2 concentrations were of greatest concern in the study. Therefore, contours have been provided for hourly mean NO_2 concentrations for HVO stack heights of 3m and 12m. These can be found in Figure 10 and Figure 11 respectively.

5.1.1.1 Nitrogen dioxide (NO_2)

Table 26 Predicted NO_2 concentrations at human receptor locations for a 7.5Mwe scenario with 3m stacks

Receptor	NO_2 annual mean			NO_2 99.79th percentile – 1 hour mean		
	Air quality standard: 40µg/m^3			Air quality standard: 200µg/m^3 not to be exceeded more than 18 times per year (99.79th percentile)		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
1	10.5	1.2	11.7	21.1	22.9	44.0
2	10.5	1.3	11.8	21.1	21.2	42.2
3	13.6	1.0	14.6	27.2	18.6	45.8
4	12.0	1.6	13.6	23.9	46.9	70.8
5	12.0	1.4	13.4	23.9	60.0	83.9
6	13.6	1.2	14.8	27.2	23.7	50.9
7	9.6	0.6	10.2	19.2	13.2	32.4
8	7.9	1.3	9.2	15.7	24.8	40.5
9	10.5	1.2	11.7	21.1	21.1	42.2
10	10.5	0.9	11.5	21.1	23.8	44.8
11	13.6	1.4	15.0	27.2	21.9	49.1
12	12.0	2.0	14.0	23.9	51.0	75.0
13	9.0	0.3	9.3	18.0	7.4	25.5
14	9.0	0.3	9.3	18.0	10.1	28.2
15	12.0	1.0	13.0	23.9	22.5	46.4
16	12.0	1.9	13.8	23.9	20.9	44.8
17	7.9	1.1	9.0	15.7	21.9	37.6
18	7.9	0.8	8.7	15.7	20.0	35.7
19	13.7	1.4	15.1	27.4	19.9	47.3
20	10.6	5.7	16.4	21.3	43.6	64.8
21	10.6	45.1	**55.8**	21.3	290.8	**312.1**
22	10.6	14.0	24.7	21.3	116.4	137.6

Receptor	NO_2 annual mean			NO_2 99.79th percentile – 1 hour mean		
	Air quality standard: 40µg/m^3			Air quality standard: 200µg/m^3 not to be exceeded more than 18 times per year (99.79th percentile)		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
23	10.6	4.4	15.0	21.3	38.4	59.7
24	13.7	3.6	17.2	27.4	46.2	73.5
25	13.7	2.9	16.6	27.4	37.8	65.1
26	10.6	35.8	**46.4**	21.3	361.0	**382.3**
N.B. concentrations in bold indicate an exceedance of the air quality limit value. * Results rounded to 1 decimal place						

Table 27 Predicted NO_2 concentrations at human receptor locations for a 7.5MW scenario with 12m stacks

Receptor	NO_2 annual mean			NO_2 99.79th percentile – 1 hour mean		
	Air quality standard: 40µg/m^3			Air quality standard: 200µg/m^3 not to be exceeded more than 18 times per year (99.79th percentile)		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
1	10.5	0.9	11.5	21.1	14.8	35.9
2	10.5	1.1	11.6	21.1	17.1	38.1
3	13.6	0.9	14.5	27.2	11.7	38.9
4	12.0	1.6	13.6	23.9	45.2	69.1
5	12.0	1.4	13.4	23.9	51.6	75.5
6	13.6	1.0	14.6	27.2	17.2	44.4
7	9.6	0.4	10.1	19.2	10.0	29.2
8	7.9	1.1	8.9	15.7	16.4	32.1
9	10.5	1.0	11.5	21.1	14.6	35.7
10	10.5	0.8	11.3	21.1	13.7	34.8
11	13.6	1.2	14.8	27.2	13.9	41.1
12	12.0	1.9	13.8	23.9	36.3	60.2

Receptor	NO_2 annual mean			NO_2 99.79th percentile – 1 hour mean		
	Air quality standard: 40µg/m^3			Air quality standard: 200µg/m^3 not to be exceeded more than 18 times per year (99.79th percentile)		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
13	9.0	0.2	9.2	18.0	6.2	24.2
14	9.0	0.3	9.3	18.0	8.7	26.7
15	12.0	0.9	12.9	23.9	17.9	41.8
16	12.0	1.7	13.7	23.9	16.5	40.5
17	7.9	0.9	8.7	15.7	15.6	31.3
18	7.9	0.7	8.5	15.7	14.4	30.1
19	13.7	1.2	14.9	27.4	15.0	42.4
20	10.6	5.0	15.6	21.3	39.2	60.5
21	10.6	16.4	27.1	21.3	153.5	174.7
22	10.6	9.3	19.9	21.3	82.4	103.6
23	10.6	4.0	14.6	21.3	31.0	52.2
24	13.7	3.1	16.8	27.4	30.2	57.6
25	13.7	2.6	16.3	27.4	25.4	52.7
26	10.6	8.8	19.4	21.3	111.6	132.9
N.B. concentrations in bold indicate an exceedance of the air quality limit value. * Results rounded to 1 decimal place						

5.1.1.2 Fine particulate matter (PM_{10} and $PM_{2.5}$)

Table 28 Predicted PM_{10} and $PM_{2.5}$ concentrations at human receptor locations for a 7.5MW scenario and 3m stacks

Receptor	PM_{10} 90.41th percentile – 24-hour mean. Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			PM_{10} – annual mean. Air quality standard: 40µg/m³			$PM_{2.5}$ – annual mean. Air quality standard:20µg/m³		
	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
1	24.8	<0.1	24.9	12.4	<0.1	12.4	8.0	<0.1	8.0
2	24.8	<0.1	24.9	12.4	<0.1	12.4	8.0	<0.1	8.0
3	26.4	<0.1	26.5	13.2	<0.1	13.2	8.2	<0.1	8.3
4	24.8	<0.1	24.8	12.4	<0.1	12.4	7.9	<0.1	8.0
5	24.8	<0.1	24.8	12.4	<0.1	12.4	7.9	<0.1	8.0
6	26.4	<0.1	26.5	13.2	<0.1	13.2	8.2	<0.1	8.3
7	23.5	<0.1	23.5	11.8	<0.1	11.8	7.7	<0.1	7.7
8	23.4	<0.1	23.4	11.7	<0.1	11.7	7.3	<0.1	7.4
9	24.8	<0.1	24.9	12.4	<0.1	12.4	8.0	<0.1	8.0
10	24.8	<0.1	24.8	12.4	<0.1	12.4	8.0	<0.1	8.0
11	26.4	<0.1	26.5	13.2	<0.1	13.2	8.2	<0.1	8.3
12	24.8	<0.1	24.9	12.4	<0.1	12.4	7.9	<0.1	8.0
13	21.9	<0.1	21.9	11.0	<0.1	11.0	7.0	<0.1	7.0
14	21.9	<0.1	21.9	11.0	<0.1	11.0	7.0	<0.1	7.0
15	24.8	<0.1	24.8	12.4	<0.1	12.4	7.9	<0.1	8.0
16	24.8	<0.1	24.9	12.4	<0.1	12.4	7.9	<0.1	8.0
17	23.4	<0.1	23.4	11.7	<0.1	11.7	7.3	<0.1	7.4
18	23.4	<0.1	23.4	11.7	<0.1	11.7	7.3	<0.1	7.4
19	24.9	<0.1	24.9	12.5	<0.1	12.5	7.9	<0.1	7.9
20	22.1	0.1	22.2	11.0	<0.1	11.1	7.0	0.1	7.1

Receptor	PM_{10} 90.41th percentile – 24-hour mean			PM_{10} – annual mean			$PM_{2.5}$ – annual mean		
	Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			Air quality standard: 40µg/m³			Air quality standard:20µg/m³		
	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
21	22.1	1.1	23.2	11.0	0.3	11.3	7.0	1.1	8.1
22	22.1	0.4	22.4	11.0	0.1	11.1	7.0	0.4	7.4
23	22.1	0.1	22.2	11.0	<0.1	11.1	7.0	0.1	7.1
24	24.9	0.1	25.0	12.5	<0.1	12.5	7.9	0.1	7.9
25	24.9	0.1	25.0	12.5	<0.1	12.5	7.9	0.1	7.9
26	22.1	1.7	23.8	11.0	0.4	12.4	7.0	1.7	8.7
* Results rounded to 1 decimal place									

Table 29 Predicted PM_{10} and $PM_{2.5}$ concentrations at human receptor locations for a 7.5MW scenario and 12m stacks

Receptor	PM_{10} 90.41th percentile – 24-hour mean			PM_{10} – annual mean			$PM_{2.5}$ – annual mean		
	Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			Air quality standard: 40µg/m³			Air quality standard:20µg/m³		
	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
1	24.8	<0.1	24.8	12.4	<0.1	12.4	8.0	<0.1	8.0
2	24.8	<0.1	24.8	12.4	<0.1	12.4	8.0	<0.1	8.0
3	26.4	<0.1	26.5	13.2	<0.1	13.2	8.2	<0.1	8.3
4	24.8	<0.1	24.8	12.4	<0.1	12.4	7.9	<0.1	8.0
5	24.8	<0.1	24.8	12.4	<0.1	12.4	7.9	<0.1	8.0
6	26.4	<0.1	26.5	13.2	<0.1	13.2	8.2	<0.1	8.3

Receptor	PM_{10} 90.41th percentile – 24-hour mean			PM_{10} – annual mean			$PM_{2.5}$ – annual mean		
	Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			Air quality standard: 40µg/m³			Air quality standard:20µg/m³		
	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background Concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
7	23.5	<0.1	23.5	11.8	<0.1	11.8	7.7	<0.1	7.7
8	23.4	<0.1	23.4	11.7	<0.1	11.7	7.3	<0.1	7.4
9	24.8	<0.1	24.8	12.4	<0.1	12.4	8.0	<0.1	8.0
10	24.8	<0.1	24.8	12.4	<0.1	12.4	8.0	<0.1	8.0
11	26.4	<0.1	26.5	13.2	<0.1	13.2	8.2	<0.1	8.3
12	24.8	<0.1	24.9	12.4	<0.1	12.4	7.9	<0.1	8.0
13	21.9	<0.1	21.9	11.0	<0.1	11.0	7.0	<0.1	7.0
14	21.9	<0.1	21.9	11.0	<0.1	11.0	7.0	<0.1	7.0
15	24.8	<0.1	24.8	12.4	<0.1	12.4	7.9	<0.1	8.0
16	24.8	<0.1	24.9	12.4	<0.1	12.4	7.9	<0.1	8.0
17	23.4	<0.1	23.4	11.7	<0.1	11.7	7.3	<0.1	7.4
18	23.4	<0.1	23.4	11.7	<0.1	11.7	7.3	<0.1	7.4
19	24.9	<0.1	24.9	12.5	<0.1	12.5	7.9	<0.1	7.9
20	22.1	0.1	22.2	11.0	<0.1	11.1	7.0	0.1	7.1
21	22.1	0.3	22.4	11.0	0.1	11.1	7.0	0.3	8.1
22	22.1	0.2	22.3	11.0	0.1	11.1	7.0	0.2	7.4
23	22.1	0.1	22.2	11.0	<0.1	11.1	7.0	0.1	7.1
24	24.9	0.1	25.0	12.5	<0.1	12.5	7.9	0.1	7.9
25	24.9	<0.1	25.0	12.5	<0.1	12.5	7.9	<0.1	7.9
26	22.1	<0.1	22.1	11.0	<0.1	11.1	7.0	<0.1	8.7
* Results rounded to 1 decimal place									

5.1.1.3 Carbon Monoxide (CO)

Table 30 Predicted CO concentrations at human receptor locations for a 7.5MW scenario with 3m stacks

Receptor	Maximum annual 8-hour running mean			1-hour mean		
	Air quality standard: 10,000μg/m^3			Air quality standard: 30,000μg/m^3		
	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)
1	0.5	9.2	9.7	0.5	16.5	17.0
2	0.5	8.0	8.5	0.5	21.3	21.8
3	0.5	4.4	4.9	0.5	11.7	12.2
4	0.5	23.2	23.7	0.5	99.3	99.8
5	0.5	23.0	23.5	0.5	98.0	98.5
6	0.5	6.9	7.4	0.5	16.3	16.8
7	0.5	7.0	7.5	0.5	41.6	42.1
8	0.4	7.2	7.6	0.4	17.6	18.0
9	0.5	7.8	8.3	0.5	12.5	13.0
10	0.5	4.5	5.0	0.5	15.6	16.1
11	0.5	6.1	6.6	0.5	13.9	14.4
12	0.5	13.3	13.8	0.5	56.1	56.6
13	0.4	3.7	4.1	0.4	16.5	16.9
14	0.4	4.6	5.0	0.4	15.8	16.2
15	0.5	12.6	13.1	0.5	67.6	68.1
16	0.5	12.2	12.7	0.5	76.3	76.8
17	0.4	8.8	9.2	0.4	16.9	17.3
18	0.4	5.9	6.3	0.4	17.1	17.5
19	0.5	13.2	13.7	0.5	86.9	87.4
20	0.5	20.4	20.9	0.5	37.6	38.1
21	0.5	154.2	154.7	0.5	186.5	187.0
22	0.5	53.6	54.1	0.5	69.3	69.8
23	0.5	12.3	12.8	0.5	36.8	37.3
24	0.5	15.2	15.7	0.5	75.7	76.2

Receptor	Maximum annual 8-hour running mean Air quality standard: 10,000μg/m^3			1-hour mean Air quality standard: 30,000μg/m^3		
	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)
25	0.5	12.5	13.0	0.5	77.4	77.9
26	0.5	238.0	238.5	0.5	252.4	252.9

Table 31 Predicted CO concentrations at human receptor locations for a 7.5MW scenario and 12m stacks

Receptor	Maximum annual 8-hour running mean Air quality standard: 10,000μg/m^3			1-hour mean Air quality standard: 30,000μg/m^3		
	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)
1	0.5	4.7	5.2	0.5	14.2	14.7
2	0.5	4.6	5.1	0.5	11.6	12.1
3	0.5	3.9	4.4	0.5	8.4	8.9
4	0.5	23.3	23.8	0.5	101.8	102.3
5	0.5	23.0	23.5	0.5	93.6	94.1
6	0.5	5.7	6.2	0.5	12.4	12.9
7	0.5	2.3	2.8	0.5	5.7	6.2
8	0.4	5.4	5.8	0.4	15.8	16.2
9	0.5	4.8	5.3	0.5	10.9	11.4
10	0.5	3.8	4.3	0.5	10.7	11.2
11	0.5	5.3	5.8	0.5	10.2	10.7
12	0.5	11.2	11.7	0.5	62.4	62.9
13	0.4	2.0	2.4	0.4	9.5	9.9
14	0.4	2.3	2.7	0.4	13.2	13.6
15	0.5	9.2	9.7	0.5	67.2	67.7
16	0.5	6.7	7.2	0.5	24.1	24.6
17	0.4	5.3	5.7	0.4	15.5	15.9
18	0.4	5.5	5.9	0.4	10.6	11.0

Receptor	Maximum annual 8-hour running mean Air quality standard: 10,000μg/m^3			1-hour mean Air quality standard: 30,000μg/m^3		
	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)
19	0.5	6.6	7.1	0.5	33.3	33.8
20	0.5	16.7	17.2	0.5	27.3	27.8
21	0.5	74.6	75.1	0.5	87.9	88.4
22	0.5	37.5	38.0	0.5	48.6	49.1
23	0.5	10.3	10.8	0.5	26.6	27.1
24	0.5	7.3	7.8	0.5	19.2	19.7
25	0.5	6.9	7.4	0.5	18.3	18.8
26	0.5	17.7	18.2	0.5	90.5	91.0

Figure 10 Area of exceedance of the hourly mean NO_2 air quality standard (99.79th percentile) using 3m stacks on HVO generators

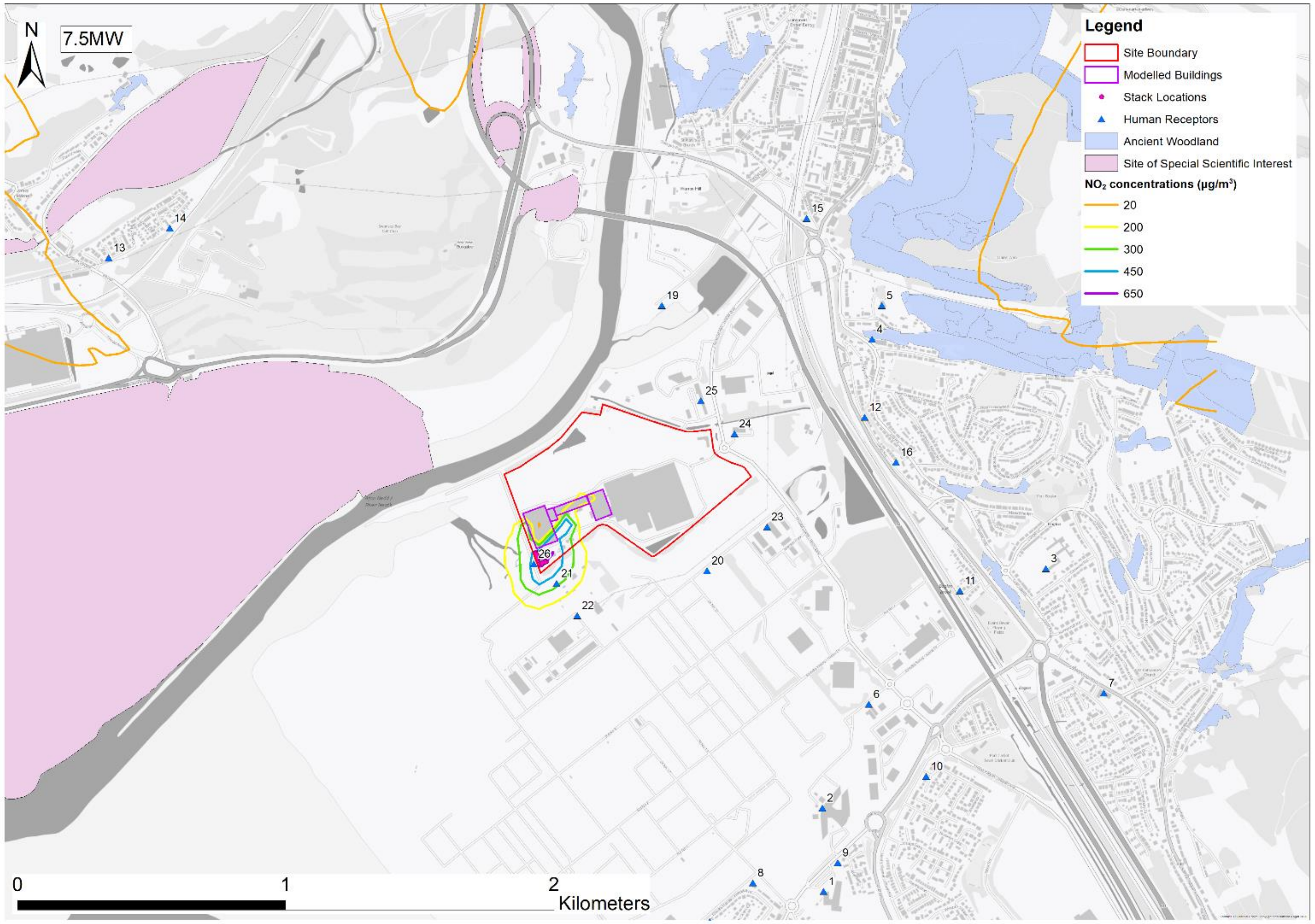
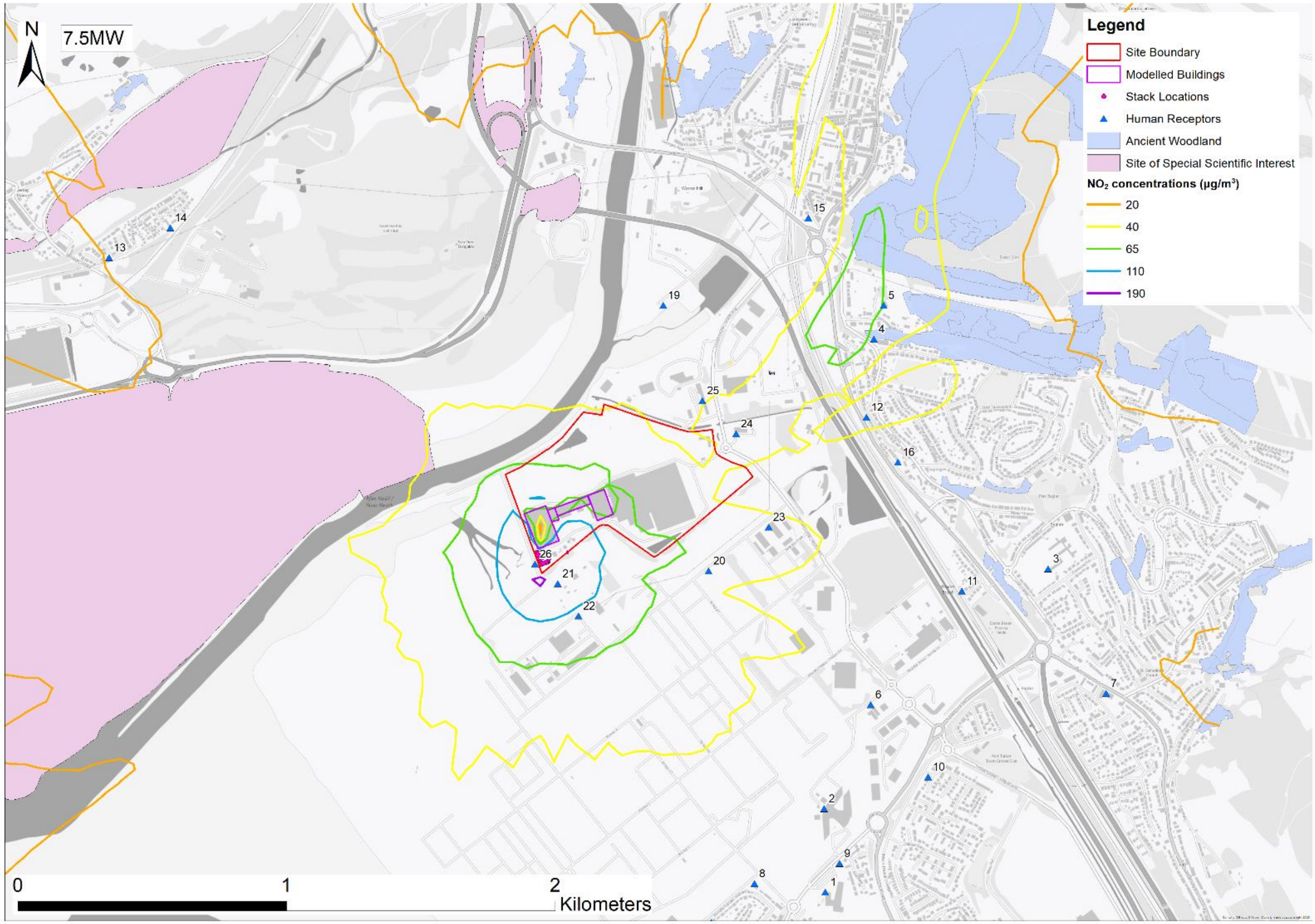


Figure 11 Hourly mean NO_2 air quality standard (99.79th percentile) using 12m stacks on HVO generators



5.1.2 Cumulative Effects – Temporary Generator Emissions and Existing Sources

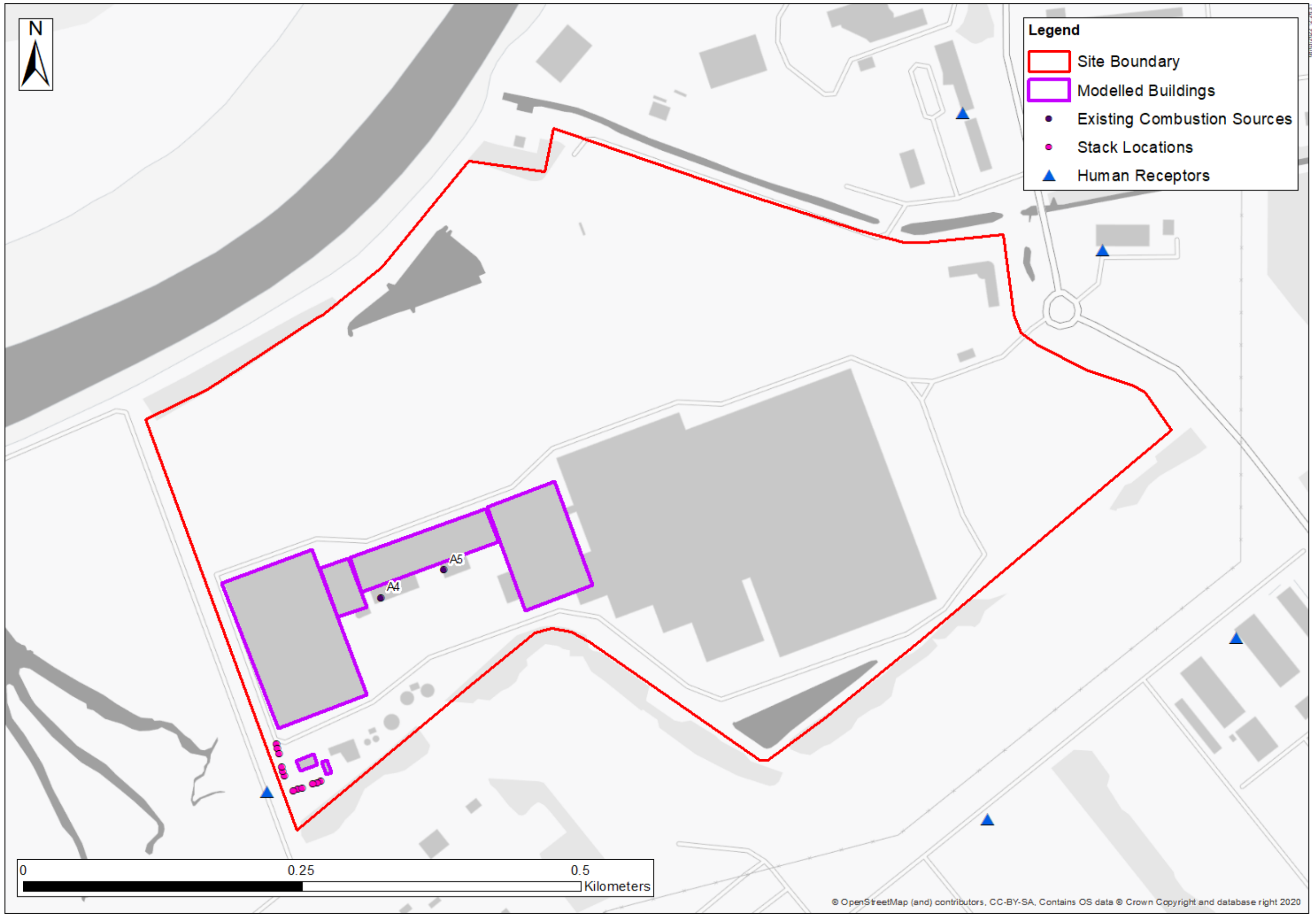
There are two existing combustion sources, A4 (Gas hood exhaust) and A5 (Boiler exhaust), already on site that have been included in modelling to obtain concentrations for all emissions from the Sofidel site. Locations of the two modelled existing combustion sources can be found in Figure 12. There are other emission point sources on-site however they are not considered to be relevant to the study. A biomass boiler is also included in the current Sofidel Environmental Permit as an emission source; however, this has never been constructed.

Details of the existing combustion sources have been provided directly from Sofidel. Pollutant emission rates have been calculated using Emission Limit Values provided in Sofidel's 2010 monitoring report. The parameters for the sources are presented in Table 32 Existing combustion sources stack parameters

Table 32 Existing combustion sources stack parameters

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>A4</th><th>A5</th></tr>
<tr><td colspan="2">Stack location</td><td>NGR (m)</td><td>273103, 192830</td><td>273160, 192855</td></tr>
<tr><td colspan="2">Exhaust flue diameter</td><td>m</td><td>1.4</td><td>1.2</td></tr>
<tr><td colspan="2">Current stack height (from ground)</td><td>m</td><td>28</td><td>25.5</td></tr>
<tr><td colspan="2">Flue gas efflux velocity</td><td>m/s</td><td>12.4</td><td>4.1</td></tr>
<tr><td colspan="2">Efflux temperature</td><td>˚C</td><td>156</td><td>182</td></tr>
<tr><td rowspan="4">Pollutant emission rate</td><td>NOx</td><td rowspan="4">g/s</td><td>0.850</td><td>0.985</td></tr>
<tr><td>PM</td><td>0.283</td><td>0.033</td></tr>
<tr><td>SO_2</td><td>0.113</td><td>0.131</td></tr>
<tr><td>CO</td><td>2.267</td><td>0.657</td></tr>
<tr><td rowspan="4">Emission limit value</td><td>NOx</td><td rowspan="4">mg/Nm^3</td><td>150</td><td>150</td></tr>
<tr><td>PM</td><td>50</td><td>5</td></tr>
<tr><td>SO_2</td><td>20</td><td>20</td></tr>
<tr><td>CO</td><td>400</td><td>100</td></tr>
<tr><td colspan="2">Volumetric flow rate wet gas</td><td>m^3/s</td><td>12.36</td><td>2.75</td></tr>
<tr><td colspan="2">Volumetric flow rate</td><td>Nm^3/s</td><td>5.67</td><td>6.57</td></tr>
<tr><td colspan="2">Oxygen content at the stack</td><td>%</td><td>15</td><td>15</td></tr>
<tr><td colspan="2">Moisture content</td><td>%</td><td>30.62</td><td>14.10</td></tr>
<tr><td colspan="2">Reference conditions</td><td colspan="3">273K, 101.3kPa</td></tr>
</table>

Figure 12 Location of existing combustion sources, A4 and A5



The predicted impacts of process contribution (PC) and predicted environmental constraint (PEC) for the full operation of the Sofidel site can be found below. The maintenance scenario is outlined in Section

As seen in Table 33 and Table 34 exceedances remain for 1-hour NO_2 and annual NO_2 at a 3m stack and are resolved when using a 12m stack. However, it should be noted that the concentrations have increased and have increased at the Power Plant and the permissive path when taking into consideration the existing on-site combustion sources. As, stated in Section 5.1, the Power Plant and the path are not deemed as sensitive receptors, however, to protect the health of the public, it is recommended that the path is closed for the time that the generators will be running.

As seen in Table 35 and Table 36 there are no exceedances for either PM_{10} or $PM_{2.5}$ at 3m or 12m stacks.

There no are exceedances for 1hr or 8hr CO with 3m HVO stacks, as seen in Table 37.

SO_2 has been modelled for the existing on-site combustion sources, results are shown in Table 39. There are no exceedances for 15-minute SO_2.

5.1.2.1 Nitrogen dioxide (NO_2)

Table 33 Predicted NO_2 concentrations at human receptor locations for a 7.5MW scenario with 3m stacks, including existing on-site combustion sources

Receptor	**NO_2 annual mean**			**NO_2 99.79th percentile - 1 hour mean**		
	Air quality standard: 40µg/m³			**Air quality standard: 200µg/m³ not to be exceeded more than 18 times per year (99.79th percentile)**		
	Background concentrations (µg/m³)	**Process Contribution (µg/m³)**	**Predicted environmental concentration (µg/m³)**	**Background concentrations (µg/m³)**	**Process Contribution (µg/m³)**	**Predicted environmental concentration (µg/m³)**
1	10.5	1.3	11.8	21.1	24.1	45.1
2	10.5	1.4	12.0	21.1	22.2	43.2
3	13.6	1.2	14.8	27.2	19.8	47.0
4	12.0	1.9	13.9	23.9	49.1	73.1
5	12.0	1.7	13.7	23.9	66.1	90.1
6	13.6	1.4	15.0	27.2	24.9	52.1
7	9.6	0.6	10.2	19.2	13.4	32.6
8	7.9	1.5	9.3	15.7	24.8	40.5
9	10.5	1.3	11.8	21.1	21.5	42.6
10	10.5	1.0	11.6	21.1	24.6	45.7
11	13.6	1.5	15.1	27.2	22.5	49.7
12	12.0	2.4	14.3	23.9	52.3	76.2
13	9.0	0.3	9.3	18.0	8.2	26.2
14	9.0	0.4	9.4	18.0	11.7	29.7
15	12.0	1.2	13.2	23.9	24.9	48.8
16	12.0	2.2	14.2	23.9	21.4	45.4
17	7.9	1.2	9.0	15.7	22.2	37.9
18	7.9	0.9	8.7	15.7	20.9	36.7
19	13.7	1.7	15.4	27.4	22.1	49.4
20	10.6	6.2	16.9	21.3	43.6	64.9
21	10.6	45.6	**56.2**	21.3	290.9	**312.1**
22	10.6	14.4	25.0	21.3	116.4	137.6

Receptor	NO_2 annual mean			NO_2 99.79th percentile - 1 hour mean		
	Air quality standard: 40µg/m^3			Air quality standard: 200µg/m^3 not to be exceeded more than 18 times per year (99.79th percentile)		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
23	10.6	4.9	15.5	21.3	38.4	59.7
24	13.7	4.4	18.1	27.4	46.9	74.2
25	13.7	3.7	17.3	27.4	38.3	65.6
26	10.6	36.2	**46.9**	21.3	361.0	**382.3**
N.B. concentrations in bold indicate an exceedance of the air quality limit value. * Results rounded to 1 decimal place						

Table 34 Predicted NO_2 concentrations at human receptor locations for a 7.5MW scenario with 12m stacks, including existing on-site combustion sources

Receptor	NO_2 annual mean			NO_2 99.79th percentile - 1 hour mean		
	Air quality standard: 40µg/m^3			Air quality standard: 200µg/m^3 not to be exceeded more than 18 times per year (99.79th percentile)		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
1	10.5	1.1	11.6	21.1	15.7	36.7
2	10.5	1.2	11.7	21.1	18.3	39.3
3	13.6	1.0	14.6	27.2	12.2	39.4
4	12.0	1.9	13.9	23.9	46.8	70.8
5	12.0	1.7	13.6	23.9	57.6	81.5
6	13.6	1.2	14.8	27.2	18.2	45.4
7	9.6	0.5	10.1	19.2	11.3	30.5
8	7.9	1.2	9.0	15.7	18.0	33.7
9	10.5	1.1	11.6	21.1	15.8	36.8
10	10.5	0.9	11.4	21.1	15.0	36.0
11	13.6	1.3	14.9	27.2	14.9	42.1
12	12.0	2.2	14.2	23.9	37.6	61.5

Receptor	NO_2 annual mean			NO_2 99.79th percentile - 1 hour mean		
	Air quality standard: 40μg/m^3			Air quality standard: 200μg/m^3 not to be exceeded more than 18 times per year (99.79th percentile)		
	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)	Background concentrations (μg/m^3)	Process Contribution (μg/m^3)	Predicted environmental concentration (μg/m^3)
13	9.0	0.3	9.3	18.0	7.2	25.2
14	9.0	0.3	9.3	18.0	8.9	26.9
15	12.0	1.1	13.1	23.9	20.1	44.0
16	12.0	2.0	14.0	23.9	17.4	41.3
17	7.9	1.0	8.8	15.7	17.1	32.8
18	7.9	0.7	8.6	15.7	15.7	31.4
19	13.7	1.5	15.2	27.4	16.2	43.6
20	10.6	5.4	16.1	21.3	39.4	60.7
21	10.6	16.9	27.5	21.3	153.5	174.7
22	10.6	9.6	20.3	21.3	82.5	103.8
23	10.6	4.5	15.1	21.3	32.5	53.8
24	13.7	4.0	17.7	27.4	31.0	58.3
25	13.7	3.3	17.0	27.4	26.0	53.4
26	10.6	9.2	19.8	21.3	111.7	133.0

N.B. concentrations in bold indicate an exceedance of the air quality limit value.
* Results rounded to 1 decimal place

5.1.2.2 Fine particulate matter (PM_{10} and $PM_{2.5}$)

Table 35 Predicted PM_{10} and $PM_{2.5}$ concentrations at human receptor locations for a 7.5MW scenario with 3m stacks, including existing on-site combustion sources

Receptor	PM_{10} 90.41th percentile - 24-hour mean			PM_{10} - annual mean			$PM_{2.5}$ - annual mean		
	Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			Air quality standard: 40µg/m³			Air quality standard:20µg/m³		
	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
1	24.8	0.1	24.9	12.4	<0.1	12.4	8.0	0.1	8.1
2	24.8	0.1	24.9	12.4	<0.1	12.5	8.0	0.1	8.1
3	26.4	0.1	25.0	13.2	<0.1	13.2	8.2	0.1	8.3
4	24.8	0.2	26.5	12.4	0.1	12.5	7.9	0.2	8.1
5	24.8	0.2	25.0	12.4	0.1	12.5	7.9	0.2	8.1
6	26.4	0.1	25.0	13.2	<0.1	13.3	8.2	0.1	8.4
7	23.5	0.1	26.6	11.8	<0.1	11.8	7.7	0.1	7.8
8	23.4	0.1	23.6	11.7	<0.1	11.7	7.3	0.1	7.5
9	24.8	0.1	23.5	12.4	<0.1	12.4	8.0	0.1	8.1
10	24.8	0.1	24.9	12.4	<0.1	12.4	8.0	0.1	8.1
11	26.4	0.1	24.9	13.2	<0.1	13.3	8.2	0.1	8.4
12	24.8	0.2	26.6	12.4	0.1	12.5	7.9	0.2	8.2
13	21.9	<0.1	25.1	11.0	<0.1	11.0	7.0	<0.1	7.1
14	21.9	<0.1	22.0	11.0	<0.1	11.0	7.0	<0.1	7.1
15	24.8	0.1	22.0	12.4	<0.1	12.5	7.9	0.1	8.1
16	24.8	0.2	25.0	12.4	0.1	12.5	7.9	0.2	8.2
17	23.4	0.1	25.1	11.7	<0.1	11.7	7.3	0.1	7.4
18	23.4	0.1	23.5	11.7	<0.1	11.7	7.3	0.1	7.4
19	24.9	0.2	23.4	12.5	0.1	12.5	7.9	0.2	8.1

Receptor	PM_{10} 90.41th percentile - 24-hour mean			PM_{10} - annual mean			$PM_{2.5}$ - annual mean		
	Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			Air quality standard: 40µg/m³			Air quality standard:20µg/m³		
	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
20	22.1	0.4	25.1	11.0	0.1	11.2	7.0	0.4	7.4
21	22.1	1.2	22.5	11.0	0.4	11.4	7.0	1.2	8.3
22	22.1	0.5	23.3	11.0	0.2	11.2	7.0	0.5	7.5
23	22.1	0.4	22.6	11.0	0.1	11.2	7.0	0.4	7.4
24	24.9	0.5	22.5	12.5	0.2	12.7	7.9	0.5	8.4
25	24.9	0.4	25.4	12.5	0.2	12.6	7.9	0.4	8.3
26	22.1	1.9	25.4	11.0	0.5	11.6	7.0	1.9	9.0
* Results rounded to 1 decimal place									

Table 36 Predicted PM_{10} and $PM_{2.5}$ concentrations at human receptor locations for a 7.5MW scenario with 12m stacks, including existing on-site combustion sources

Receptor	PM_{10} 90.41th percentile - 24-hour mean			PM_{10} - annual mean			$PM_{2.5}$ - annual mean		
	Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			Air quality standard: 40µg/m³			Air quality standard:20µg/m³		
	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
1	24.8	0.1	24.9	12.4	<0.1	12.4	8.0	0.1	8.1
2	24.8	0.1	25.0	12.4	<0.1	12.4	8.0	0.1	8.1
3	26.4	0.1	26.5	13.2	<0.1	13.2	8.2	0.1	8.3

Receptor	PM_{10} 90.41th percentile - 24-hour mean			PM_{10} - annual mean			$PM_{2.5}$ - annual mean		
	Air quality standard: 50µg/m³ not to be exceeded more than 7 times per year (98.08th percentile)			Air quality standard: 40µg/m³			Air quality standard:20µg/m³		
	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
4	24.8	0.2	25.0	12.4	0.1	12.5	7.9	0.2	8.1
5	24.8	0.2	25.0	12.4	0.1	12.5	7.9	0.2	8.1
6	26.4	0.1	26.6	13.2	<0.1	13.3	8.2	0.1	8.4
7	23.5	0.1	23.6	11.8	<0.1	11.8	7.7	0.1	7.8
8	23.4	0.1	23.5	11.7	<0.1	11.7	7.3	0.1	7.4
9	24.8	0.1	24.9	12.4	<0.1	12.4	8.0	0.1	8.1
10	24.8	0.1	24.9	12.4	<0.1	12.4	8.0	0.1	8.1
11	26.4	0.1	26.6	13.2	<0.1	13.3	8.2	0.1	8.3
12	24.8	0.2	25.1	12.4	0.1	12.5	7.9	0.2	8.2
13	21.9	<0.1	22.0	11.0	<0.1	11.0	7.0	<0.1	7.1
14	21.9	<0.1	22.0	11.0	<0.1	11.0	7.0	<0.1	7.1
15	24.8	0.1	25.0	12.4	<0.1	12.5	7.9	0.1	8.1
16	24.8	0.2	25.1	12.4	0.1	12.5	7.9	0.2	8.2
17	23.4	0.1	23.4	11.7	<0.1	11.7	7.3	0.1	7.4
18	23.4	0.1	23.4	11.7	<0.1	11.7	7.3	0.1	7.4
19	24.9	0.2	25.1	12.5	0.1	12.5	7.9	0.2	8.1
20	22.1	0.4	22.5	11.0	0.1	11.2	7.0	0.4	7.4
21	22.1	0.5	22.6	11.0	0.1	11.2	7.0	0.5	7.5
22	22.1	0.4	22.5	11.0	0.1	11.2	7.0	0.4	7.4
23	22.1	0.4	22.5	11.0	0.1	11.2	7.0	0.4	7.4
24	24.9	0.5	25.4	12.5	0.2	12.6	7.9	0.5	8.4
25	24.9	0.4	25.4	12.5	0.2	12.6	7.9	0.4	8.3
26	22.1	0.4	22.5	11.0	0.1	11.2	7.0	0.4	7.4
* Results rounded to 1 decimal place									

5.1.2.3 Carbon Monoxide (CO)

Table 37 Predicted CO concentrations at human receptor locations for a 7.5MW scenario with 3m stacks, including existing on-site combustion sources

Receptor	Maximum annual 8-hour running mean Air quality standard: 10,000µg/m^3			CO - 1-hour mean Air Quality Standard: 30,000µg/m^3		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
1	0.5	11.5	12.0	0.5	30.5	31.0
2	0.5	9.91	10.4	0.5	29.8	30.3
3	0.5	7.98	8.5	0.5	15.2	15.7
4	0.5	31.8	32.3	0.5	149.0	149.5
5	0.5	33.2	33.7	0.5	155.4	155.9
6	0.5	10.7	11.2	0.5	18.4	18.9
7	0.5	7.26	7.8	0.5	41.6	42.1
8	0.4	8.96	9.5	0.4	26.1	26.5
9	0.5	11.1	11.6	0.5	30.4	30.9
10	0.5	7.2	7.7	0.5	18.5	19.0
11	0.5	9.22	9.7	0.5	16.2	16.7
12	0.5	15.8	16.3	0.5	61.4	61.9
13	0.4	4.71	5.2	0.4	18.1	18.5
14	0.4	4.94	5.4	0.4	17.0	17.4
15	0.5	14	14.5	0.5	90.3	90.8
16	0.5	16.8	17.3	0.5	77.0	77.5
17	0.4	10.1	10.6	0.4	25.0	25.4
18	0.4	9.84	10.3	0.4	19.5	19.9
19	0.5	17.4	17.9	0.5	87.5	88.0
20	0.5	24.9	25.4	0.5	53.0	53.5
21	0.5	154	154.5	0.5	186.5	187.0
22	0.5	56.6	57.1	0.5	69.3	69.8
23	0.5	23.5	24.0	0.5	37.4	37.9
24	0.5	19.4	19.9	0.5	76.5	77.0

Receptor	Maximum annual 8-hour running mean Air quality standard: 10,000µg/m³			CO - 1-hour mean Air Quality Standard: 30,000µg/m³		
	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
25	0.5	20.6	21.1	0.5	78.0	78.5
26	0.5	238	238.5	0.5	252.4	252.9
* Results rounded to 1 decimal place						

Table 38 Predicted CO concentrations at human receptor locations for a 7.5MW scenario and 12m stacks, including existing on-site combustion sources

Receptor	Maximum annual 8-hour running mean Air quality standard: 10,000µg/m³			CO - 1-hour mean Air Quality Standard: 30,000µg/m³		
	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)	Background concentrations (µg/m³)	Process Contribution (µg/m³)	Predicted environmental concentration (µg/m³)
1	0.5	8.2	8.7	0.5	31.1	31.6
2	0.5	9.57	10.1	0.5	30.4	30.9
3	0.5	7.5	8.0	0.5	12.9	13.4
4	0.5	32	32.5	0.5	151.5	152.0
5	0.5	33.2	33.7	0.5	151.0	151.5
6	0.5	10.4	10.9	0.5	17.8	18.3
7	0.5	5.36	5.9	0.5	9.9	10.4
8	0.4	8.17	8.7	0.4	25.8	26.2
9	0.5	7.76	8.3	0.5	31.1	31.6
10	0.5	6.8	7.3	0.5	18.6	19.1
11	0.5	8.36	8.9	0.5	13.3	13.8
12	0.5	13.2	13.7	0.5	67.7	68.2
13	0.4	4.52	5.0	0.4	13.0	13.4
14	0.4	3.81	4.3	0.4	17.3	17.7
15	0.5	13.4	13.9	0.5	89.9	90.4
16	0.5	10.2	10.7	0.5	26.1	26.6
17	0.4	7.4	7.9	0.4	23.5	23.9

Receptor	Maximum annual 8-hour running mean Air quality standard: 10,000µg/m^3			CO - 1-hour mean Air Quality Standard: 30,000µg/m^3		
	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)	Background concentrations (µg/m^3)	Process Contribution (µg/m^3)	Predicted environmental concentration (µg/m^3)
18	0.4	9.59	10.1	0.4	19.8	20.2
19	0.5	13.2	13.7	0.5	33.8	34.3
20	0.5	23.7	24.2	0.5	52.9	53.4
21	0.5	76.2	76.7	0.5	94.0	94.5
22	0.5	42.1	42.6	0.5	54.0	54.5
23	0.5	21.8	22.3	0.5	37.5	38.0
24	0.5	17.2	17.7	0.5	28.3	28.8
25	0.5	19.4	19.9	0.5	30.5	31.0
26	0.5	31.6	32.1	0.5	109.0	109.5
* Results rounded to 1 decimal place						

5.1.2.4 Sulphur Dioxide (SO_2)

Table 39 Predicted SO_2 concentrations at human receptor locations for existing on-site combustion sources

Receptor	SO_2 99.9th percentile – 15-minute mean Air quality standard: 266µg/m^3		
	Background concentrations (µg/m^3)	Process Contribution (µg /m^3)	Predicted environmental concentration (µg/m^3)
1	5.6	0.9	6.5
2	5.6	1.2	6.8
3	5.6	0.6	6.2
4	5.6	7.1	12.7
5	5.6	4.5	10.1
6	5.6	1.4	7.0
7	5.6	0.7	6.3
8	5.6	0.9	6.5
9	5.6	1.1	6.7

Receptor	SO_2 99.9th percentile – 15-minute mean		
	Air quality standard: 266µg/m³		
	Background concentrations (µg/m³)	Process Contribution (µg /m³)	Predicted environmental concentration (µg/m³)
10	5.6	1.1	6.7
11	5.6	0.6	6.2
12	5.6	1.3	6.9
13	5.6	0.4	6.0
14	5.6	0.6	6.2
15	5.6	0.9	6.5
16	5.6	1.3	6.9
17	5.6	0.8	6.4
18	5.6	0.7	6.3
19	5.6	1.3	6.9
20	5.6	2.5	8.1
21	5.6	3.2	8.8
22	5.6	2.7	8.3
23	5.6	1.9	7.5
24	5.6	1.9	7.5
25	5.6	1.7	7.3
26	5.6	4.5	10.1
* Results rounded to 1 decimal place			

5.1.2.5 Short Term Modelling

Short term model runs were undertaking to identify the number of times the hourly NO_2 limit, 200µg/m^3 is exceeded per receptor until the end of June. The key receptors of interest are 21 (power plant) and 26 (permissive path) as these exceed the hourly mean NO_2 objective (where 200µg/m^3 is exceeded more than 18 times a year). Results are shown for 3m, below in Table 40. There were no exceedances for 12m stacks, therefore this has not been included.

Table 40 Number of times 200µg/m^3 was exceeded for receptors 21 and 26 for 3m until the end of June

Receptor	**Criteria**	**3m stacks**
		No. of exceedances
21	>200	208
26	>200	144

5.2 Maintenance scenario

5.2.1 Temporary Generator Emissions Only

During generator maintenance periods, a 7.5MW scenario would be maintained, however the specific generators running would be cycled through to balance out running hours and cover their maintenance.

The predicted concentrations for this scenario with both 3m and 12m are shown below in Table 41 and Table 42 respectively.

For the maintenance scenario, exceedances are predicted at receptors for hourly mean NO_2, annual NO_2 and 8 hour rolling CO with a 3m stack. Using a 12m stack there is only one exceedance for hourly mean NO_2.

Contours have been provided for hourly mean NO_2 concentrations for HVO stack heights of 3m and 12m. These can be found in Figure 13 and Figure 14 respectively.

Receptor 26 was predicted the highest concentrations for hourly mean NO_2, annual NO_2 and 8 hour rolling CO, concentrations were 1043.4 µg/m^3, 108.4 µg/m^3 and 37.5 µg/m^3 respectively, for the 3m scenario. In the 12m scenario, the only exceedance was at receptor 21 for hourly mean NO_2 and was 290.2 µg/m^3. However as specified in the main report, these receptors are not classed as sensitive.

Table 41 Predicted concentrations at human receptor locations for 3m stacks on HVO and gas generators for a 7.5MW maintenance scenario

Receptor ID	2019 Defra Background Concentration (µg/m^3)					Process Contribution (µg/m^3)					Predicted Environmental Concentrations (µg/m^3)				
	Short term NO_2	Annual Mean NO_2	Short term PM_{10}	Short term $PM_{2.5}$	Short Term CO	Hourly Mean NO_2 (99.79th Percentile)	Annual Mean NO_2	24 hr PM_{10}	24 hr $PM_{2.5}$	Short Term CO	Hourly Mean NO_2 (99.79th Percentile)	Annual Mean NO_2	24 hr PM_{10}	24 hr $PM_{2.5}$	Short Term CO
1	21.1	10.5	24.8	16.0	0.5	46.3	2.5	0.0	0.0	0.5	67.3	13.0	24.9	16.0	0.9
2	21.1	10.5	24.8	16.0	0.5	44.7	2.7	0.0	0.0	0.5	65.8	13.3	24.9	16.0	1.0
3	27.2	13.6	26.4	16.5	0.5	37.3	2.2	0.0	0.0	0.4	64.5	15.8	26.5	16.5	0.9
4	23.9	12.0	24.8	15.9	0.5	104.3	3.5	0.0	0.0	0.7	128.2	15.4	24.9	15.9	1.1
5	23.9	12.0	24.8	15.9	0.5	113.5	3.0	0.0	0.0	0.6	137.5	15.0	24.9	15.9	1.0
6	27.2	13.6	26.4	16.5	0.5	50.1	2.5	0.0	0.0	0.5	77.3	16.2	26.5	16.5	0.9
7	19.2	9.6	23.5	15.4	0.5	25.6	1.2	0.0	0.0	0.2	44.8	10.8	23.5	15.4	0.7
8	15.7	7.9	23.4	14.7	0.4	51.0	2.8	0.0	0.0	0.5	66.7	10.7	23.4	14.7	1.0
9	21.1	10.5	24.8	16.0	0.5	42.7	2.5	0.0	0.0	0.5	63.7	13.0	24.9	16.0	0.9
10	21.1	10.5	24.8	16.0	0.5	47.6	2.0	0.0	0.0	0.4	68.7	12.5	24.9	16.0	0.8
11	27.2	13.6	26.4	16.5	0.5	46.4	2.9	0.0	0.0	0.5	73.6	16.5	26.5	16.5	1.0
12	23.9	12.0	24.8	15.9	0.5	110.6	4.2	0.1	0.1	0.8	134.5	16.2	24.9	15.9	1.3
13	18.0	9.0	21.9	14.1	0.4	16.1	0.6	0.0	0.0	0.1	34.2	9.6	21.9	14.1	0.5
14	18.0	9.0	21.9	14.1	0.4	21.9	0.7	0.0	0.0	0.1	39.9	9.7	21.9	14.1	0.6
15	23.9	12.0	24.8	15.9	0.5	48.1	2.2	0.0	0.0	0.4	72.0	14.1	24.8	15.9	0.9
16	23.9	12.0	24.8	15.9	0.5	44.8	3.9	0.0	0.0	0.7	68.7	15.9	24.9	15.9	1.2

17	15.7	7.9	23.4	14.7	0.4	45.0	2.3	0.0	0.0	0.4	60.7	10.2	23.4	14.7	0.9
18	15.7	7.9	23.4	14.7	0.4	41.7	1.7	0.0	0.0	0.3	57.4	9.6	23.4	14.7	0.8
19	27.4	13.7	24.9	15.7	0.5	41.8	3.0	0.0	0.0	0.6	69.2	16.6	25.0	15.8	1.0
20	21.3	10.6	22.1	14.0	0.5	93.8	12.2	0.1	0.1	2.3	115.1	22.9	22.2	14.2	2.8
21	21.3	10.6	22.1	14.0	0.5	605.9	94.4	1.3	1.3	18.0	**627.2**	**105.0**	23.4	15.4	**18.4**
22	21.3	10.6	22.1	14.0	0.5	244.7	29.9	0.5	0.5	5.7	**266.0**	**40.5**	22.6	14.5	6.1
23	21.3	10.6	22.1	14.0	0.5	77.8	9.3	0.1	0.1	1.7	99.0	19.9	22.2	14.1	2.2
24	27.4	13.7	24.9	15.7	0.5	90.9	7.5	0.1	0.1	1.4	118.2	21.2	25.0	15.8	1.9
25	27.4	13.7	24.9	15.7	0.5	73.9	6.2	0.1	0.1	1.2	101.3	19.8	25.0	15.8	1.6
26	21.3	10.6	22.1	14.0	0.5	1021.1	97.7	2.9	2.9	37.0	**1042.4**	**108.4**	25.0	16.9	**37.5**
N.B. concentrations in bold indicate an exceedance of the air quality limit value. * Results rounded to 1 decimal place															

Table 42 Predicted concentrations at human receptor locations for 12m stacks on HVO generators and 3m stacks on gas generators for a 7.5MW maintenance scenario

Receptor ID	**2019 Defra Background Concentration (µg/m^3)**					**Process Contribution (µg/m^3)**					**Predicted Environmental Concentrations (µg/m^3)**				
	Short term NO_2	**Annual Mean NO_2**	**Short term PM_{10}**	**Short term $PM_{2.5}$**	**Short Term CO**	**Hourly Mean NO_2 (99.79th Percentile)**	**Annual Mean NO_2**	**24 hr PM_{10}**	**24 hr $PM_{2.5}$**	**Short Term CO**	**Hourly Mean NO_2 (99.79th Percentile)**	**Annual Mean NO_2**	**24 hr PM_{10}**	**24 hr $PM_{2.5}$**	**Short Term CO**
1	21.1	10.5	24.8	16.0	0.5	29.9	1.9	0.0	0.0	0.4	51.0	12.5	24.9	16.0	0.8
2	21.1	10.5	24.8	16.0	0.5	35.6	2.2	0.0	0.0	0.4	56.6	12.7	24.9	16.0	0.9

3	27.2	13.6	26.4	16.5	0.5	21.4	1.9	0.0	0.0	0.3	48.6	15.5	26.5	16.5	0.8
4	23.9	12.0	24.8	15.9	0.5	103.1	3.4	0.0	0.0	0.7	127.1	15.4	24.9	15.9	1.1
5	23.9	12.0	24.8	15.9	0.5	97.7	3.0	0.0	0.0	0.6	121.6	14.9	24.9	15.9	1.0
6	27.2	13.6	26.4	16.5	0.5	36.0	2.1	0.0	0.0	0.4	63.2	15.7	26.5	16.5	0.9
7	19.2	9.6	23.5	15.4	0.5	14.9	0.9	0.0	0.0	0.2	34.1	10.5	23.5	15.4	0.6
8	15.7	7.9	23.4	14.7	0.4	34.4	2.2	0.0	0.0	0.4	50.1	10.0	23.4	14.7	0.8
9	21.1	10.5	24.8	16.0	0.5	30.8	1.9	0.0	0.0	0.4	51.9	12.5	24.9	16.0	0.8
10	21.1	10.5	24.8	16.0	0.5	26.0	1.6	0.0	0.0	0.3	47.0	12.1	24.8	16.0	0.7
11	27.2	13.6	26.4	16.5	0.5	29.5	2.4	0.0	0.0	0.5	56.7	16.0	26.5	16.5	0.9
12	23.9	12.0	24.8	15.9	0.5	75.0	3.9	0.0	0.0	0.7	99.0	15.9	24.9	15.9	1.2
13	18.0	9.0	21.9	14.1	0.4	13.5	0.5	0.0	0.0	0.1	31.5	9.5	21.9	14.1	0.5
14	18.0	9.0	21.9	14.1	0.4	15.4	0.6	0.0	0.0	0.1	33.4	9.6	21.9	14.1	0.5
15	23.9	12.0	24.8	15.9	0.5	38.6	1.9	0.0	0.0	0.4	62.5	13.9	24.8	15.9	0.8
16	23.9	12.0	24.8	15.9	0.5	30.3	3.5	0.0	0.0	0.7	54.2	15.5	24.9	15.9	1.1
17	15.7	7.9	23.4	14.7	0.4	32.6	1.8	0.0	0.0	0.3	48.3	9.6	23.4	14.7	0.8
18	15.7	7.9	23.4	14.7	0.4	29.8	1.4	0.0	0.0	0.3	45.5	9.2	23.4	14.7	0.7
19	27.4	13.7	24.9	15.7	0.5	27.8	2.5	0.0	0.0	0.5	55.1	16.2	24.9	15.8	0.9
20	21.3	10.6	22.1	14.0	0.5	83.5	10.4	0.1	0.1	2.0	104.7	21.0	22.2	14.1	2.4
21	21.3	10.6	22.1	14.0	0.5	269.0	28.3	0.4	0.4	4.9	**290.2**	38.9	22.4	14.4	5.4
22	21.3	10.6	22.1	14.0	0.5	165.8	18.6	0.3	0.3	3.4	187.1	29.2	22.4	14.3	3.9
23	21.3	10.6	22.1	14.0	0.5	62.2	8.3	0.1	0.1	1.5	83.5	18.9	22.2	14.1	2.0
24	27.4	13.7	24.9	15.7	0.5	51.9	6.5	0.1	0.1	1.2	79.3	20.2	25.0	15.8	1.7

25	27.4	13.7	24.9	15.7	0.5	43.2	5.4	0.1	0.1	1.0	70.6	19.1	25.0	15.8	1.5
26	21.3	10.6	22.1	14.0	0.5	80.0	6.3	0.0	0.0	0.5	101.2	17.0	22.1	14.1	0.9

N.B. concentrations in bold indicate an exceedance of the air quality limit value.
* Results rounded to 1 decimal place

Figure 13 Area of exceedance for the hourly mean NO_2 air quality standard (99.79th percentile) using HVO fuel and a 3m stack on HVO generators

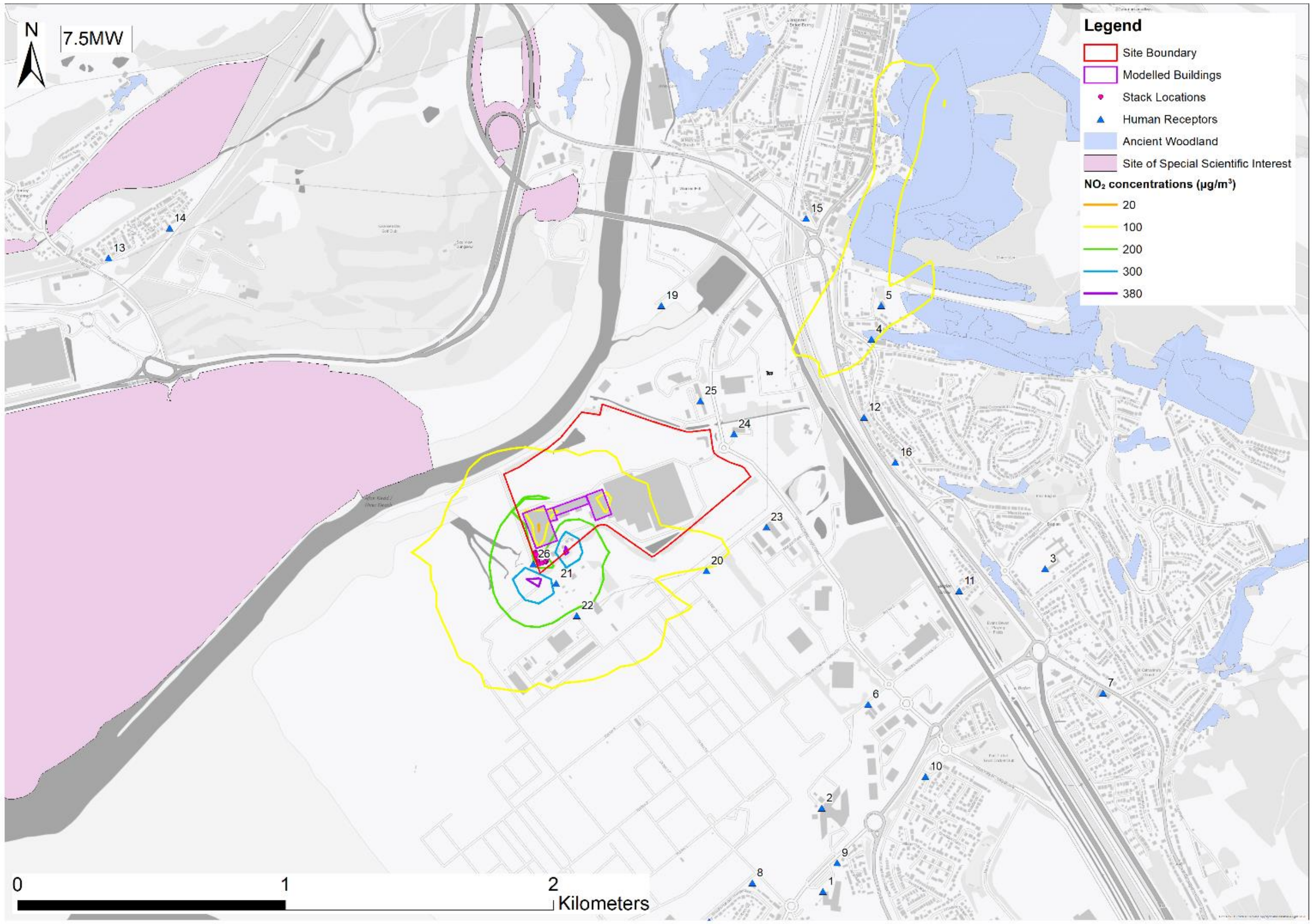
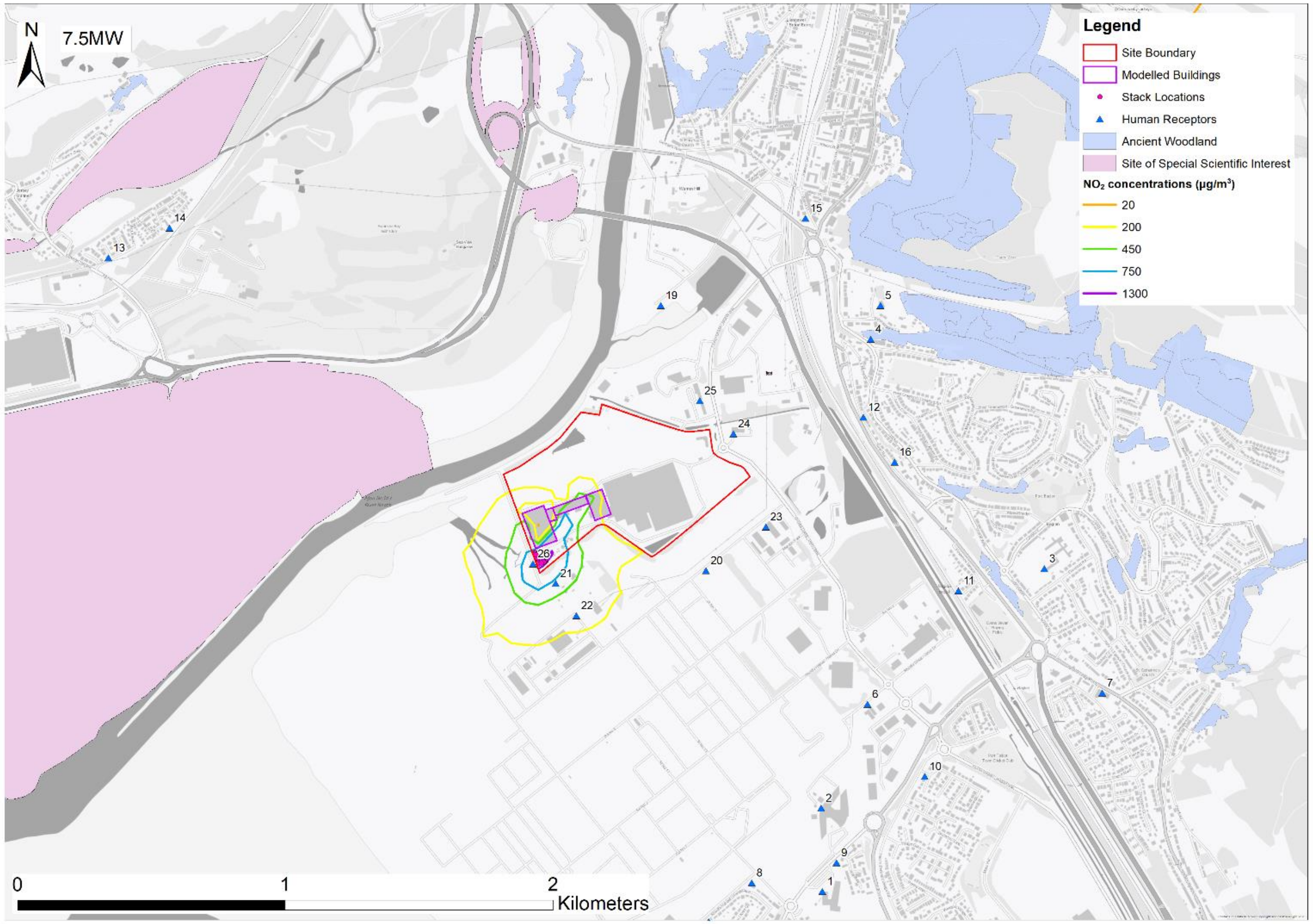


Figure 14 Area of exceedance of the hourly mean NO_2 air quality standard (99.79th percentile) using HVO fuel and 12m stacks on HVO generators



5.2.2 Cumulative Effects – Temporary Generator Emissions and Existing Sources

In addition to including existing on-site combustion sources to the current generator set up, models were also run for the maintenance scenario detailed in Section 5.2.1 above.

The predicted concentrations for this scenario with both 3m and 12m are shown below in Table 43 and Table 44 respectively. SO_2 results have not been included in the results below as the maintenance scenario does not affect SO_2 concentration outcomes.

Table 43 Predicted concentrations at human receptor locations for 3m stacks on HVO and gas generators for a 7.5MW maintenance scenario

Receptor ID	2019 Defra Background Concentration (μg/m^3)					Process Contribution (μg/m^3)					Predicted Environmental Concentrations (μg/m^3)				
	Short term NO_2	Annual Mean NO_2	Short term PM_{10}	Short term $PM_{2.5}$	Short Term CO	Hourly Mean NO_2 (99.79th Percentile)	Annual Mean NO_2	24 hr PM_{10}	24 hr $PM_{2.5}$	Short Term CO	Hourly Mean NO_2 (99.79th Percentile)	Annual Mean NO_2	24 hr PM_{10}	24 hr $PM_{2.5}$	Short Term CO
1	21.1	10.5	24.8	16.0	0.5	47.2	2.6	0.1	0.1	0.7	68.2	13.1	25.0	16.1	1.2
2	21.1	10.5	24.8	16.0	0.5	45.4	2.9	0.2	0.2	0.8	66.4	13.4	25.0	16.1	1.3
3	27.2	13.6	26.4	16.5	0.5	38.1	2.3	0.1	0.1	0.6	65.3	15.9	26.5	16.6	1.1
4	23.9	12.0	24.8	15.9	0.5	106.5	3.8	0.2	0.2	1.3	130.4	15.7	25.0	16.1	1.7
5	23.9	12.0	24.8	15.9	0.5	121.2	3.3	0.2	0.2	1.1	145.2	15.3	25.0	16.1	1.6
6	27.2	13.6	26.4	16.5	0.5	50.9	2.7	0.1	0.1	0.8	78.1	16.3	26.6	16.6	1.3
7	19.2	9.6	23.5	15.4	0.5	26.7	1.3	0.1	0.1	0.4	45.9	10.9	23.6	15.5	0.8
8	15.7	7.9	23.4	14.7	0.4	51.8	2.9	0.1	0.1	0.8	67.5	10.8	23.5	14.8	1.2
9	21.1	10.5	24.8	16.0	0.5	43.3	2.6	0.1	0.1	0.7	64.3	13.1	25.0	16.1	1.2
10	21.1	10.5	24.8	16.0	0.5	48.7	2.1	0.1	0.1	0.6	69.7	12.6	24.9	16.1	1.1
11	27.2	13.6	26.4	16.5	0.5	46.4	3.0	0.1	0.1	0.8	73.7	16.6	26.6	16.6	1.3
12	23.9	12.0	24.8	15.9	0.5	111.8	4.6	0.3	0.3	1.6	135.8	16.6	25.1	16.1	2.0
13	18.0	9.0	21.9	14.1	0.4	17.1	0.6	0.0	0.0	0.2	35.1	9.6	22.0	14.1	0.6
14	18.0	9.0	21.9	14.1	0.4	23.4	0.7	0.1	0.1	0.2	41.5	9.7	22.0	14.1	0.7
15	23.9	12.0	24.8	15.9	0.5	50.2	2.3	0.1	0.1	0.8	74.1	14.3	25.0	16.0	1.2
16	23.9	12.0	24.8	15.9	0.5	45.2	4.3	0.2	0.2	1.4	69.1	16.2	25.1	16.1	1.9

17	15.7	7.9	23.4	14.7	0.4	45.4	2.4	0.1	0.1	0.6	61.1	10.3	23.5	14.8	1.1
18	15.7	7.9	23.4	14.7	0.4	42.1	1.8	0.1	0.1	0.5	57.9	9.7	23.4	14.7	0.9
19	27.4	13.7	24.9	15.7	0.5	43.1	3.2	0.2	0.2	1.1	70.4	16.9	25.1	16.0	1.6
20	21.3	10.6	22.1	14.0	0.5	94.0	12.7	0.4	0.4	3.2	115.3	23.4	22.5	14.5	3.7
21	21.3	10.6	22.1	14.0	0.5	606.0	94.8	1.6	1.6	18.6	**627.2**	**105.5**	23.7	15.6	**19.1**
22	21.3	10.6	22.1	14.0	0.5	244.7	30.3	0.7	0.7	6.3	**266.0**	**40.9**	22.8	14.7	6.7
23	21.3	10.6	22.1	14.0	0.5	77.8	9.8	0.4	0.4	2.8	99.1	20.4	22.5	14.5	3.3
24	27.4	13.7	24.9	15.7	0.5	91.5	8.3	0.5	0.5	3.1	118.8	22.0	25.5	16.3	3.6
25	27.4	13.7	24.9	15.7	0.5	75.1	6.9	0.5	0.5	2.6	102.5	20.6	25.4	16.2	3.1
26	21.3	10.6	22.1	14.0	0.5	1022.2	98.3	3.3	3.3	38.3	**1043.5**	**108.9**	25.4	17.3	**38.7**
N.B. concentrations in bold indicate an exceedance of the air quality limit value. * Results rounded to 1 decimal place															

Table 44 Predicted concentrations at human receptor locations for 12m stacks on HVO generators and 3m stacks on gas generators for a 7.5MW maintenance scenario

Receptor ID	**2019 Defra Background Concentration (µg/m^3)**					**Process Contribution (µg/m^3)**					**Predicted Environmental Concentrations (µg/m^3)**				
	Short term NO_2	**Annual Mean NO_2**	**Short term PM_{10}**	**Short term $PM_{2.5}$**	**Short Term CO**	**Hourly Mean NO_2 (99.79th Percentile)**	**Annual Mean NO_2**	**24 hr PM_{10}**	**24 hr $PM_{2.5}$**	**Short Term CO**	**Hourly Mean NO_2 (99.79th Percentile)**	**Annual Mean NO_2**	**24 hr PM_{10}**	**24 hr $PM_{2.5}$**	**Short Term CO**
1	21.1	10.5	24.8	16.0	0.5	31.1	2.0	0.1	0.1	0.6	52.2	12.6	24.9	16.1	1.0
2	21.1	10.5	24.8	16.0	0.5	36.0	2.3	0.1	0.1	0.7	57.1	12.9	25.0	16.1	1.2
3	27.2	13.6	26.4	16.5	0.5	22.7	2.0	0.1	0.1	0.6	49.9	15.6	26.5	16.6	1.0

4	23.9	12.0	24.8	15.9	0.5	104.8	3.7	0.2	0.2	1.3	128.7	15.7	25.0	16.1	1.7
5	23.9	12.0	24.8	15.9	0.5	102.7	3.2	0.2	0.2	1.1	126.6	15.2	25.0	16.1	1.6
6	27.2	13.6	26.4	16.5	0.5	36.6	2.2	0.1	0.1	0.7	63.8	15.8	26.6	16.6	1.2
7	19.2	9.6	23.5	15.4	0.5	15.7	1.0	0.1	0.1	0.3	34.9	10.6	23.6	15.5	0.8
8	15.7	7.9	23.4	14.7	0.4	36.0	2.3	0.1	0.1	0.6	51.7	10.1	23.5	14.8	1.1
9	21.1	10.5	24.8	16.0	0.5	32.1	2.1	0.1	0.1	0.6	53.2	12.6	24.9	16.1	1.1
10	21.1	10.5	24.8	16.0	0.5	27.0	1.7	0.1	0.1	0.5	48.1	12.2	24.9	16.1	1.0
11	27.2	13.6	26.4	16.5	0.5	30.4	2.6	0.1	0.1	0.7	57.6	16.2	26.6	16.6	1.2
12	23.9	12.0	24.8	15.9	0.5	76.8	4.3	0.3	0.3	1.5	100.7	16.2	25.1	16.1	2.0
13	18.0	9.0	21.9	14.1	0.4	14.3	0.5	0.0	0.0	0.2	32.3	9.5	22.0	14.1	0.6
14	18.0	9.0	21.9	14.1	0.4	16.3	0.6	0.0	0.0	0.2	34.3	9.6	22.0	14.1	0.6
15	23.9	12.0	24.8	15.9	0.5	40.2	2.1	0.1	0.1	0.7	64.1	14.1	25.0	16.0	1.2
16	23.9	12.0	24.8	15.9	0.5	31.4	3.9	0.2	0.2	1.3	55.3	15.8	25.1	16.1	1.8
17	15.7	7.9	23.4	14.7	0.4	34.0	1.9	0.1	0.1	0.5	49.7	9.7	23.5	14.8	1.0
18	15.7	7.9	23.4	14.7	0.4	30.9	1.4	0.1	0.1	0.4	46.6	9.3	23.4	14.7	0.8
19	27.4	13.7	24.9	15.7	0.5	30.5	2.7	0.2	0.2	1.0	57.9	16.4	25.1	15.9	1.5
20	21.3	10.6	22.1	14.0	0.5	83.6	10.9	0.4	0.4	2.8	104.9	21.5	22.5	14.4	3.3
21	21.3	10.6	22.1	14.0	0.5	269.0	28.8	0.6	0.6	5.5	**290.3**	39.4	22.7	14.6	6.0
22	21.3	10.6	22.1	14.0	0.5	166.0	18.9	0.5	0.5	4.0	187.2	29.6	22.6	14.5	4.5
23	21.3	10.6	22.1	14.0	0.5	64.4	8.8	0.4	0.4	2.6	85.7	19.4	22.5	14.4	3.1
24	27.4	13.7	24.9	15.7	0.5	52.6	7.3	0.5	0.5	2.9	80.0	21.0	25.5	16.3	3.4
25	27.4	13.7	24.9	15.7	0.5	44.0	6.1	0.5	0.5	2.5	71.3	19.8	25.4	16.2	2.9

26	21.3	10.6	22.1	14.0	0.5	80.1	6.8	0.4	0.4	1.7	101.3	17.4	22.5	14.4	2.2

N.B. concentrations in bold indicate an exceedance of the air quality limit value.
* Results rounded to 1 decimal place

5.3 Ecological receptors

5.3.1 Temporary Generator Emissions Only

The impact at ecological receptors has been assessed and screening has been undertaken against the relevant air quality standards. Results for ecological impacts can be found in Table 45 to Table 56.

The modelling at ecological receptors has focussed on the introduction of the temporary generators only, rather than the cumulative with existing emission sources, so that the potential impact of the generators can be considered in isolation.

A number of ecological receptors (E1, E2, E3 and E22) could not be screened out as insignificant for daily mean NO_x, with process contributions predicted to exceed the >10% criterion of 75µg/m^3 critical level, however there are no exceedances of the critical load at these sites, therefore this is not considered to be significant. Potentially significant impacts are however predicted at the Baglan Bay LWS (E23), immediately adjacent to the generators, with exceedances of both the annual and daily mean NOx critical level with a 3m stack, and the daily mean NOx critical level for a 12m stack. Figure 15 and Figure 16 illustrate the predicted pollutant contours for annual mean and 24 hour NOx for the 3m stacks on the HVO generators.

With regard to nutrient nitrogen, the impact at sites E7-E22 are predicted to be above PC> 1% and PEC >70% of the relevant critical loads for both the 3m and 12m HVO generator stacks, however in all cases the background already exceed the relevant critical load used in the assessment so are not considered to be significant.

Acid deposition at E7, E20-E21 is predicted to exceed the 1% PC threshold and 70% PEC threshold for the 3m and 12m stack scenarios, however as the background deposition values are already well over 100% of the relevant critical load, these changes are also not considered to be significant.

Predicted impacts at the internationally designated SAC sites E4, E5, E6 are not considered to be significant, so no further assessment is needed at these sites as part of a HRA study.

Ecological receptors 1 and 3 are not considered to be sensitive to nitrogen deposition or acid deposition and therefore have not been included in the discussion but are presented for completeness.

5.3.1.1 Annual mean NO_x concentrations

Table 45 Predicted annual mean NO_x concentrations at sensitive ecological sites, and comparison with the critical level (30 µg/m³) using a 3m stack

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) (µg/m³)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)	Predicted total NO_X (PEC) (µg/m³)	SSSI/ SAC PEC screening (stage 2)
			If PC is >100% of 30µg/m³ (30 µg/m³)	If PC is >1% of 30µg/m³ (0.3 µg/m³)		If PEC is >70% of 30µg/m³ (21 µg/m³)
E1	Crymlyn Burrows SSSI	3.03	-	Yes	12.4	No
E2	Pant-Y-Sais/Crymlyn Bog/Cors Crymlyn SSSI	0.57	-	No	-	-
E3	Earlswood Road Cutting and Ferryboat Inn Quarries SSSI	0.91	-	No	-	-
E4	Kenfig/Cynffig SAC	0.14	-	No	-	-
E5	Gower Ash Woods / Coedydd Ynn Gwyr SAC	0.02	-	No	-	-
E6	Gower Commons / Tiroedd Comin Gwyr SAC	0.03	-	No	-	-
E7	AW 1	0.42	No	-	-	-
E8	AW 2	0.66	No	-	-	-
E9	AW 3	0.81	No	-	-	-
E10	AW 4	1.70	No	-	-	-
E11	AW 5	1.75	No	-	-	-
E12	AW 6	2.31	No	-	-	-
E13	AW 7	1.88	No	-	-	-
E14	AW 8	1.99	No	-	-	-
E15	AW 9	1.20	No	-	-	-

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) (µg/m³)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)	Predicted total NO_X (PEC) (µg/m³)	SSSI/ SAC PEC screening (stage 2)
			If PC is >100% of 30µg/m³ (30 µg/m³)	If PC is >1% of 30µg/m³ (0.3 µg/m³)		If PEC is >70% of 30µg/m³ (21 µg/m³)
E16	AW 10	1.13	No	-	-	-
E17	AW 11	0.71	No	-	-	-
E18	AW 12	0.58	No	-	-	-
E19	AW 13	0.70	No	-	-	-
E20	AW 14	1.03	No	-	-	-
E21	AW 15	0.84	No	-	-	-
E22	Cors Crymlyn SSSI	0.33	-	No	9.3	No
E23	Baglan Bay LWS	102.3	**Yes**	-	-	-

Table 46 Predicted annual mean NOx concentrations at sensitive ecological sites, and comparison with the critical level (30 µg/m^3) using a 12m stack

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) (µg/m^3)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)	Predicted total NO_X (PEC) (µg/m^3)	SSSI/ SAC PEC screening (stage 2)
			If PC is >100% of 30µg/m^3 (30 µg/m^3)	If PC is >1% of 30µg/m^3 (0.3 µg/m^3)		If PEC is >70% of 30µg/m^3 (21 µg/m^3)
E1	Crymlyn Burrows SSSI	2.63	-	Yes	12.0	No
E2	Pant-Y-Sais/Crymlyn Bog/Cors Crymlyn SSSI	0.43	-	Yes	8.5	No
E3	Earlswood Road Cutting and Ferryboat Inn Quarries SSSI	0.82	-	Yes	14.5	No
E4	Kenfig/Cynffig SAC	0.12	-	No	-	-
E5	Gower Ash Woods / Coedydd Ynn Gwyr SAC	0.02	-	No	-	-
E6	Gower Commons / Tiroedd Comin Gwyr SAC	0.03	-	No	-	-
E7	AW 1	0.32	No	-	-	-
E8	AW 2	0.57	No	-	-	-
E9	AW 3	0.65	No	-	-	-
E10	AW 4	1.69	No	-	-	-
E11	AW 5	1.74	No	-	-	-
E12	AW 6	2.09	No	-	-	-
E13	AW 7	1.72	No	-	-	-
E14	AW 8	1.72	No	-	-	-
E15	AW 9	1.04	No	-	-	-
E16	AW 10	0.98	No	-	-	-

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) (µg/m^3)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)	Predicted total NO_X (PEC) (µg/m^3)	SSSI/ SAC PEC screening (stage 2)
			If PC is >100% of 30µg/m^3 (30 µg/m^3)	If PC is >1% of 30µg/m^3 (0.3 µg/m^3)		If PEC is >70% of 30µg/m^3 (21 µg/m^3)
E17	AW 11	0.57	No	-	-	-
E18	AW 12	0.45	No	-	-	-
E19	AW 13	0.60	No	-	-	-
E20	AW 14	0.92	No	-	-	-
E21	AW 15	0.82	No	-	-	-
E22	Cors Crymlyn SSSI	0.28	-	No	-	-
E23	Baglan Bay LWS	2.63	No	-	-	-

5.3.1.2 Daily mean NO_x concentrations

Table 47 Predicted daily mean NO_x concentrations at sensitive ecological sites, and comparison with the critical level (75 µg/m^3) with a 3m stack

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) (µg/m^3)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)
			If PC is >100% of 75µg/m^3 (75 µg/m^3)	If PC is >10% of 75µg/m^3 (7.5 µg/m^3)
E1	Crymlyn Burrows	36.41	-	Yes
E2	Pant-Y-Sais/Crymlyn Bog/Cors Crymlyn	15.87	-	Yes
E3	Earlswood Road Cutting and Ferryboat Inn Quarries	10.92	-	Yes
E4	Kenfig/Cynffig	2.01	-	No
E5	Gower Ash Woods / Coedydd Ynn Gwyr	0.45	-	No
E6	Gower Commons / Tiroedd Comin Gwyr	0.58	-	No
E7	AW 1	12.99	No	-
E8	AW 2	6.72	No	-
E9	AW 3	14.74	No	-
E10	AW 4	23.45	No	-
E11	AW 5	15.83	No	-
E12	AW 6	18.62	No	-
E13	AW 7	14.73	No	-
E14	AW 8	24.06	No	-
E15	AW 9	7.87	No	-
E16	AW 10	8.55	No	-
E17	AW 11	9.24	No	-
E18	AW 12	10.97	No	-
E19	AW 13	5.99	No	-

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) (µg/m^3)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)
			If PC is >100% of 75µg/m^3 (75 µg/m^3)	If PC is >10% of 75µg/m^3 (7.5 µg/m^3)
E20	AW 14	11.15	No	-
E21	AW 15	6.18	No	-
E22	Cors Crymlyn SSSI	7.65	-	Yes
E23	Baglan Bay LWS	879.6	**Yes**	-

Table 48 Predicted daily mean NOx concentrations at sensitive ecological sites, and comparison with the critical level (75 µg/m^3) with a 12m stack

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) (µg/m^3)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)
			If PC is >100% of 75µg/m^3 (75 µg/m^3)	If PC is >10% of 75µg/m^3 (7.5 µg/m^3)
E1	Crymlyn Burrows	33.38	-	Yes
E2	Pant-Y-Sais/Crymlyn Bog/Cors Crymlyn	5.85	-	No
E3	Earlswood Road Cutting and Ferryboat Inn Quarries	10.89	-	Yes
E4	Kenfig/Cynffig	1.54	-	No
E5	Gower Ash Woods / Coedydd Ynn Gwyr	0.37	-	No
E6	Gower Commons / Tiroedd Comin Gwyr	0.56	-	No
E7	AW 1	5.56	No	-
E8	AW 2	6.52	No	-
E9	AW 3	8.64	No	-
E10	AW 4	23.27	No	-
E11	AW 5	18.00	No	-
E12	AW 6	13.87	No	-
E13	AW 7	10.95	No	-
E14	AW 8	11.00	No	-
E15	AW 9	6.41	No	-
E16	AW 10	6.32	No	-
E17	AW 11	3.81	No	-
E18	AW 12	4.03	No	-
E19	AW 13	4.03	No	-
E20	AW 14	5.45	No	-
E21	AW 15	5.61	No	-

Ecological receptor ID	Receptor location	Predicted modelled NO_X (PC) ($\mu g/m^3$)	Local nature site PC screening	SSSI/ SAC PC screening (stage 1)
			If PC is >100% of $75\mu g/m^3$ ($75\ \mu g/m^3$)	If PC is >10% of $75\mu g/m^3$ ($7.5\ \mu g/m^3$)
E22	Cors Crymlyn SSSI	4.11	-	No
E23	Baglan Bay LWS	182.6	**Yes**	-

Figure 15: Area of exceedance of the annual mean NO_x critical level at 3m

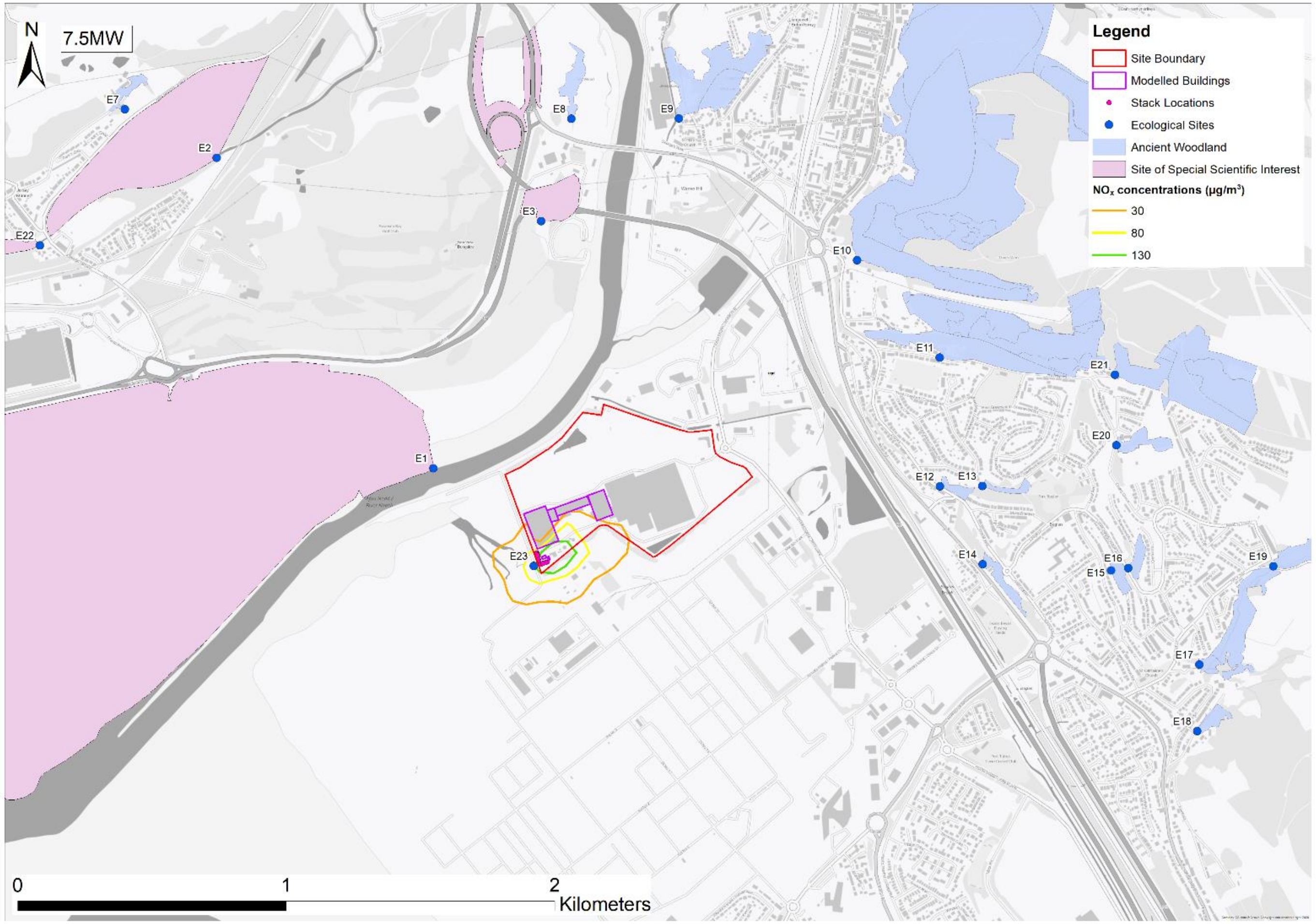
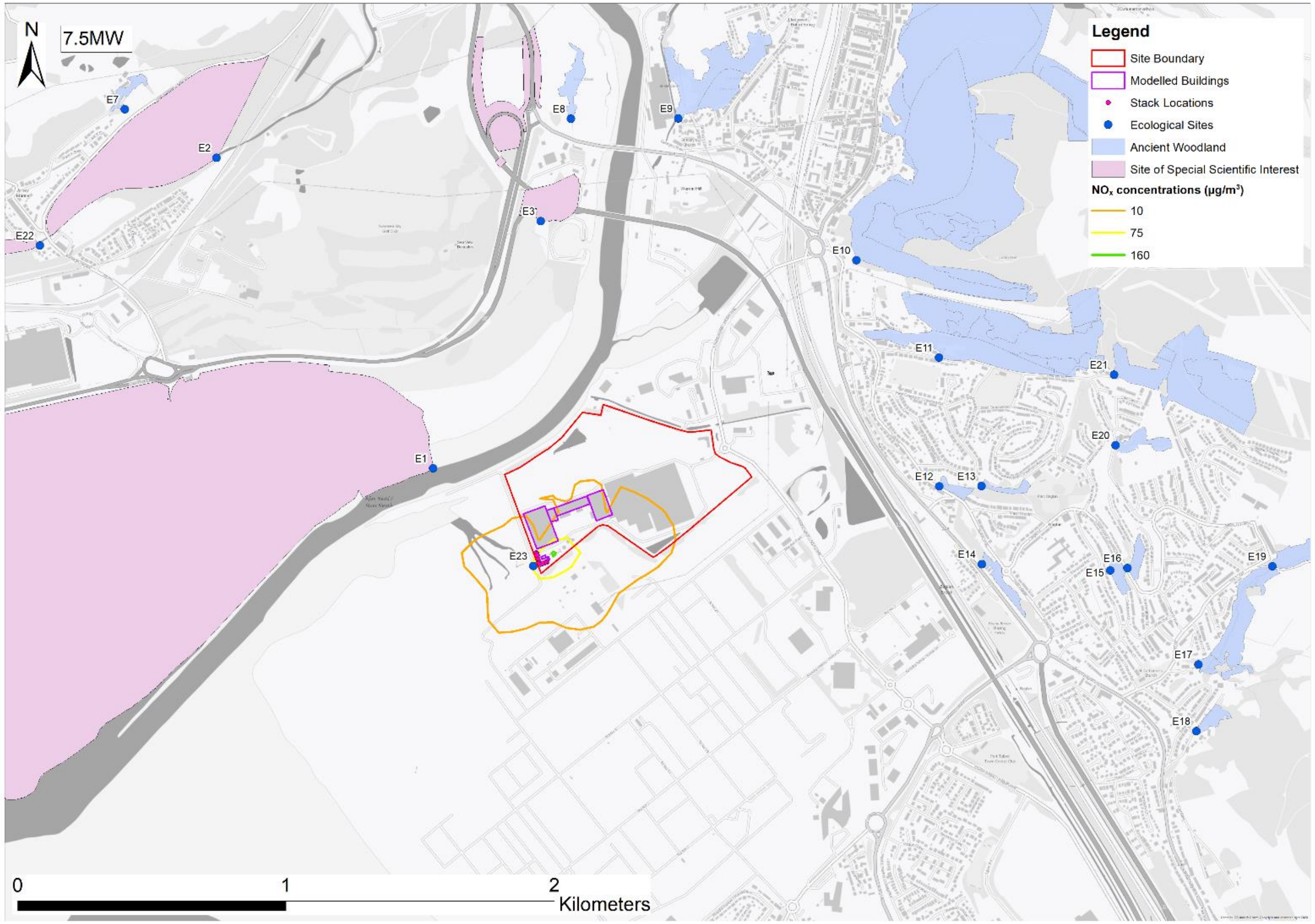


Figure 16: Area of exceedance of the 24 mean NO_x critical level at 3m



5.3.1.4 Nutrient nitrogen deposition

Table 49 Nutrient nitrogen deposition critical loads and background deposition levels

Ecological receptor ID	**Designated area**	**Most sensitive habitat**	**Critical Load Nutrient Nitrogen (kg N/ha/yr)**	**Background N dep (kg N/ha/yr)**
E2	Pant-Y-Sais/Crymlyn Bog/Cors Crymlyn SSSI	Fen	10	10.5
E4	Kenfig/Cynffig SAC	Calcareous Grassland	10	9.0
E5	Gower Ash Woods / Coedydd Ynn Gwyr SAC	Tilio-Acerion forests of flopes, screes and ravines	15	16.6
E6	Gower Commons / Tiroedd Comin Gwyr SAC	Northern Atlantic we heaths tetralix	10	10.8
E7	AW 1	N/A	5	17.1
E8	AW 2	N/A	5	17.1
E9	AW 3	N/A	5	17.1
E10	AW 4	N/A	5	17.1
E11	AW 5	N/A	10	17.1
E12	AW 6	N/A	10	17.1
E13	AW 7	N/A	10	17.1
E14	AW 8	N/A	10	17.1
E15	AW 9	N/A	10	20.3
E16	AW 10	N/A	10	20.3
E17	AW 11	N/A	10	20.3
E18	AW 12	N/A	10	20.3
E19	AW 13	N/A	10	20.3
E20	AW 14	N/A	10	20.3
E21	AW 15	N/A	10	20.3

Ecological receptor ID	Designated area	Most sensitive habitat	Critical Load Nutrient Nitrogen (kg N/ha/yr)	Background N dep (kg N/ha/yr)
E22	Cors Crymlyn SSSI/SAC	Dry Heath	10	12.5

5.3.1.5 Effects as a percentage of critical loads

Table 50 Nutrient nitrogen deposition effects as a percentage of critical loads with a 3m stack

Ecological receptor ID	(PC) Max N (kg N/ha/yr)	Max N + Bgd (kg N/ha/yr)	Proportion of Total Dep to CL (%)	Proportion of PC to CL (%)
E2	0.06	10.56	105.57	0.57
E4	0.02	9.01	90.14	0.14
E5	0.01	16.60	110.70	0.03
E6	<0.1	10.80	108.03	0.03
E7	<0.01	17.17	**343.30**	**1.70**
E8	0.09	17.21	**344.27**	**2.67**
E9	0.13	17.24	**344.88**	**3.28**
E10	0.16	17.42	**348.46**	**6.86**
E11	0.34	17.43	**174.33**	**3.53**
E12	0.35	17.55	**175.45**	**4.65**
E13	0.47	17.46	**174.58**	**3.78**
E14	0.38	17.48	**174.82**	**4.02**
E15	0.40	20.54	**205.41**	**2.41**

Ecological receptor ID	**(PC) Max N (kg N/ha/yr)**	**Max N + Bgd (kg N/ha/yr)**	**Proportion of Total Dep to CL (%)**	**Proportion of PC to CL (%)**
E16	0.24	20.53	**205.29**	**2.29**
E17	0.23	20.44	**204.42**	**1.42**
E18	0.14	20.42	**204.18**	**1.18**
E19	0.12	20.44	**204.42**	**1.42**
E20	0.14	20.51	**205.07**	**2.07**
E21	0.21	20.47	**204.70**	**1.70**
E22	0.17	12.57	125.66	0.66

Table 51 Nutrient nitrogen deposition effects as a percentage of critical loads with a 12m stack

Ecological receptor ID	(PC) Max N (kg N/ha/yr)	Max N + Bgd (kg N/ha/yr)	Proportion of Dep to CL (%)	Proportion of PC to CL (%)
E2	0.09	10.59	105.61	0.61
E4	0.03	9.03	90.17	0.17
E5	0.01	16.61	110.71	0.04
E6	0.01	10.81	108.05	0.05
E7	0.15	17.23	**343.45**	**1.85**
E8	0.25	17.33	**344.88**	**3.28**
E9	0.32	17.40	**345.33**	**3.73**
E10	0.64	17.72	**351.35**	**9.75**
E11	0.65	17.73	**175.82**	**5.02**
E12	0.87	17.95	**176.82**	**6.02**
E13	0.70	17.78	**175.76**	**4.96**
E14	0.81	17.89	**175.76**	**4.96**
E15	0.44	20.74	**205.98**	**2.98**
E16	0.41	20.71	**205.82**	**2.82**
E17	0.23	20.53	**204.64**	**1.64**
E18	0.22	20.52	**204.28**	**1.28**
E19	0.25	20.55	**204.72**	**1.72**
E20	0.34	20.64	**205.65**	**2.65**
E21	0.29	20.59	**205.36**	**2.36**
E22	0.11	12.61	125.81	0.81

5.3.1.6 Acid deposition

Table 52 Acid deposition critical loads and background deposition rates

Ecological receptor ID	Designated area	Most sensitive habitat	CLNmin (kg N/ha/yr)	CLNmax (kg N/ha/yr)	CLSmax (kg N/ha/yr)	N bgd (kg N/ha/yr)	S bgd (kg N/ha/yr)
E2	Pant-Y-Sais/Crymlyn Bog/Cors Crymlyn SSSI	Fen	0.223	0.536	0.170	0.80	0.20
E4	Kenfig/Cynffig SAC	Calcareous Grassland	0.856	4.856	4.000	0.60	0.20
E5	Gower Ash Woods / Coedydd Ynn Gwyr SAC	Tilio-Acerion forests of flopes, screes and ravines	0.142	0.607	0.322	1.20	0.20
E6	Gower Commons / Tiroedd Comin Gwyr SAC	Northern Atlantic we heaths tetralix	0.642	0.802	0.160	0.77	0.14
E7	AW 1	N/A	0.285	0.960	0.675	1.22	0.25
E8	AW 2	N/A	0.357	2.963	2.606	1.22	0.25
E9	AW 3	N/A	0.357	2.963	2.606	1.22	0.25
E10	AW 4	N/A	0.357	2.968	2.611	1.22	0.25
E11	AW 5	N/A	0.357	2.968	2.611	1.22	0.25
E12	AW 6	N/A	0.357	2.955	2.598	1.22	0.25
E13	AW 7	N/A	0.357	2.955	2.598	1.22	0.25
E14	AW 8	N/A	0.357	2.955	2.598	1.22	0.25
E15	AW 9	N/A	0.357	3.024	2.667	1.45	0.29
E16	AW 10	N/A	0.357	3.024	2.667	1.45	0.29
E17	AW 11	N/A	0.357	3.024	2.667	1.45	0.29
E18	AW 12	N/A	0.357	3.024	2.667	1.45	0.29
E19	AW 13	N/A	0.357	3.024	2.667	1.45	0.29
E20	AW 14	N/A	0.285	1.030	0.745	1.45	0.29
E21	AW 15	N/A	0.285	1.030	0.745	1.45	0.29

E22	Cors Crymlyn SSSI/SAC	Dry Heath	0.642	0.982	0.170	0.9	0.2

Table 53 Maximum acid deposition at the designated sites using a 3m stack

Ecological receptor ID	PC N dep (keq N/ha/yr)
E2	0.0041
E4	0.0010
E5	0.0004
E6	0.0002
E7	0.0061
E8	0.0095
E9	0.0117
E10	0.0245
E11	0.0252
E12	0.0332
E13	0.0270
E14	0.0287
E15	0.0172
E16	0.0163
E17	0.0102
E18	0.0084
E19	0.0101
E20	0.0148
E21	0.0121
E22	0.0047

Table 54 Maximum acid deposition at the designated sites using a 12m stack

Ecological receptor ID	PC N dep (keq N/ha/yr)
E2	0.0044
E4	0.0012
E5	0.0005
E6	0.0003
E7	0.0066
E8	0.0117
E9	0.0133
E10	0.0348
E11	0.0359
E12	0.0430
E13	0.0355
E14	0.0354
E15	0.0213
E16	0.0201
E17	0.0117
E18	0.0092
E19	0.0123
E20	0.0189
E21	0.0168
E22	0.0058

5.3.1.8 Assessment of acid deposition on designated sites

Table 55 Assessment of acid deposition impact on designated sites for a 3m stack

Ecological receptor ID	PC % of Critical Load Function	Background % of Critical Load Function	PEC % of Critical Load Function
E2	<0.1	183.2	183.2
E4	<0.1	5.0	5.0
E5	<0.1	230.6	230.6
E6	<0.1	113.5	113.5
E7	1.0	**153.1**	**154.2**
E8	0.3	49.6	49.9
E9	0.3	49.6	49.9
E10	0.7	49.5	50.2
E11	1.0	49.5	50.5
E12	1.0	49.7	50.8
E13	1.0	49.7	50.8
E14	1.0	49.7	50.8
E15	0.7	49.7	50.4
E16	0.7	57.5	58.2
E17	0.3	57.5	57.9
E18	0.3	57.5	57.9
E19	0.3	57.5	57.9
E20	1.0	**168.9**	**169.9**
E21	1.0	**168.9**	**169.9**
E22	<0.1	112.0	112.0

Table 56 Assessment of acid deposition impact on designated sites for a 12m stack

Ecological receptor ID	PC % of Critical Load Function	Background % of Critical Load Function	PEC % of Critical Load Function
E2	1.9	**186.6**	**188.4**
E4	<0.1	5.0	5.0
E5	<0.1	230.6	230.6
E6	<0.1	113.5	113.5
E7	1.0	**153.1**	**154.2**
E8	0.7	49.6	50.3
E9	0.7	49.6	50.3
E10	1.7	49.5	51.2
E11	1.7	49.5	51.2
E12	2.0	49.7	51.8
E13	1.7	49.7	51.4
E14	2.0	49.7	51.8
E15	1.0	57.5	58.5
E16	1.0	57.5	58.5
E17	0.7	57.5	58.2
E18	0.7	57.5	58.2
E19	0.7	57.5	58.2
E20	1.9	**168.9**	**170.9**
E21	1.9	**168.9**	**170.9**
E22	1.0	**112.0**	**113.0**

6 Mitigation and enhancement

Mitigation measures have been considered and assessed for the use of the generators. This is to identify BAT measures to reduce point source emissions to atmosphere and also minimise potential air quality impacts. These mitigation measures included the use of gas generators, alternative power outputs / loads, installation of varying height exhaust stacks and the use of HVO fuel, instead of diesel. The BAT assessment is outlined in Appendix A.

The generators have been installed on-site for emergency purposes pending a grid connection and are therefore a short term and temporary asset.

7 Conclusion

An air quality assessment has been undertaken for the use of temporary emergency generators at the existing Intertissue facility in Baglan.

The air quality assessment was undertaken using a realistic modelling scenario obtained by Aggreko (generator supplier) to meet the operational needs of the facility, using HVO fuel. All generators currently have 3m exhaust stacks on top of the containerised units. There is an option for 12m stacks to be added to the HVO generators at a later date once available, but this is not confirmed. Both scenarios have been modelled.

Both scenarios were modelled, concluding that with a 3m stack on the HVO generators there were predicted exceedances of the air quality standards for hourly mean NO_2 (99.79th percentile) at two receptors located at the adjacent former Power Plant and permissive path.

As there is no public access to the former Bagan Power Plant site, there will be no public exposure and therefore **no significant impacts** are likely to occur at this location. It has also been recommended that the permissive path is shut during the period that the generators are running, this was agreed with NPTC on 09/03/2022, and therefore **no significant impacts** are likely to occur at this location. When a 12m stack was modelled, there are no predicted exceedances.

A number of Ancient Woodland sites are predicted to exceed the 1% process contribution and 70% predicted environmental concentrations criteria for nutrient nitrogen and acid deposition. However, in all cases the existing background deposition levels exceed the relevant critical loads and therefore it is considered that the increase in deposition will results in **no significant impacts**.

In summary, **no significant impacts to human health or ecologically designated receptors are predicted**.

This is as a result of the extensive design interactions and mitigation measures which have been included on-site to minimise the potential impact from emissions to air whilst maintaining operational functionality.

Appendix A

Best Available Technique Assessment

A1 Overview of Scenario Testing for Best Available Technique (BAT)

This appendix contains the findings and background of the appraisal of Best Available Technique (BAT) and reports the findings of various alterations that have been made to the system of generators on the site in order to provide the minimum power required to operate the facility and to minimise air quality impacts as far as practicable. BAT is explained in detail in the Environment Agency Guidance[34] 'Best Available Techniques: environmental permits'[35].The term 'technique' encompasses the technology used and the way the system is designed, built and operated.

The following appendix outlines the initial model setup prior to understanding that alterations would be required to achieve BAT, and subsequently outlines the various scenarios that have been assessed to improve predicted air quality concentrations.

The following scenarios have been presented to show the design development taken on-site through the process and to provide an indication as to the potential effectiveness of different design measures.

It should be noted only receptors 1-19 are presented in this Appendix. The additional receptors 20-25 that are included in the main report were added at a later stage following consultation with Public Health Wales and Natural Resources Wales. These receptors were not therefore included in the early design development models, so the original receptors 1-19 have been maintained to provide consistency.

Emissions of nitrogen dioxide (NO_2) were identified early in the design development as the principal pollutant of concern and therefore this BAT review focusses on the differences in predicted short term and long term NO_2 concentrations only, to determine the effectiveness of key measures.

[34] This Environment Agency guidance is considered to be applicable to Wales in the absence of separate guidance specific to Natural Resources Wales.

[35] Environment Agency, 2016. Best Available Techniques: environmental permits. Available at: https://www.gov.uk/guidance/best-available-techniques-environmental-permits [Accessed January 2022]

A1.1 Scenario 1: All Diesel vs Diesel & Gas Generators

The original model scenario was based on the equipment initially installed on-site, and comprised nine operational diesel generators, with additional redundancy in the event of failure. The emissions modelled assumed that all nine diesel generators were running together at 100% load. This scenario would likely have produced more power than was needed to power the site and is therefore not considered to be representative of likely potential impacts.

This however was the initial assessment and is included here to demonstrate the need to review alternative options and to consider BAT.

Early on however, it was realised that the impact of operating on solely diesel generators was unlikely to be feasible. Therefore, the option of introducing three gas generators (operating at 100%) and then reducing the load on the remaining diesel generators to match the power output, was considered and assessed to determine the effectiveness. Three gas generators is the maximum that the site could accommodate based on the existing gas connection.

The predicted concentrations for this scenario are shown below in Table 57.

For the all diesel scenario, exceedances were predicted at a number of receptors for hourly mean NO_2. Exceedances were also predicted for the hybrid gas and diesel generator option, however it can be seen that on the whole, there was a large predicted improvement in both 1 hour and annual mean concentrations using the hybrid approach.

Overall, there is an average improvement of 28% and 18% for the 1 hour and annual mean concentrations, respectively, using the hybrid gas/diesel set up compared to solely diesel.

It was therefore recommended that the three gas generators were installed to replace the use of diesel generators.

Table 57: Predicted concentrations at human receptor locations for diesel generators vs diesel and gas generators combined hybrid

Receptor ID	**Receptor Description**	**2019 Defra Background Concentration (µg/m³)**		**All diesel PEC (µg/m³)**		**Diesel / Gas hybrid PEC (µg/m³)**		**Change - 1 hour NO_2**		**Change – annual mean NO_2**	
		1hr NO_2	**Annual Mean NO_2**	**1hr NO_2**	**Annual Mean NO_2**	**1hr NO_2**	**Annual Mean NO_2**	**Concentrations (µg/m³)**	**% difference**	**Concentrations (µg/m³)**	**% difference**
1	Ysgol Gymraeg Bro Dur	21.1	10.5	171.6	16.1	130.3	13.7	41.3	24.1	2.4	14.9
2	Ysgol Bae Baglan	21.1	10.5	130.3	17.3	136.6	14.6	-6.3	-4.8	2.7	15.8
3	Ysgol Gynradd Baglan Primary School	27.2	13.6	132.6	20.5	86.4	16.5	46.2	34.9	4.0	19.5
4	Baglan Lodge Care Home	23.9	12.0	524.4	21.3	202.4	15.4	322.0	61.4	6.0	27.9
5	Woodside House Nursing Home	23.9	12.0	454.4	20.4	183.2	15.0	271.3	59.7	5.3	26.3
6	All Born Curious Day Nursery	27.2	13.6	179.1	20.4	212.0	18.4	-32.9	-18.4	2.0	9.9
7	Miles of Smiles Day Nursery	19.2	9.6	212.4	13.2	51.2	10.7	161.2	75.9	2.5	18.7
8	Residential Dwelling: Handel Avenue	15.7	7.9	147.7	13.6	127.0	11.1	20.7	14.0	2.5	18.1
9	Residential Dwelling: Afandale	21.1	10.5	167.0	16.5	117.0	14.0	50.1	30.0	2.5	15.1
10	Residential Dwelling: Westlands	21.1	10.5	196.8	16.0	161.4	14.6	35.4	18.0	1.4	8.7
11	Residential Dwelling: Burrows Road	27.2	13.6	210.6	22.6	124.5	17.4	86.1	40.9	5.1	22.7
12	Residential Dwelling: Swan Road	23.9	12.0	357.8	22.1	96.0	15.7	261.8	73.2	6.4	29.1

13	Residential Dwelling: Ocean View 1	18.0	9.0	61.1	10.5	69.1	9.9	-8.1	-13.2	0.6	5.7
14	Residential Dwelling: Ocean View 2	18.0	9.0	81.0	11.0	73.3	9.9	7.7	9.5	1.1	9.8
15	Residential Dwelling: Bethel Street	23.9	12.0	113.5	17.2	97.8	14.2	15.8	13.9	3.0	17.6
16	Residential Dwelling: Swan Road 2	23.9	12.0	163.9	22.0	76.4	15.9	87.5	53.4	6.1	27.6
17	Residential Dwelling: Brahms Avenue	15.7	7.9	143.8	12.8	108.1	10.6	35.7	24.8	2.2	17.2
18	Residential Dwelling: Parry Road	15.7	7.9	164.8	12.0	127.0	10.2	37.8	22.9	1.8	14.8
19	Residential Dwelling: Travelling Community	27.4	13.7	147.1	21.2	131.3	17.2	15.8	10.7	4.1	19.2
								Average % difference	**27.9**	-	**17.8**

A1.2 Scenario 2: HVO Fuel in place of Diesel, and Addition of Gas Generators

Following the introduction of gas generators to the design in Scenario 1, it became clear that the majority of the total process contribution was due to the diesel generators. The project team discussed the use of the biofuel known as HVO, as Aggreko have tested this fuel and had some initial evidence of its success in reducing NOx and PM_{10} emissions in diesel generators by approximately 40% (further information provided as part of the Permit Variation Application). HVO is known to be sulphur free, so no sulphur emissions were included.

This scenario therefore presents the comparison of the use of the HVO fuel in the diesel generators, together with the introduction of the three gas generators.

The predicted concentrations for the comparison between diesel and HVO use are shown below in Table 58.

As expected, it can be seen that in all cases predicted concentrations reduced for both short term and long term NO_2, on average by 28.7% and 7.7% respectively and therefore the replacement of conventional diesel in all units with HVO was recommended.

Table 58: Predicted concentrations at human receptor locations for Diesel vs HVO fuel

Receptor ID	Receptor Description	2019 Defra Background Concentration (µg/m³)		Diesel / Gas hybrid: Predicted Environmental Concentrations (µg/m³)		HVO & Gas: Predicted Environmental Concentrations (µg/m³)		1 hour mean NO_2		Annual Mean NO_2	
		1 hour mean NO_2	Annual Mean NO_2	1 hour mean NO_2	Annual Mean NO_2	1 hour mean NO_2	Annual Mean NO_2	Change in concentrations (µg/m³)	% difference	Change in concentrations (µg/m³)	% difference
1	Ysgol Gymraeg Bro Dur	21.1	10.5	130.3	13.7	90.7	12.5	39.6	30.4	1.2	8.6
2	Ysgol Bae Baglan	21.1	10.5	136.6	14.6	93.2	13.1	43.4	31.8	1.5	10.1
3	Ysgol Gynradd Baglan Primary School	27.2	13.6	86.4	16.5	64.3	15.4	22.1	25.5	1.1	6.5
4	Baglan Lodge Care Home	23.9	12.0	202.4	15.4	138.7	14.1	63.7	31.5	1.2	8.1
5	Woodside House Nursing Home	23.9	12.0	183.2	15.0	126.5	13.9	56.7	31.0	1.1	7.4

6	All Born Curious Day Nursery	27.2	13.6	212.0	18.4	142.4	16.7	69.7	32.9	1.7	9.4
7	Miles of Smiles Day Nursery	19.2	9.6	51.2	10.7	40.1	10.3	11.2	21.8	0.4	3.8
8	Residential Dwelling: Handel Avenue	15.7	7.9	127.0	11.1	85.4	9.9	41.7	32.8	1.2	10.9
9	Residential Dwelling: Afandale	21.1	10.5	117.0	14.0	83.0	12.7	34.0	29.0	1.3	9.1
10	Residential Dwelling: Westlands	21.1	10.5	161.4	14.6	111.4	13.2	50.1	31.0	1.5	10.2
11	Residential Dwelling: Burrows Road	27.2	13.6	124.5	17.4	90.6	16.0	34.0	27.3	1.4	8.3
12	Residential Dwelling: Swan Road	23.9	12.0	96.0	15.7	71.2	14.4	24.9	25.9	1.3	8.4
13	Residential Dwelling: Ocean View 1	18.0	9.0	69.1	9.9	51.6	9.6	17.5	25.4	0.3	3.2

14	Residential Dwelling: Ocean View 2	18.0	9.0	73.3	9.9	54.8	9.6	18.6	25.3	0.3	3.2
15	Residential Dwelling: Bethel Street	23.9	12.0	97.8	14.2	71.2	13.4	26.6	27.2	0.8	5.8
16	Residential Dwelling: Swan Road 2	23.9	12.0	76.4	15.9	56.5	14.5	19.9	26.1	1.4	8.6
17	Residential Dwelling: Brahms Avenue	15.7	7.9	108.1	10.6	75.9	9.6	32.2	29.8	1.0	9.6
18	Residential Dwelling: Parry Road	15.7	7.9	127.0	10.2	86.4	9.3	40.6	32.0	0.9	8.4
19	Residential Dwelling: Travelling Community	27.4	13.7	131.3	17.2	93.9	15.9	37.5	28.5	1.2	7.1
								Average % difference	**28.7**	**-**	**7.72**

A1.3 Scenario 3: Different Power Outputs / Generator Loads

Given the high concentrations predicted in Scenario 1, the output power and hence number of diesel generators in use were reduced and the use of cleaner gas generators was continued and maximised. The power used by the Sofidel factory was reviewed and although the exact power needed to operate was not known at this stage, various power options were tested, including:

- 7MW Case;
- 9MW Case;
- The Worst Case (max operation of generators).

Aggreko provided the breakdown of power inputs and number of generators needed for each of the power outputs tested, which are outlined below in Table 59.

NOx emissions are considered to be linear based on comparable engine datasheets provided and therefore reductions were made by an appropriate percentage for each scenario.

Models were set up for each of these four scenarios to review the air quality results associated with altering the power output that would be achieved. This was reviewed under the context of limiting production while simultaneously limiting emissions. These are presented in Table 60

In summary, the following predicted reductions in pollutant concentrations were recorded on average across all receptors between scenarios: -

Worst case vs 9MWe power demand = 34.0% (1 hour) and 10.6% (annual)

9MWe vs 7MWe power demand = 23.8% (1 hour) and 5.40% (annual)

In the end, a 7.5MWe load was deemed the minimum required and is what the main assessment is focussed on, which still represents a significant reduction in pollutant concentrations compared to the maximum worst case operating scenario original tested.

Table 59: Operational power scenarios and associated emissions

Operation Scenario: Worse Case												
Emissions (g/s)	GG1	GG2	GG3	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
NO_x	0.49	0.49	0.49	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
Operation Scenario: 9MW Case												
Emissions (g/s)	GG1	GG2	GG3	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9
	100%	100%	100%	75%	75%	75%	75%	75%	75%	0%	0%	0%
NO_x	0.49	0.49	0.49	2.97	2.97	2.97	2.97	2.97	2.97	0.00	0.00	0.00
Operation Scenario: 7MW Case												
Emissions (g/s)	GG1	GG2	GG3	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9
	100%	100%	100%	62%	62%	62%	62%	0%	0%	0%	0%	0%
NO_x	0.49	0.49	0.49	0.29	0.29	0.29	0.29	0.00	0.00	0.00	0.00	0.00

Notes:
'GG' stands for Gas Generator and 'DG' stands for Diesel Generator
All emissions are shown to only two decimal places, full numbers were included in the model setups.

Table 60: Predicted concentrations at human receptor locations comparing alternative power loads

ID	7MW Power – Predicted Environmental Concentrations (µg/m^3)		9MW Power – Predicted Environmental Concentrations (µg/m^3)		1 hour mean NO2		Annual Mean NO_2		Worst Case Power – Predicted Environmental Concentrations (µg/m^3)		1 hour mean NO2		Annual Mean NO_2	
	1 hour mean NO_2	Annual Mean NO_2	1 hour mean NO_2	Annual Mean NO_2	Change in concentrations (µg/m^3) between 7MW and 9MW	% difference	Change in concentrations (µg/m^3) between 7MW and 9MW	% difference	1 hour mean NO_2	Annual Mean NO_2	Change in concentrations (µg/m^3) between 9MW and Worst Case	% difference	Change in concentrations (µg/m^3) between 9MW and Worst Case	% difference
1	44.7	11.5	58.2	12.1	13.4	23.1	0.6	4.9	86.2	13.4	28.0	32.5	1.3	9.6
2	40.8	11.7	52.6	12.4	11.8	22.4	0.7	5.8	79.5	14.0	27.0	33.9	1.6	11.4
3	43.9	14.8	54.2	15.5	10.3	19.0	0.7	4.8	79.7	17.2	25.5	32.0	1.7	9.7
4	123.0	13.8	187.7	15.0	64.8	34.5	1.2	7.9	333.3	17.6	145.6	43.7	2.6	15.0
5	108.3	13.6	163.2	14.6	55.0	33.7	1.1	7.2	288.2	17.0	125.0	43.4	2.4	13.9
6	53.7	14.8	64.3	15.5	10.6	16.4	0.7	4.5	96.2	17.1	31.9	33.1	1.5	9.1
7	36.5	10.2	45.2	10.6	8.7	19.2	0.4	3.5	64.4	11.4	19.1	29.7	0.8	7.2
8	36.2	8.8	46.8	9.4	10.5	22.5	0.6	6.3	72.4	10.7	25.7	35.4	1.3	12.0

9	43.3	11.6	57.1	12.2	13.8	24.1	0.6	5.2	84.8	13.6	27.7	32.6	1.4	10.2
10	45.6	11.5	59.2	12.0	13.6	23.0	0.6	4.6	91.1	13.3	31.9	35.0	1.2	9.2
11	54.2	15.2	72.7	16.2	18.5	25.4	1.0	6.3	112.6	18.5	39.9	35.4	2.3	12.3
12	115.3	14.1	175.8	15.4	60.6	34.4	1.4	8.8	306.0	18.4	130.2	42.5	3.0	16.2
13	25.8	9.3	30.4	9.4	4.6	15.1	0.2	1.8	41.0	9.8	10.6	25.9	0.4	3.8
14	36.1	9.4	47.1	9.6	11.0	23.3	0.2	2.3	61.1	10.1	14.0	22.9	0.5	5.0
15	36.4	13.0	44.9	13.6	8.5	18.9	0.6	4.7	64.2	15.1	19.3	30.1	1.4	9.6
16	49.4	13.9	67.7	15.1	18.3	27.0	1.2	8.0	102.3	17.8	34.7	33.9	2.7	15.3
17	37.2	8.7	50.0	9.2	12.8	25.6	0.5	5.5	78.7	10.4	28.7	36.4	1.1	10.9
18	42.3	8.6	55.3	9.0	12.9	23.4	0.4	4.9	83.6	10.0	28.4	33.9	1.0	9.6
19	49.3	15.1	63.1	16.0	13.8	21.8	0.9	5.6	94.2	18.1	31.2	33.1	2.1	11.5

A1.4 Scenario 4: Stack Height Tests

To improve the predicted concentrations resulting from the operation of the emergency diesel/HVO generators which were still the greatest source of impact, the potential addition of stacks was tested, as Aggreko noted that stacks could be added to the generators in 3m intervals.

This final Scenario therefore compares the effectiveness of the use of stacks on the generators, looking at no stacks, 3m, 6m and 12m.

The gas generators were modelled with a 3m stack each time as they are known to be MCP compliant and would not require higher stacks.

These stack heights were added to the height of the generator units in the model so that the actual height could be modelled. The diesel generator units are 2.6m high, and the gas generators are 5.2m.

As expected, it was found that the higher the stack, the lower the predicted concentrations associated with the generators. The predicted concentrations for the scenarios are shown below in Table 61.

In summary, the following predicted reductions in pollutant concentrations were recorded on average across all receptors between scenarios: -

0m stack vs 3m stacks = 6.40% (1 hour) and 1.48% (annual)

3m stacks vs 6m stacks = 9.98% (1 hour) and 0.92% (annual)

6m stacks vs 12m stacks =18.0% (1 hour) and 2.60% (annual)

It was subsequently found that 3m stacks could be made available immediately and installed easily, and 12m stacks would become available after a couple of months. The final model scenario operated on the basis that the diesel generators would have 3m stacks, that could subsequently be replaced with 12m stacks if needed.

Table 61: Predicted concentrations at human receptor locations for differing stack heights

ID	No stack PEC (µg/m³)		3m stack PEC (µg/m³)		1 hour mean NO2		Annual Mean NO_2		6m stack PEC (µg/m³)		1 hour mean NO2		Annual Mean NO_2		12m stack PEC (µg/m³)		1 hour mean NO2		Annual Mean NO_2	
	1 hour mean NO_2	Annual Mean NO_2	1 hour mean NO_2	Annual Mean NO_2	Change in concentrations (µg/m3) between no stack and 3m	% difference	Change in concentrations (µg/m3) between no stack and 3m	% difference	1 hour mean NO_2	Annual Mean NO_2	Change in concentrations (µg/m3) between 3m and 6m	% difference	Change in concentrations (µg/m3) between 3m and 6m	% difference	1 hour mean NO_2	Annual Mean NO_2	Change in concentrations (µg/m3) between 6m and 12m	% difference	Change in concentrations (µg/m3) between 6m and 12m	% difference
1	118.4	13.4	97.7	13.1	20.7	17.4	0.3	2.4	90.4	12.9	7.3	7.5	0.3	2.0	62.0	12.3	28.4	31.4	0.6	4.4
2	126.4	14.2	91.8	13.7	34.7	27.4	0.5	3.4	72.2	13.3	19.6	21.4	0.4	2.7	57.5	12.7	14.7	20.4	0.6	4.8
3	84.3	16.4	75.2	16.3	9.1	10.8	0.1	0.7	66.8	16.1	8.4	11.2	0.1	0.8	57.9	15.8	8.8	13.2	0.3	2.1
4	207.3	15.2	231.8	15.4	-24.5	-11.8	-0.2	-1.0	244.4	15.5	-12.6	-5.4	-0.1	-0.8	214.7	15.5	29.8	12.2	0.1	0.4
5	187.7	14.9	213.3	15.0	-25.6	-13.6	-0.1	-0.9	215.7	15.1	-2.4	-1.1	-0.1	-0.5	186.0	15.0	29.8	13.8	0.1	0.6
6	185.8	17.9	160.9	17.0	24.9	13.4	0.9	5.1	118.2	16.5	42.7	26.5	0.5	2.7	70.3	15.7	48.0	40.6	0.8	4.7
7	47.7	10.7	45.5	10.7	2.2	4.6	0.0	0.0	51.7	10.9	-6.2	-13.5	-0.2	-1.5	50.4	10.7	1.3	2.4	0.1	1.4
8	115.1	10.8	95.9	10.5	19.3	16.7	0.3	3.0	79.1	10.3	16.8	17.5	0.3	2.4	50.7	9.6	28.4	35.9	0.6	5.9

9	104.7	13.7	101.9	13.3	2.8	2.7	0.4	2.7	82.7	13.0	19.3	18.9	0.3	2.2	62.0	12.4	20.7	25.0	0.6	4.5
10	145.3	14.2	117.3	13.3	28.0	19.3	0.9	6.3	99.1	12.9	18.2	15.5	0.4	3.1	64.1	12.2	35.0	35.3	0.7	5.1
11	117.5	17.3	110.9	17.1	6.7	5.7	0.2	1.1	84.6	17.0	26.3	23.7	0.1	0.8	78.0	16.6	6.7	7.9	0.4	2.3
12	84.8	15.5	107.6	15.6	-22.8	-26.8	-0.1	-0.9	138.0	15.8	-30.5	-28.3	-0.2	-1.3	200.7	16.0	-62.7	-45.4	-0.2	-1.0
13	62.1	9.8	70.2	9.7	-8.1	-13.0	0.0	0.5	50.5	9.7	19.6	28.0	0.1	0.6	32.0	9.5	18.6	36.7	0.2	1.8
14	74.7	9.8	57.2	9.8	17.5	23.4	0.0	0.1	56.5	9.8	0.7	1.2	0.0	-0.1	41.4	9.7	15.2	26.8	0.1	1.5
15	94.3	14.0	79.6	13.9	14.7	15.6	0.1	1.0	57.0	13.8	22.6	28.4	0.1	0.5	48.5	13.9	8.5	15.0	0.0	-0.3
16	71.9	15.6	76.8	15.6	-4.9	-6.8	0.0	-0.2	76.8	15.7	0.0	0.0	-0.1	-0.4	76.1	15.6	0.7	0.9	0.1	0.7
17	89.9	10.3	93.1	10.1	-3.2	-3.5	0.2	2.1	81.2	9.9	11.9	12.8	0.2	1.7	54.9	9.4	26.3	32.3	0.5	5.0
18	106.0	9.9	82.6	9.7	23.5	22.1	0.2	2.0	78.0	9.6	4.6	5.5	0.2	1.8	61.6	9.2	16.5	21.1	0.4	3.9
19	125.7	16.8	103.0	16.7	22.8	18.1	0.1	0.9	82.3	16.6	20.7	20.1	0.1	0.7	68.0	16.3	14.4	17.4	0.3	1.7