AECOM Delivering a better world

CHAPTER 08
Air Quality

Shannon LNG Limited
August 2021

Shannon Technology and Energy Park
Environmental Impact Assessment Report

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8. Air Quality

8.1 Introduction

This chapter describes the potential for the construction, operation and decommission of the Proposed Development to have a significant effect on local air quality. Impacts on air quality can affect human receptors through harm to health and amenity, and nature conservation receptors through harm to vegetation and habitat.

This chapter provides a description of relevant legislation and policy framework, assessment methodology, baseline conditions at the Proposed Development site and its surroundings, an estimate of the anticipated air emissions associated with each of the phases of the Proposed Development, the mitigation measures required to prevent, reduce, or offset any significant adverse effects, and the likely residual effects after these measures have been employed.

8.1.1 Competent Expert

The assessment has been undertaken by Gareth Hodgkiss, an Associate Director with AECOM who has over 15 years of experience in the field of air quality assessment. Gareth holds a Masters of Science degree in Environmental Management from the University of Nottingham (UK) and is a Member of the Institute of Air Quality Management and a Member of the Institution of Environmental Sciences. He has experience of undertaking air quality assessment to support planning and licence applications for industrial sources across Ireland, and experience of assessing air quality impacts in the oil and gas sector for projects in the UK, Central Asia and Africa.

8.1.2 Scope of Assessment

The construction and operational phases of the Proposed Development are covered by this assessment. The air quality impacts arising from these are summarised as follows:

- Construction phase
  - Emissions of dust and particulates from construction activity; and
  - Emissions of oxides of nitrogen (NO_X) (including nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) from construction phase traffic movements, site plant and Non-Road Mobile Machinery.
- Operational Phase
  - Combustion emissions associated with combustion sources for generating heat and power, including NO_X (including NO_2), PM_{10} and $PM_{2.5}$, Total Hydrocarbons (THC) and Volatile Organic Compounds (VOC) (with Formaldehyde (CH_2O) considered separately), carbon monoxide (CO) and sulphur dioxide (SO_2); and
  - Emissions of NO_2 and particulate matter PM_{10} and $PM_{2.5}$ from operational phase traffic movements.

Being an industrial development with storage facilities for natural gas and associated processes, including the storage of diesel fuel and odorants, there is a risk of potential odour emissions from fugitive sources during the operation of the Proposed Development. The Proposed Development will be operated under the conditions of an Industrial Emissions (IE) Licence. The terms of the Licence will require that any fugitive emissions are controlled at source through appropriate management/ mitigation, possibly set out as part of an Operational Emissions Management Plan, or a specific Odour Management Plan. This will reference the application of the Environmental Protection Agency (EPA) guidance 'Odour Impact Assessment Guidance for EPA Licensed Sites (AG5)' (EPA, 2019). The enforcement of the IE licence will ensure that fugitive emissions of odour are minimised and any associated impact at the nearest sensitive locations are negligible and as such, odour emissions are not considered further in this assessment.

There is no detailed plan for decommissioning at this stage, but it is considered that potential air quality impacts during the decommissioning phase will be no worse than those during the construction and operational phase scenarios that are being assessed.

8.2 Legislation and Policy

8.2.1 National Air Quality Standards

The National Air Quality Standards (Government of Ireland, 2011) were transcribed from the following EU legislation:

- European Union (EU) air quality legislation is provided within Directive 2008/50/EC (Clean Air for Europe (CAFE)), which came into force on 11th June 2008. This Directive consolidated previous legislation which was designed to deal with specific pollutants in a consistent manner and provided new air quality objectives for particulate matter with an aerodynamic diameter of less than 2.5 µm ($PM_{2.5}$). The consolidated Directive includes:
  - Directive 99/30/EC - the First Air Quality ‘Daughter’ Directive - sets ambient Air Quality Limit Values (AQLVs) for NO2, oxides of nitrogen (NOX), sulphur dioxide, lead and particulate matter with an aerodynamic diameter of less than 10µm (PM10);
  - Directive 2000/69/EC - the Second Air Quality ‘Daughter’ Directive - sets ambient AQLVs for benzene and carbon monoxide; and
  - Directive 2002/3/EC - the Third Air Quality ‘Daughter’ Directive - seeks to establish long term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.
- The fourth daughter Directive was not included within the consolidation and is described as Directive 2004/107/EC. This sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.
- Directive 2008/50/EC has been implemented through the Air Quality Standards Regulations 2011 (EPA, 2011). These regulations set out upper and lower assessment thresholds for the pollutants of concern. The Air Quality Standards include thresholds to encourage a higher standard of air quality where possible.

The EU Limit Values and National Air Quality Standards that are of relevance to this assessment are presented in Table 8-1.

In addition to the Limit Values and Air Quality Standards, Table 8-1 provides relevant Environmental Assessment Levels and averaging periods for other pollutants, as referred to within EPA guidance (2020). These, which are commonly associated with industrial emissions, are not covered by the EU Directives listed above, but are considered potentially harmful to the environment and human health if present at concentrations exceeding the Environmental Assessment Levels listed.

Table 8-1 also provides Critical Loads for nutrient nitrogen and acid (nitrogen and sulphur), set by the Convention on Long-Range Transboundary Air Pollution (APIS, 2016), for habitats that may potentially be affected by emissions associated with the Proposed Development.

Table 8-1 Air Quality Standards and Environmental Assessment Levels

Pollutant	Averaging Period	Irish Air Quality Standard/ EU Limit Value/ Environmental Assessment Level	Allowable Exceedance
Irish Air Quality Standard/ EU Limit Value			
Nitrogen dioxide (NO_2)	Annual mean	40 µg/m^3	No exceedances allowed
	Hourly mean	200 µg/m^3	18 allowable exceedances (99.79th percentile of hours/year)
Particulate matter (PM_{10})	Annual mean	40 µg/m^3	No exceedances allowed
	Daily mean	50 µg/m^3	35 allowable exceedances (99.41st percentile of days/year)

Pollutant	Averaging Period	Irish Air Quality Standard/ EU Limit Value/ Environmental Assessment Level	Allowable Exceedance
Fine particulate matter ($PM_{2.5}$)	Annual mean	25 µg/m^3	No exceedances allowed
Carbon monoxide (CO)	Rolling 8-hour maximum	10,000 µg/m^3	No exceedances allowed
Sulphur dioxide (SO_2)	Daily mean	125 µg/m^3	3 allowable exceedances (99.18th percentile of days/year)
	Hourly mean	350 µg/m^3	24 allowable exceedances (99.73th percentile of hours/year)
Benzene (C_6H_6)	Annual mean	5 µg/m^3	No exceedances allowed
Oxides of nitrogen (NO_X) – for the protection of ecosystems	Annual mean	30 µg/m^3	No exceedances allowed
Sulphur dioxide (SO_2) – for the protection of ecosystems	Annual mean	20 µg/m^3	No exceedances allowed
UK EA Environmental Assessment Levels			
Carbon monoxide (CO)	Hourly maximum	30,000 µg/m^3	No exceedance allowed (100th percentile rolling 8-hour periods/year)
Sulphur dioxide (SO_2)	15-minute mean	266 µg/m^3	35 allowable exceedances (99.99th percentile of 15-minute periods/year)
Benzene (C_6H_6)	Hourly maximum	195 µg/m^3	No exceedance allowed (100th percentile of hours/year)
Formaldehyde (CH_2O)	Annual Mean	5 µg/m^3	No exceedances allowed
	Hourly maximum	100 µg/m^3	No exceedance allowed (100th percentile of hours/year)
Oxides of nitrogen (NO_X) – for the protection of ecosystems[1]	Daily maximum	75 µg/m^3	No allowable exceedances (100th percentile of days/year)
Sulphur dioxide (SO_2) – for the protection of ecosystems	Annual Mean	10-20 µg/m^3	No exceedances allowed
Convention on Long-Range Transboundary Air Pollution Critical Loads			
Nutrient nitrogen deposition	Annual	Habitat relevant Critical Loads[2]	No exceedances allowed
Acid deposition	Annual	Habitat relevant Critical Loads[2]	No exceedances allowed

Notes:

[1] Research cited in IAQM guidance (2020) states that the daily NO_X standard is of less importance than the annual NO_X standard at nature conservation sites. The daily NO_X standard is typically only of concern at a nature conservation site when SO_2 and O_3 concentrations are elevated close to or in excess of their Air Quality Standards for the protection of ecosystems. The SO_2 concentrations reported in Table 8-17 and the O_3 data reported in Table 8-14 demonstrate that concentrations of neither SO_2 or O_3 are elevated close to those standards and as such, the nature conservation receptors included in this assessment are not considered sensitive to the daily NO_X impacts reported.

[2] See Table 8.9 for habitat specific Critical Loads.

8.2.2 Industrial Emissions Directive

The installed aggregated thermal capacity of the Proposed Development will exceed 50 MW. As such, its operations will fall within the remit of the EU's Industrial Emissions Directive (2010/75/EU). The primary aims of the Industrial Emissions Directive are to prevent or reduce pollution from industrial activities, to reduce waste and to promote energy efficiency. The Directive applies to all large industrial installations and to power plants, which are above a certain size threshold. The Directive will apply to the applicable combustion plant associated with the Proposed Development site.

The Environmental Protection Agency (EPA) is the statutory body for the regulation of IE licences. Shannon Technology and Energy Park will be required to obtain an IE licence from the EPA for the proposed CCGT Power Plant. IE licences are determined having regard to the principle of Best Available Techniques (BAT), which, in turn, is based on the Best Available Techniques Reference Documents ('BREF' documents) developed and published by the European Commission. The EU has prepared a series of reference documents for different industrial activities, which define BAT for that activity.

A Best Available Technology (BAT) Assessment has been undertaken and is summarised in Chapter 01 – Introduction.

8.2.3 Relevant Environmental Legislation

Other national legislative measures that relate to air quality and are of relevance to this assessment are listed are follows:

- European Union (Environmental Impact Assessment) (Environmental Protection Agency Act 1992) (Amendment) Regulations 2020, S.I. No. 191 of 2020;
- European Communities (Birds and Natural Habitats) (Amendment) Regulations 2015, S.I. No. 355 of 2015;
- European Union (Industrial Emissions) Regulations 2013, S.I. 138 of 2013;
- Environmental Protection Agency (Industrial Emissions) (Licensing) Regulations 2013, S.I. 137 of 2013; and
- European Communities (Birds and Natural Habitats) Regulations 2011, S.I. No. 477 of 2011.

8.2.4 National Planning Policy

8.2.4.1 Project Ireland 2040

Project Ireland 2040 is the Government's long-term overarching strategy for future development and infrastructure in Ireland. It consists of several documents, including the National Planning Framework (Government of Ireland, 2018), which is the Government's high-level strategic plan for shaping the future growth and development of Ireland up to 2040.

The National Planning Framework includes the following overarching aim that is relevant to this assessment:

> '*Creating a Clean Environment for a Healthy Society:*
>
> *…Promoting Cleaner Air: Addressing air quality problems in urban and rural areas through better planning and design.*'

The National Planning Framework includes National Policy Objective 64, which stresses the importance of improving ambient air quality:

> '*National Policy Objective 64: Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport to the private car, the promotion of energy efficient buildings and homes, heating systems with zero local emissions, green infrastructure planning and innovative design solutions.*'

Project Ireland 2040 also includes the Government's National Development Plan (Government of Ireland, 2018). This document is focused on Ireland's long-term economic, environmental and social progress up to 2027, and references improvements in air quality as an additional benefit to improving energy efficiency for the primary purpose of reducing carbon emissions.

The air quality assessment described in this chapter will demonstrate whether or not the emissions associated with the construction, operation and decommissioning of the Proposed Development contravene the relevant aims and objectives of Project Ireland 2040.

8.2.5 Local Planning Policy

8.2.5.1 Kerry County Development Plan 2015 – 2021

Planning decisions within Co. Kerry's administrative area are considered against the policies set out in the current County Development Plan (Kerry County Council, 2015). With regards to local air quality and amenity impacts, the following policies are of relevance:

- **Core Strategy CS11** - Support the National Climate Change Strategy and the National Climate Change Adaptation Framework, Building Resilience to Climate Change on an ongoing basis through implementation of supporting objectives in this Plan, particularly those supporting use of alternative and renewable energy sources, sustainable transport, air quality, coastal zone management, flood risk management, soil erosion and promotion of the retention of and planting of trees, hedgerows and afforestation subject to compatibility with environmental designations and legislative requirements.
- **Objective ES28** - Proposals for any economic development in rural areas must demonstrate… That there will be no adverse impact on the residential amenity of nearby residents, particularly in relation to noise, traffic, air quality odours or vermin.
- **Objective NR5** - Ensure all extractive development proposals comply with the objectives of this plan as they relate to development management standards, flood risk management requirements and the protection of landscape, biodiversity, infrastructure, water and air quality, built and cultural heritage and residential amenity.

The Kerry County Development Plan 2022 – 2028 should be published by the Council later this year, having gone through public consultation and review since 2020.

The air quality assessment described in this chapter will demonstrate whether or not the emissions associated with the construction, operation and decommission of the Proposed Development contravene the relevant strategies and aims of Kerry County Development Plan.

8.3 Methodology

8.3.1 Study Area

The air quality study area varies dependent on the source of emissions being considered. The construction phase dust assessment follows the industry standard guidance published by the Institute of Air Quality Management (IAQM) (2014) and considers construction dust impacts on amenity and human health at locations within 350 m of the construction site boundary, and at locations with 50 m of a public road used by construction traffic that is within 500 m of the egress point onto the public road. Construction dust impacts on ecologically sensitive areas within 50 m of the construction site boundary are considered.

The methodology for the assessment of road traffic emissions impacts follows guidance explicitly for that source (TII (NRA), 2011; Highways England (HE), 2019; Moorcroft and Barrowcliffe, et al., 2017) and considers impacts on selected representative receptors located within 200 m of a public road that experiences a defined change in traffic flows. Of the guidance available, that published by the IAQM (Moorcroft and Barrowcliffe, et al., 2017) provides the most stringent criteria with consideration recommended for roads that experience an increase in traffic flow, composition and/ or speed to the extent that it exceeds the criteria below:

- An increase in Light Duty Vehicles (weight <3.5t) of +500 two-way movements per average 24-hour day; and/ or
- An increase in Heavy Duty Vehicles (weight >3.5t) of +100 two-way movements per average 24-hour day.

The methodology for the assessment of industrial site emissions impacts is based on the EPA's Air Dispersion Modelling Guidance Note (AG4) (2020), with reference to UK Environment Agency's Air emissions risk assessment for your environmental permit guidance (2016), which considers locations to represent the worst-case impacts of such emissions from the Proposed Development site, as well as internationally designated nature conservation sites within 10 km of the Proposed Development site.

8.3.2 Impact Assessment

8.3.2.1 Construction Phase Dust and Particulate Matter Assessment

Overview

The movement and handling of soils and spoil during construction is likely to give rise to some short-term airborne dust. The occurrence and significance of dust generated by earth moving operations onsite depositing beyond the site boundary is difficult to estimate and depends upon the weather conditions, ground conditions and location of the work relative to receptors, and the nature of the actual activity being carried out.

Dust emissions and subsequent deposition and soiling at sensitive locations have the potential to harm the amenity of the users of that sensitive land use and or harm vegetation by affecting the rate of photosynthesis. Particulates emissions at sensitive locations is associated with increased risk of harm to human health.

At present, there are no statutory Irish or EU standards relating to the assessment or control of dust. The emphasis of the regulation and control of construction dust, therefore, is through the adoption of Best Practicable Means (BPM) when working onsite. It is intended that significant adverse environmental effects are avoided at the design stage and through embedded mitigation where possible, including the use of good working practices to minimise dust formation which is detailed further in Section 8.6.1.5 of this Chapter.

Assessment Approach

The IAQM provides guidance for good practice qualitative assessment of risk of dust emissions from construction and demolition activities (Holman et al., 2014). The guidance considers the risk of dust emissions from unmitigated activities to cause human health (PM_{10}) impacts, dust soiling impacts, and ecological impacts (such as physical smothering, and chemical impacts for example from deposition of alkaline materials). The appraisal of risk is based on the scale and nature of activities and on the sensitivity of receptors, and the outcome of the appraisal is used to determine the level of good practice mitigation required for adequate control of dust.

The assessment undertaken for this chapter is consistent with the overarching approach to the assessment of the impacts of construction, and the application of example descriptors of impact and risk set out in IAQM guidance. It considered the significance of effects from potential impacts with no mitigation and recommends mitigation measures appropriate to the identified risks to receptors. To encourage consistency with the wider EIA, some of the terminology used in the IAQM guidance has been adjusted to match common terminology used in EPA guidance (2017). The steps in the assessment are to:

- Identify receptors within the screening distance of the site boundary;
- Identify the magnitude of effect through consideration of the scale, duration and location of activities being carried out (including demolition, earthworks, construction and trackout, where construction vehicles could carry mud onto the public highway);
- Establish the sensitivity of the area through determination of the sensitivity and number of receptors and their distance from construction activities;
- Determine the risk of significant effects from impacts on receptors occurring as a result of the magnitude of impact and the sensitivity of the area, assuming no additional mitigation (beyond the identified development design and impact avoidance measures) is applied;
- Determine the level of mitigation required based on the level of risk, to reduce potential impacts at receptors to insignificant or negligible; and
- Summarise the potential residual effects of the mitigated works.

A detailed description of the IAQM construction dust assessment methodology is provided in Volume 4, Appendix A8-1 of this EIAR.

8.3.2.2 Construction Phase Site Plant and Non-Road Mobile Machinery Emissions Assessment

Overview

Combustion products will be emitted to air from onsite construction plant and/ or Non-Road Mobile Machinery (NRMM) operations during construction activities. This will affect air quality and give rise to impact in the form of exposure to increased concentrations of pollutants of sensitive receptors.

Assessment Approach

The IAQM guidance on the assessment of dust from demolition and construction (Holman et al., 2014) includes some discussion of onsite plant and NRMM emissions and states:

> '*Experience of assessing the exhaust emissions from onsite plant … and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and onsite traffic, consideration should be given to the number of plant/ vehicles and their operating hours and locations to assess whether a significant effect is likely to occur.*'

In this instance, the closest human health sensitive receptor is over 300 m from the nearest point of the site boundary and whilst sections of the site boundary adjoin a Candidate Special Area of Conservation (cSAC) and Special Protection Area (SPA), the nearest habitat within the cSAC/ SPA that is considered sensitive to air quality impacts is over 2 km away.

The Highways England guidance (2019) suggests that a source of road traffic emissions that is in excess of 200 m from a receptor will not likely contribute to a significant effect and does not require quantification. For the purpose of this assessment it is considered that such conditions also apply to site plant and NRMM, due to the similar height of emissions release and the intermittent and transient nature of those emissions. As such, and due to the distance between the construction site boundary (and works within) and the nearest air quality sensitive receptors, it is considered that site plant and NRMM emissions impacts will not have a significant effect on local air quality. The impact of construction phase site plant and NRMM emissions has not been considered further.

8.3.2.3 Construction Phase Traffic Emissions Assessment

Overview

The incomplete combustion of fuel in vehicle engines results in the presence of combustion products of CO, PM_{10}, and $PM_{2.5}$ in exhaust emissions as well as hydrocarbons (HC) such as benzene and 1,3-butadiene. Similarly, but to a lesser extent, any sulphur in the fuel can be converted to SO_2 that is then released to atmosphere. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and the fuel is oxidised to form oxides of nitrogen, mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere. NO_2 is associated with adverse effects on human health. Better emission control technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

Although SO_2, CO, benzene, and 1,3-butadiene are present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of this Proposed Development. This is because the released concentrations of these pollutants are low enough so as to not be likely to give rise to significant effects, either in isolation or in combination. In addition, no areas within the local area are considered to be at risk of exceeding the relevant objectives for these pollutants. Therefore, the risks to the attainment of the relevant air quality objectives in the vicinity of the Proposed Development are considered negligible. Emissions of SO_2, CO, benzene, and 1, 3-butadiene from road traffic are therefore not considered further within this assessment.

The exhaust emissions from road vehicles that do have the potential to affect the ambient concentrations of pollutants are NO_2, PM_{10} and $PM_{2.5}$. Therefore, these pollutants are the focus of the assessment of the significance of road traffic air quality impacts.

Assessment Approach

The Design Manual for Roads and Bridges (DMRB) LA105 guidance (Highways England, 2019) sets out criteria to establish the need for an air quality assessment from road traffic. The guidance considers the following changes in traffic anticipated as a result of a development, to identify the need for further evaluation or assessment:

- Annual Average Daily Traffic (AADT) flows of more than 1,000 vehicles;
- 200 Heavy Duty Vehicles (HDV, all vehicles greater than 3.5 tonnes gross weight, including buses);
- A change in the speed band; or
- A change in carriageway alignment by 5m or more.

Guidance published by the IAQM/ EPUK (Moorcroft & Barrowcliffe et al., 2017) sets out alternative and more stringent criteria with a change of 500 light duty vehicles (LDV) and/ or 100 HDV movements when outside of an area considered highly sensitive to changes in emissions (e.g. where an Air Quality Standard is being exceeded or at risk of being exceeded). For changes in traffic below these criteria, significant changes in air quality are not expected. That guidance also suggests that even where these criteria are exceeded, it does not necessarily mean there is potential for significant effect, but more detailed consideration may be required to confirm that.

Prior to any assessment, traffic movements are screened against appropriate criteria, to establish if there is the potential for a significant effect to occur. Where the criteria are exceeded on a given road link that has been considered as part of the Proposed Development Transport Assessment (Chapter 11 - Traffic and Transport), an assessment of air quality impacts will be undertaken.

Construction phase traffic data shared by the project transport consultant has demonstrated that the largest increase is traffic flow is anticipated to occur on the L1010, with 1086 additional two-way LDV movements and 73 additional two-way HDV movements (which equates to an AADT of 1159 two-way vehicle movements) in the year of peak construction. The construction of the Proposed Development is not expected to notably alter the daily average speed of vehicles using the roads, nor the alignment of the roads. Both the DMRB guidance and IAQM/ EPUK guidance suggest that such a change does have the potential to cause an effect of significance and further assessment is required.

Because of the temporary nature of impacts and pollutant concentrations associated with construction phase road traffic emissions from the Proposed Development, and the high standard of baseline air quality, the assessment is based on Highways England's DMRB simple assessment methodology, rather than a detailed assessment method using dispersion modelling software. This is considered to be a proportionate assessment for the consideration of such road traffic emissions contributions.

This approach makes use of a spreadsheet-based tool to predict annual mean NO_X and PM_{10} concentrations based on the relationship between traffic flow characteristics (annual daily average flows, composition of flows and speed) and the distance of a receptor from the road. The tool does not provide outputs for $PM_{2.5}$, so for this assessment, PM_{10} outputs are conservatively assumed to represent $PM_{2.5}$ also.

The annual mean NO_X and PM_{10} (and $PM_{2.5}$) road contribution output from the tool has been multiplied by a factor of 3 to simulate the adjustment of the model for model-bias. Professional experience suggests this is a precautionary approach. The factored road contribution NO_X is converted to NO_2 using a tool made available by the UK Governmental Department for the Environment, Food and Rural Affairs (DEFRA), which uses assumptions on ozone (O_3), NO_X and NO_2 at Local Planning Authority (LPA) level to estimate an appropriate conversion rate. Because the tool is based on conditions within UK LPAs, an assumption has been made to use the conversion rate estimated for Armagh, Banbridge and Craigavon, in Northern Ireland. This was selected as being a predominantly rural location, representative of the study area, on the same landmass and sharing a border with the Ireland.

The assessment of road traffic emissions has considered the following scenarios:

- 2019 Existing Baseline;
- 2024 Future Baseline; and
- 2024 Future Construction Phase.

Input data for the road traffic screening assessment spreadsheet is summarised in Table 8-11. The contribution of road traffic emissions to impacts and total pollutant concentrations has been quantified at receptors located within 200 m of the roads for which traffic data has been provided.

Table 8-2 Road Traffic Assessment Input Data – Construction Phase

Road Link	Traffic Flow Data						Traffic Speed (kph)[3]
	2019 Existing Baseline		2024 Future Baseline		2024 Future Construction		
	AADT[1]	%HDV[2]	AADT[1]	%HDV[2]	AADT[1]	%HDV[2]	
L1010 west of site entrance	352	0.4	372	0.4	372	0.4	- 45-80 on free-flowing sections - 20-45 at the approach to junctions
L1010 east of site entrance	352	0.4	372	0.4	1,458	5.1	
N67 north of Tarbert	1,607	2.6	1,671	2.6	1,715	2.5	
N69 Bridewell Street	5,261	2.4	5,473	2.4	6,515	3.1	
N69 east of Tarbert	5,838	3.6	6,073	3.6	6,825	4.1	
N69 south of Tarbert	4,883	2.8	5,079	2.8	5,329	2.9	
R551 southwest of Tarbert	2,909	2.5	3,026	2.5	3,026	2.5	

Notes:
[1] 24-hour Annual Average Daily Traffic (AADT) data (2-way flows)
[2] Heavy Duty Vehicles (all vehicles >3.5t in weight)
[3] Based on Highways England speed banding

It is noted that the contribution of road traffic emissions to impacts and total pollutant concentrations of pollutants associated with road traffic emissions can only be provided for pollutants with long-term (annual) averaging periods. This is because the traffic data used to inform the air quality assessment is based on average daily flows, and also because it is not standard practice to quantify short-term NO_2 contributions associated with vehicle movements. Instead, annual mean concentrations are compared against an annual mean proxy value of 60 µg/m^3 and 32 µg/m^3, values defined by research undertaken on the UK, to suggest potential for an exceedance of the hourly mean NO_2 and daily mean PM_{10} Air Quality Standards respectively (DEFRA, 2016).

8.3.2.4 Operational Phase Site Emissions Assessment

Overview

The operation of the Proposed Development will include a number of sources with emissions to air associated with combustion plant, to generate heat and power for onsite activity. Emissions to air associated with such plant vary with the type of plant and its purpose, the thermal capacity of the plant and the fuel used to enable combustion.

Natural gas will be the primary fuel source for all non-emergency plant at the Proposed Development site. Emissions from natural gas-fired plant predominantly include the pollutants NO_X and CO but may also include other pollutants to a lesser extent for some sources, including THC, some of which will comprise of VOC, including CH_2O.

Liquid fuel will also be utilised. Onshore, this fuel is limited to generators that will only ever be operational in the event of an emergency and for limited periods of testing and maintenance. Offshore, liquid fuel is required as the pilot fuel for the main power engines on the Floating Storage and Re-gasification Unit (FSRU) and the operational facility's tug fleet. Liquid fuel is also likely to be the engine fuel for a proportion of the Liquified Natural Gas Carriers (LNGC) delivering to the operational facility. Emissions from liquid fuel-fired plant include the same pollutants associated with natural gas, plus PM_{10} and SO_2 (although SO_2 emissions are generally lessened by the use of low and ultra-low sulphur content fuels).

Assessment Method

The assessment of operational site emissions has been undertaken with detailed reference to the EPA's Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA, 2020). Detailed dispersion modelling has been undertaken using the atmospheric dispersion model system (ADMS) 5 (version 5.2.4), which is an advanced steady-state Gaussian type plume model that can simulate dispersion from multiple sources, and is a model authorised for use by the EPA. It has been used to calculate the contribution of site emissions to the total concentration of key pollutants at identified sensitive receptors. The contribution and total pollutant concentrations quantified have been compared with the defined National Air Quality Standards and Environmental Assessment Levels that are relevant to this assessment.

Modelled Scenarios

The main assessment considered in this chapter focuses on what is referred to in this assessment as the Normal Operational Scenario. This is based on the operation of plant at the Proposed Development site in the manner anticipated. However, a series of Sensitivity Scenarios have also been considered, based on alternative and/ or conservative assumptions on the operation of plant at the Proposed Development site. The Normal Operational Scenario and subsequent Sensitivity Scenarios are summarised in Table 8-2.

Table 8-2 Modelled Scenarios Description

Scenario	Operational Plant	Description of Operation
Normal Operational Scenario (Combined Loop Re-gasification[1])	4x main engines on the FSRU	Duel-fuelled – gas-fired for 95% of the year and liquid fuel-fired for 5% of the year
	3x re-gasification boilers on the FSRU	Gas-fired with 4,380 hours of operation/ year
	4x tugs	Liquid fuel-fired with 2x tugs operating for 2,310 hours/ year and 2x tugs operating for 1,155 hours/ year
	Main engine on LNGC delivering to the operational facility	Assumed 50% of LNGC visiting site are gas-fired and 50% are liquid fuel-fired, for 2,310 hours/ year[4]
	3x Water Bath Heaters (WBH)	Gas-fired with 8,760 hours of operation/ year
	4x (+1 spare) package boilers for the Above Ground Installation (AGI)	Gas-fired with 8,760 hours of operation/ year
	6x Combine Cycle Gas Turbines (CCGT)	Gas-fired with 8,760 hours of operation/ year[5]
	7x emergency/backup/auxiliary plant	Gas-fired and liquid fuel-fired with 52 hours/ year for testing and maintenance
Sensitivity Scenario 1: Operational Scenario (Combined Loop Re-gasification[1]) with Combustion Turbine Generator (CTG)	4x main engines on the FSRU	Duel-fuelled – gas-fired for 95% of the year and liquid fuel-fired for 5% of the year
	3x re-gasification boilers on the FSRU	Gas-fired with 4,380 hours of operation/ year
	4x tugs engines	Liquid fuel-fired with 2x tugs operating for 2,310 hours/ year and 2x tugs operating for 1,155 hours/ year
	Main engine on LNGC delivering to the operational facility	Assumed 50% of LNGC visiting site are gas-fired and 50% are liquid fuel-fired, for 2,310 hours/ year[4]
	3x Water Bath Heaters (WBH)	Gas-fired with 8,760 hours of operation/ year
	4x (+1 spare) package boilers for the Above Ground Installation (AGI)	Gas-fired with 8,760 hours of operation/ year
	2x (+1 spare) CTG plant	Gas-fired with 8,760 hours of operation/ year
	2x emergency plant	Liquid fuel-fired with 52 hours/ year for testing and maintenance
Sensitivity Scenario 2: Operational Scenario (Closed Loop Re-gasification[2])	4x main engines on the FSRU	Duel-fuelled – gas-fired for 95% of the year and liquid fuel-fired for 5% of the year
	3x re-gasification boilers on the FSRU	Gas-fired with 8,760 hours of operation/ year
	4x tugs	Liquid fuel-fired with 2x tugs operating for 2,310 hours/ year and 2x tugs operating for 1,155 hours/ year[4]

Scenario	Operational Plant	Description of Operation
	Main engine on LNGC delivering to the operational facility	Assumed 50% of LNGC visiting site are gas-fired and 50% are liquid fuel-fired, for 2,310 hours/ year
	3x Water Bath Heaters (WBH)	Gas-fired with 8,760 hours of operation/ year
	4x (+1 spare) package boilers for the Above Ground Installation (AGI)	Gas-fired with 8,760 hours of operation/ year
	6x Combine Cycle Gas Turbines (CCGT)	Gas-fired with 8,760 hours of operation/ year[4]
	7x emergency/ backup/ auxiliary plant	Gas-fired and liquid fuel-fired with 52 hours/ year for testing and maintenance
Sensitivity Scenario 3: Operational Scenario (Conservative[3])	4x main engines on the FSRU	Duel-fuelled – gas-fired and liquid fuel-fired for 50% of the year each
	3x re-gasification boilers on the FSRU	Gas-fired with 8,760 hours of operation/ year
	4x tugs	Liquid fuel-fired with 2x tugs operating for 4,620 hours/ year and 2x tugs operating for 2,310 hours/ year
	Main engine on LNGC delivering to the operational facility	Assumed 50% of LNGC visiting site are gas-fired and 50% are liquid fuel-fired, for 8760 hours/ year[4]
	3x Water Bath Heaters (WBH)	Gas-fired with 8,760 hours of operation/year
	4x (+1 spare) package boilers for the Above Ground Installation (AGI)	Gas-fired with 8,760 hours of operation/ year
	6x Combine Cycle Gas Turbines (CCGT)	Gas-fired with 8,760 hours of operation/ year[4]
	3x CTG plant	Gas-fired with 8,760 hours of operation/ year
	7x emergency/ backup/ auxiliary plant	Gas-fired and liquid fuel-fired with 52 hours/ year for testing and maintenance

Notes:

[1] Combined loop re-gasification requires the re-gasification boilers to be operational for half the year. During the warmer half of the year, heat is provided by seawater.

[2] Closed loop re-gasification requires the re-gasification boilers to be operational for the full year, without any use of seawater.

[3] Conservative scenario includes a number of unlikely and improbable assumptions, including a greater reliance on liquid fuel for the FSRU, increased frequency in LNGC presence and associated tug movements, and the operation of all 3 CTG plant alongside the CCGT plant.

[4] Whist the frequency of LNGCs accessing the operational facility is currently estimated at up to 60 visits per year, the type of LNGC, or specifically the nature of the visiting LNGC propulsion systems is unknown, beyond the knowledge that LNGC engines will have to comply with the emissions standards set by the MARPOL convention, when using liquid fuel. The International Gas Union (IGN) published a breakdown of the world's LNGC fleet as of the end of 2018 (IGN, 2019). The data demonstrated that the majority of LNGCs used either gas-fired propulsion, or multiple-fuel propulsion systems (with the emphasis on gas mode with Boil-off Gas being readily available). LNGCs that rely on liquid-fuel only propulsion systems account for approximately 10% of the operational LNGCs. The IGN document also reports the LNGC order book going forward, which suggests the proportion of LNGCs with liquid-only fuel propulsion systems is likely to decrease. The assumption made in this assessment on type of LNGC to visit the operation facility is considered to be suitably precautionary.

[5] In reality, CCGT plant will operate for less than 8760 hours per year and the number of hours of operation is expected to decrease year on year.

The scenarios described above include emissions associated with emergency/ backup/ auxiliary plant for testing and maintenance purposes only. The assessment does not consider a scenario for the operation of the emergency/ backup/ auxiliary plant in unison. Such an event when all such plant is in operation at any one time is considered highly unlikely, as is the operation of such plant for a duration of more than one hour. Emergency/ backup/ auxiliary plant operating in isolation for anything other than routine testing and maintenance is also considered unlikely.

Emissions Inventory

A list of individual sources of emissions to air at the Proposed Development site, as included in the dispersion modelling assessment, their emissions characteristics and emission rates are provided in Table 8-3. The table includes the source of data for each emissions point and describes any assumptions on emissions sources that have had to be made. Where assumptions have been made, the intention has been to be precautionary and err on the side of caution.

Table 8-4 provides the same details for the major cumulative sources of emissions to air in the vicinity of the Proposed Development – Moneypoint Power Station and Tarbert Power Station.

Table 8-3 Proposed Development Emissions Inventory

Source	Location		Operational Profile (hrs/yr)[1,2]	Emissions Release Height (m)[3]	Emissions Release Diameter. (m)	Emissions Exit Temp. (ºC)	Emissions Volumetric Flow Rate (m^3/s)	Emissions Exit Velocity (m/s)	Mass Emission Rates (g/s)					
	X	Y							NO_X	CO	THC/VOC	CH_2O	SO_2	PM
FSRU Main Engine (Wärtsilä 6L50DF) (gas-fired)[4]	102932	149328	8760	50	1.07	303	15.4	17.1	1.95	1.46	0.80	0.37	-	0.10
FSRU Main Engine (Wärtsilä 6L50DF) (liquid fuel-fired)[4]	102931	149332	8760	50	1.07	284	11.1	9.98	5.13	1.43	0.50	-	0.40	0.15
FSRU Main Engine (Wärtsilä 8L50DF) (gas-fired)_1[4]	102931	149336	8760	50	1.13	319	19.0	18.9	2.60	1.95	1.06	0.50	-	0.14
FSRU Main Engine (Wärtsilä 8L50DF) (gas-fired)_2[4]	102930	149340	8760	50	1.13	319	19.0	18.9	2.60	1.95	1.06	0.50	-	0.14
FSRU Main Engine (Wärtsilä 8L50DF) (gas-fired)_3[4]	102932	149328	8760	50	1.13	319	19.0	18.9	2.60	1.95	1.06	0.50	-	0.14
FSRU Main Engine (Wärtsilä 8L50DF) (liquid fuel-fired)_1[4]	102931	149332	438	50	1.13	297	12.2	12.2	5.13	1.43	0.50	-	0.40	0.15
FSRU Main Engine (Wärtsilä 8L50DF) (liquid fuel-fired)_2[4]	102931	149336	438	50	1.13	297	12.2	12.2	5.13	1.43	0.50	-	0.40	0.15
FSRU Main Engine (Wärtsilä 8L50DF) (liquid fuel-fired)_3[4]	102930	149340	438	50	1.13	297	12.2	12.2	5.13	1.43	0.50	-	0.40	0.15
FSRU Re-gas Boiler (MAC-90BF Boiler)_1[4]	102922	149336	4380	50	1.47	450	36.4	21.4	2.86	2.41	0.16	0.07	-	0.21
FSRU Re-gas Boiler (MAC-90BF Boiler)_2[4]	102922	149333	4380	50	1.47	450	36.4	21.4	2.86	2.41	0.16	0.07	-	0.21
FSRU Re-gas Boiler (MAC-90BF Boiler)_3[4]	102923	149328	4380	50	1.47	450	36.4	21.4	2.86	2.41	0.16	0.07	-	0.21
Tug_1[5,6]	102774	149164	2310	7.25	0.46	500	7.78	47.1	0.46	0.57	-	-	0.01	0.23

Source	Location		Operational Profile (hrs/yr)[1,2]	Emissions Release Height (m)[3]	Emissions Release Diameter. (m)	Emissions Exit Temp. (°C)	Emissions Volumetric Flow Rate (m^3/s)	Emissions Exit Velocity (m/s)	Mass Emission Rates (g/s)					
	X	Y							NO_X	CO	THC/VOC	CH_2O	SO_2	PM
Tug_2[5,6]	102779	149182	2310	7.25	0.46	500	7.78	47.1	0.46	0.57	-	-	0.01	0.23
Tug_3[5,6]	102784	149203	1155	7.25	0.46	500	7.78	47.1	0.46	0.57	-	-	0.01	0.23
Tug_4[5,6]	102789	149223	1155	7.25	0.46	500	7.78	47.1	0.46	0.57	-	-	0.01	0.23
LNGC (gas-fired)[4,6]	102937	149392	1155	35	0.60	400	2.63	9.30	1.17	0.44	0.02	0.01	-	0.03
LNGC (liquid fuel-fired)[6,7]	102937	149392	1155	35	1.68	316	9.31	4.20	2.03	11.3	-	-	0.35	0.11
WBH_1[5]	102618	148765	8760	10	0.30	398	2.36	32.0	0.08	0.12	0.02	-	-	-
WBH_2[5]	102615	148770	8760	10	0.30	398	2.36	32.0	0.08	0.12	0.02	-	-	-
WBH_3[5]	102612	148775	8760	10	0.30	398	2.36	32.0	0.08	0.12	0.02	-	-	-
AGI Package Boiler_1[5]	102775	148628	8760	8	0.20	70	0.28	9.00	0.04	0.03	-	-	-	-
AGI Package Boiler_2[5]	102781	148626	8760	8	0.20	70	0.28	9.00	0.04	0.03	-	-	-	-
AGI Package Boiler_3[5]	102788	148624	8760	8	0.20	70	0.28	9.00	0.04	0.03	-	-	-	-
AGI Package Boiler_4[5]	102793	148623	8760	8	0.20	70	0.28	9.00	0.04	0.03	-	-	-	-
CTG_1[5]	102722	148766	0	9	2.40	532	110	25.0	1.10	1.10	0.70	-	-	-

Source	Location		Operational Profile (hrs/yr)[1,2]	Emissions Release Height (m)[3]	Emissions Release Diameter. (m)	Emissions Exit Temp. (ºC)	Emissions Volumetric Flow Rate (m^3/s)	Emissions Exit Velocity (m/s)	Mass Emission Rates (g/s)					
	X	Y							NO_X	CO	THC/VOC	CH_2O	SO_2	PM
CTG_2[5]	102733	148773	0	9	2.40	532	110	25.0	1.10	1.10	0.70	-	-	-
CTG_3[5]	102744	148780	0	9	2.40	532	110	25.0	1.10	1.10	0.70	-	-	-
Black Start Generator[5]	102689	148769	52	5	0.25	523	1.98	39.1	2.40	0.12	0.01	-	0.07	0.01
Diesel Fire Water Pump_A[5]	102652	148694	52	3	0.20	499	1.23	38.0	1.53	0.08	0.01	-	0.05	0.01
CCGT_1a[5]	102263	148549	8760	35	3.00	76	143	19.0	5.63	11.3	2.50	-	-	-
CCGT_1b[5]	102282	148561	8760	35	3.00	76	143	19.0	5.63	11.3	2.50	-	-	-
CCGT_2a[5]	102348	148601	8760	35	3.00	76	143	19.0	5.63	11.3	2.50	-	-	-
CCGT_2b[5]	102368	148613	8760	35	3.00	76	143	19.0	5.63	11.3	2.50	-	-	-
CCGT_3a[5]	102434	148654	8760	35	3.00	76	143	19.0	5.63	11.3	2.50	-	-	-
CCGT_3b[5]	102453	148666	8760	35	3.00	76	143	19.0	5.63	11.3	2.50	-	-	-
Auxiliary Boiler[5]	102491	148570	52	32	0.80	150	9.44	17.8	0.45	0.65	0.20	-	-	-
Standby Diesel Generator_1[5]	102337	148544	52	17	0.25	523	1.98	39.1	2.40	0.12	0.01	-	0.07	0.01
Standby Diesel Generator_2[5]	102430	148601	52	17	0.25	523	1.98	39.1	2.40	0.12	0.01	-	0.07	0.01

Source	Location		Operational Profile (hrs/yr)[1,2]	Emissions Release Height (m)[3]	Emissions Release Diameter. (m)	Emissions Exit Temp. (ºC)	Emissions Volumetric Flow Rate (m^3/s)	Emissions Exit Velocity (m/s)	Mass Emission Rates (g/s)					
	X	Y							NO_X	CO	THC/VOC	CH_2O	SO_2	PM
Standby Diesel Generator_3[5]	102516	148653	52	17	0.25	523	1.98	39.1	2.40	0.12	0.01	-	0.07	0.01
Diesel Fire Water Pump_B[5]	102588	148763	52	3	0.15	499	1.80	48.1	1.10	0.06	0.01	-	0.03	0.01

Notes:

[1] Profile based on normal operational scenario, as provided by the Proposed Development design team.

[2] In the normal operational scenario, the CCGT plant is the main source of power for the facility and the CTG plant will not be in operation. In sensitivity scenario 1, the CCGT plant is not in operation and instead, two of the three CTG plant are in operation for 8760 hours of the year.

[3] Emissions release height above ground level for onshore sources and sea level for Offshore sources.

[4] Emissions data sourced from the *Gas Import Jetty and Pipeline Project Environmental Effects Statement – Air Quality Impact Assessment* (AGL Wholesale Gas Limited and APA Transmission Pty Limited, 2020), which utilised the same FSRU technology as proposed and a near identical energy demand and provided data on a representative gas-fired LNGC.

[5] Emissions data provided by the Proposed Development design team.

[6] All emissions from tugs and LNGC are modelled at the location at which those sources are closest to the shore and the nearest air quality sensitive receptors.

[7] Emissions data sourced from the *Liquefaction Facility Air Quality Modelling Report Supporting Resource Report No. 9* (Alaska LNG, 2017), which contained a representative example of a liquid fuel-fired LNGC.

Table 8-4 Cumulative Sources Emissions Inventory Emissions Inventory

Source	Location		Operational Profile (hrs/yr)	Emissions Release Height (m)[5]	Emissions Release Diameter. (m)	Emissions Exit Temp. (ºC)	Emissions Volumetric Flow Rate (m^3/s)	Emissions Exit Velocity (m/s)	Mass Emission Rates (g/s)					
	X	Y							NO_X	CO	THC/VOC	CH_2O	SO_2	PM
Moneypoint Power Station Stack 1[1,2]	103490	151683	8,760	220	6.89	145	1020.56	27.4	133	-	-	-	133	33.3
Moneypoint Power Station Stack 2[1,2]	103624	151634	8,760	220	6.89	145	510.28	13.7	66.7	-	-	-	66.7	16.7

Source	Location		Operational Profile (hrs/yr)	Emissions Release Height (m)[5]	Emissions Release Diameter. (m)	Emissions Exit Temp. (ºC)	Emissions Volumetric Flow Rate (m^3/s)	Emissions Exit Velocity (m/s)	Mass Emission Rates (g/s)					
	X	Y							NO_X	CO	THC/VOC	CH_2O	SO_2	PM
Tarbert Power Station Stack 1[2,3]	107679	149489	794.2[4]	121	3.05	121	144.49	19.8	7.54	-	-	-	15.1	1.33
Tarbert Power Station Stack 2[2,3]	107616	149543	794.2[4]	152	5.4	152	523.25	22.8	12.9	-	-	-	12.9	1.61

Notes:

[1] Emissions information sourced from the air quality assessment reported in the *Environmental Impact Statement Shannon LNG CHP Plant* (Shannon LNG, 2012) and the Moneypoint Power Station Environmental Licence (Licence Reg No. P0605-04).

[2] Emissions data based on Moneypoint and Tarbert Power Stations operating at Licenced Emission Limits. In reality, they operate at levels well below Licenced Emission Limits (Moneypoint in particular). The cumulative assessment is therefore precautionary. Furthermore, coal burning at Moneypoint Power Station and oil burning at Tarbert Power Station is due to cease by 2025. Should the Power Stations be retrofitted with non-coal and non-oil burning plant, mass emissions of the pollutants of concern to this assessment are likely to lower than those reported in this table.

[3] Emissions information sourced from the air quality assessment reported in the *Environmental Impact Statement Shannon LNG CHP Plant* (Shannon LNG, 2012) and the Tarbert Power Station Environmental Licence (Licence Reg. No. 716).

[4] Tarbert Power Station is utilised as peaking plant to the Irish National Grid. The hours/year assumed in this assessment equates to the average hours of operation from 2015 and 2019.

[5] Emissions release height above ground level.

Meteorological Data

Actual measured hourly-sequential meteorological data is required for input into dispersion models, and it is important to select data as representative as possible for the site that will be modelled. This is usually achieved by selecting a meteorological station as close to the site as possible, although other stations may be used if the local terrain and conditions vary considerably, or if the station does not provide sufficient data.

The meteorological site that was selected for the assessment is Shannon Airport, located approximately 35 km east-northeast of the Proposed Development site, at a location close to the Shannon Estuary, on a flat airfield in a principally agricultural area. Therefore, the meteorological site is considered representative of the air quality study area and a surface roughness of 0.2 m (representative of an agricultural area) has been selected for the meteorological site.

The modelling for this assessment has utilised 5 years of meteorological data for the period 2016 – 2020. Wind roses for each of the years within this period are shown in Figure 8-1.

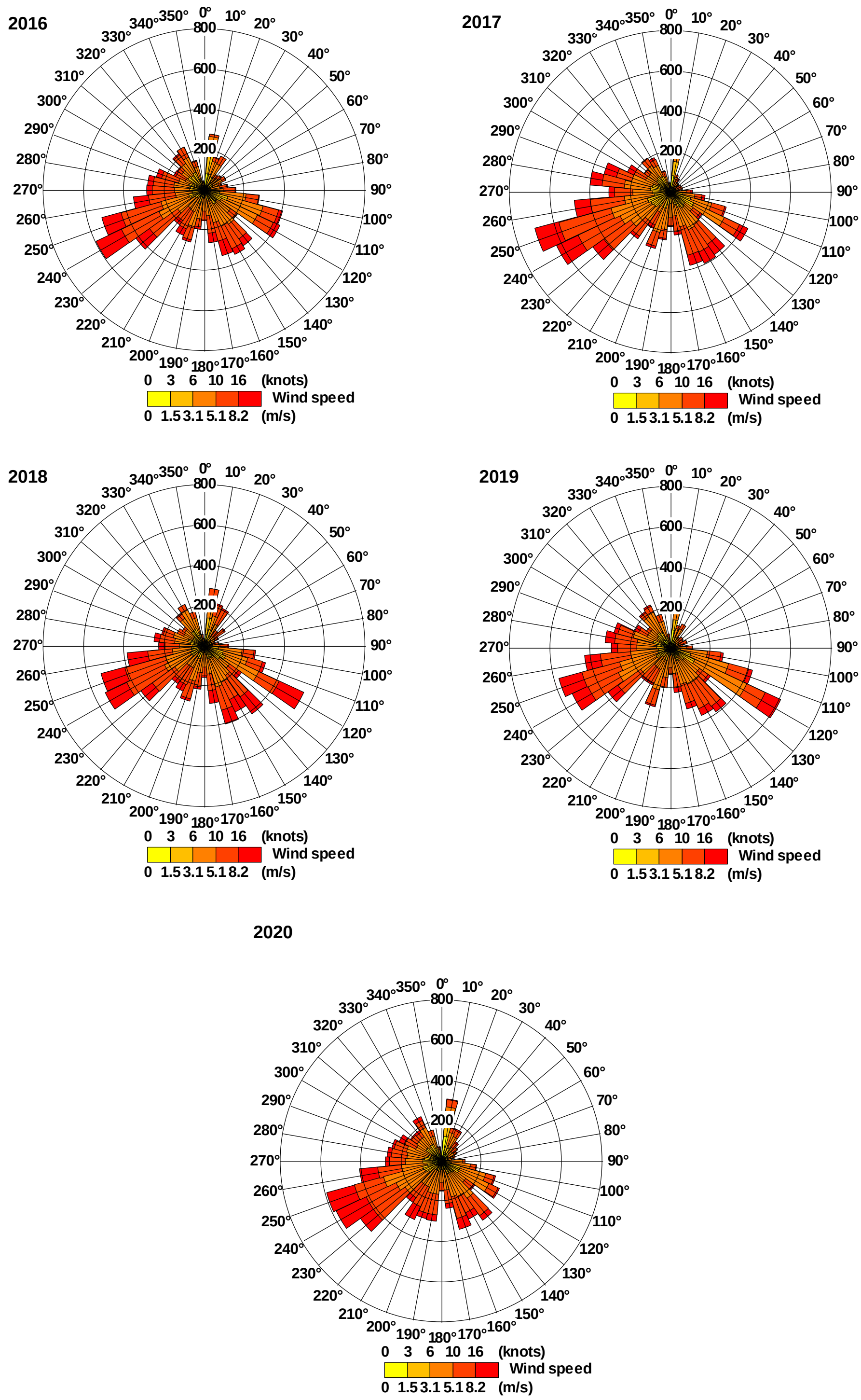

Figure 8-1 Wind Rose Plots for Shannon Airport

A sensitivity analysis of the use of meteorological data in the model is provided in Volume 4, Appendix A8-2 of this EIAR.

Building Data

The buildings and structures that make up the Proposed Development have the potential to affect the dispersion of emissions from the operational site sources. The ADMS 5 buildings effect module has therefore been used to incorporate building downwash effects as part of the modelling procedure. Nearby buildings and structures that are greater than one third of the range of stack heights modelled have the potential to affect the dispersion of emissions and have been included within the modelling assessment.

Buildings associated with the Proposed Development that have been considered to be of sufficient height and size to potentially impact on the dispersion of emission stacks are shown in Table 8-5. A plan showing the buildings layout used in the ADMS simulation is illustrated in Figure 8-2. A sensitivity analysis of the influence of building data in the model is provided in Volume 4, Appendix A8-2.

Table 8-5 Building Downwash Input Data

Building Name	Location		Height (m)	Length (m)	Width (m)	Orientation (º)	Diameter (m)
	X	y					
HRSG Building 1	102272	148559	28.8	46	28	238.5	-
HRSG Building 2	102359	148613	28.8	46	28	238.5	-
HRSG Building 3	102444	148665	28.8	46	28	238.5	-
Turbine Hall 1	102474	148661	13.8	96	66	238.5	-
Turbine Hall 2	102302	148556	13.8	96	66	238.5	-
Turbine Hall 3	102389	148609	13.8	96	66	238.5	-
Cooling Tower 1	102285	148631	25	57	50	238.5	-
Cooling Tower 2	102368	148682	25	57	50	238.5	-
Cooling Tower 3	102454	148734	25	57	50	238.5	-
CTG1	102721	148767	6	16	10	148.5	-
CTG2	102733	148774	6	16	10	148.5	-
CTG3	102744	148781	6	16	10	148.5	-
Auxiliary Boiler	102485	148580	15.5	15	15	148.5	-
GIS Substation	102346	148497	14.2	61	19	238.5	-
Canteen	102450	148559	7.5	52	14	238.5	-
Central Control	102507	148594	5.7	23	14	148.5	-
FG Regulating	102620	148773	4.8	17	16	148.5	-
Raw Water Tank B	102582	148746	24	-	-	-	21
Raw Water Tank A	102568	148770	24	-	-	-	21
Firewater Tank A	102657	148708	16	-	-	-	17
Firewater Tank B	102669	148688	16	-	-	-	17
FSRU Nav Deck	102883	149327	38.8	40	14	171.1	-
FSRU Engine Emissions	102922	149334	45	38	22	171.1	-
LNG Carrier	102931	149389	30	38	22	171.1	-

Terrain Data

Due to the limited variation in terrain across the study area, Shuttle Radar Topography Mission (SRTM) terrain data has been incorporated into the model with a resolution of 90 m. Figure 8-3 provides a visual representation of the terrain data across the air quality study area. A sensitivity analysis of the influence of terrain data in the model is provided in Volume 4, Appendix A8-2.

Surface Roughness Data

Due to the location of the site on and adjacent to the Shannon Estuary, the effect of surface roughness on turbulence and flow field has been accounted for with the inclusion of a variable surface roughness file in the dispersion model. Areas of the Shannon Estuary have a surface roughness value of 0.0001 m and areas on land 0.2 m. This is illustrated in Figure 8-4, with white representing areas with a surface roughness of 0.0001 m and purple representing areas with a surface roughness of 0.2 m. A sensitivity analysis of the influence of surface roughness data in the model is provided in Volume 4, Appendix A8-2.

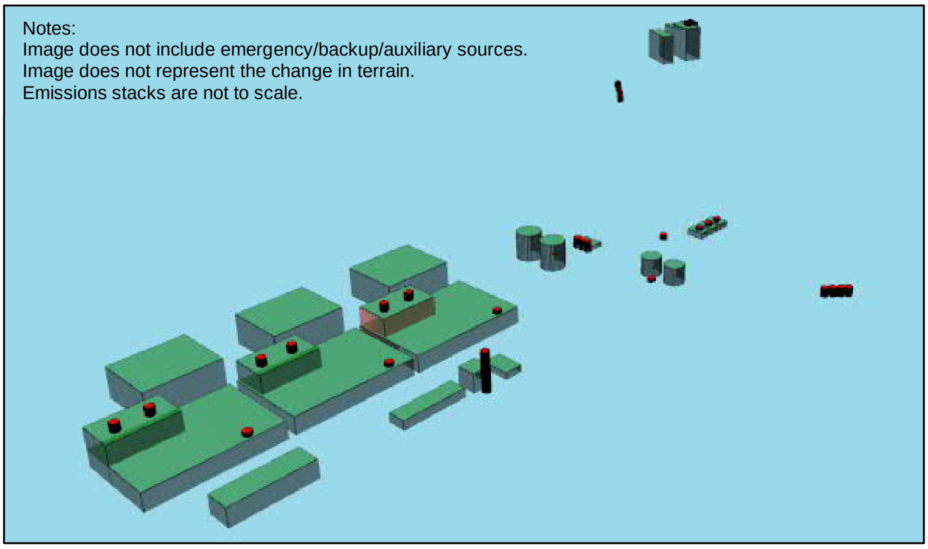

Figure 8-2 Visual Representation of Modelled Building in ADMS 5 Dispersion Model

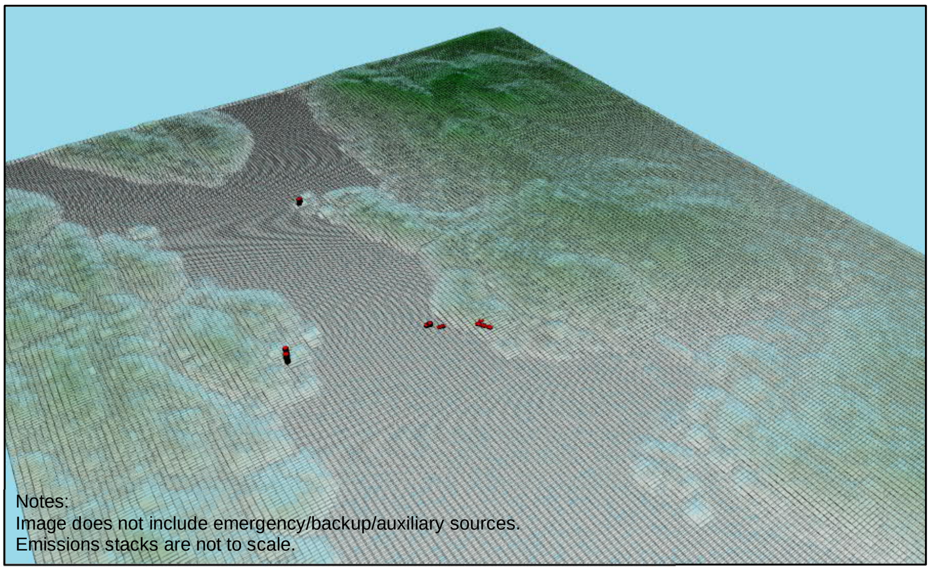

Figure 8-3 Visual Representation of Modelled Terrain Data in ADMS Dispersion Model

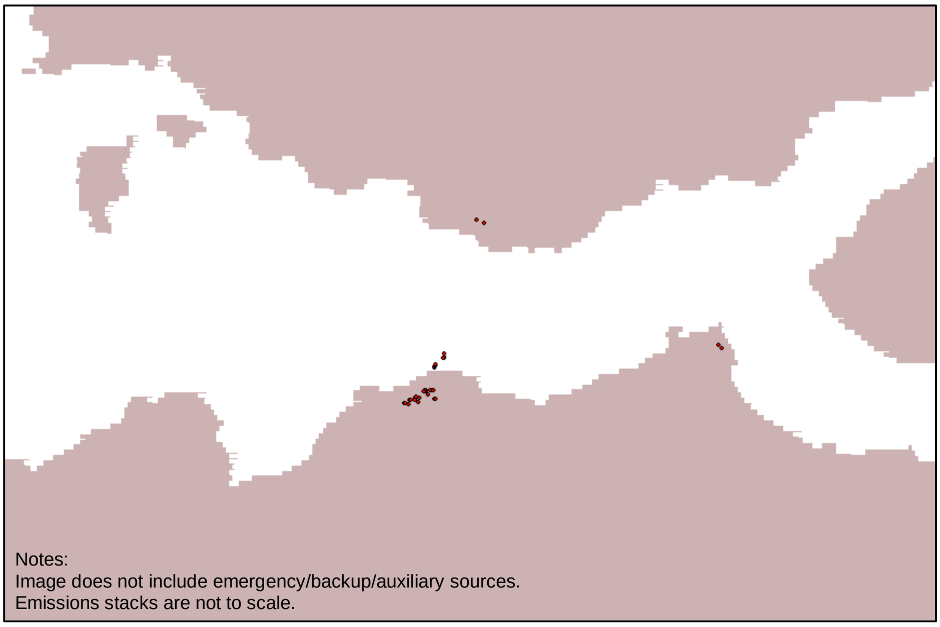

Figure 8-4 Visual Representation of Modelled Surface Roughness Data in ADMS Dispersion Model

Conversion of NO_X to NO_2

Emissions of nitrogen oxides from industrial point sources are typically dominated by nitric oxide (NO), with emissions from combustion sources typically in the ratio of nitric oxide to nitrogen dioxide of 9:1. However, it is nitrogen dioxide that has specified environmental standards due to its potential impact on human health. In the ambient air, nitric oxide is oxidised to nitrogen dioxide by the ozone present, and the rate of oxidation is dependent on the relative concentrations of nitric oxide and ozone in the ambient air.

For the purposes of detailed modelling, and in accordance with EPA technical guidance (2020), it is assumed that 100% of nitric oxide emitted from the stack is oxidised to nitrogen dioxide in the long term and 50% of the emitted nitric oxide is oxidised to nitrogen dioxide in the local vicinity of the site in the short-term.

Background Pollutant Concentration Data

The dispersion model predicts the contribution of pollutants from Proposed Development emissions sources at selected air quality sensitive receptors. To report total pollutant concentrations that can be compared to the relevant Air Quality Standards and Environmental Assessment Levels at the selected air quality sensitive receptors, this contribution needs to be added onto the background (or ambient) pollutant concentrations that are representative of those locations.

The background pollutant concentrations used to inform this assessment have been obtained from the most recent *Air Quality in Ireland* report published by the EPA (2020) and the Environmental Impact Assessment Report for the *Foynes to Limerick Road (including Adare Bypass)* (Roughan & O'Donovan – AECOM Alliance, 2019).

The background pollutant concentration data is listed in Table 8-6. For pollutants with averaging periods of less than the annual mean, it is standard practice to assume the background concentration is the annual mean (long-term) value doubled, which is in line with EPA guidance (2020). This is sometimes considered overly precautionary for pollutants that have an Air Quality Standard or Environmental Assessment Level averaged over 24-hours, and it is often more appropriate that the background for pollutants with daily mean Standards or Assessment Levels is the annual mean background x 1.5. In this instance, double the annual mean background has been used for all short-term (<annual mean) pollutants, due to the existing standard of air quality in the study area. Background nitrogen deposition values were sourced from EPA Research Report No. 323 (EPA, 2020). No ambient background data could be found for acid deposition rates and a proxy background value has been used as an alternative, as described in Table 8-6. Due to the use of this proxy value, there remains some uncertainty in the annual mean acid deposition rates reported in this chapter.

Table 8-6 Background Pollutant Concentration Data

Pollutant	Averaging Period	Rural Concentration (µg/m^3 unless stated))	Urban Concentration (µg/m^3 unless stated)
National Air Quality Standard Pollutant			
Nitrogen dioxide (NO_2)	Annual mean	4.3	4.7
	Hourly mean	8.7	9.4
Particulate matter (PM_{10})	Annual mean	9.0	14.3
	Daily mean	18.0	28.5
Fine particulate matter ($PM_{2.5}$)	Annual mean	4.0	9.3
Carbon monoxide (CO)	Rolling 8-hour mean	100	100
Sulphur dioxide (SO_2)	Daily mean	2.6	6.1
	Hourly mean	2.6	6.1
Benzene (C_6H_6)	Annual mean	0.2	0.2
Oxides of nitrogen (NO_X) – for the protection of ecosystems	Annual mean	6.2	7.8
Sulphur dioxide (SO_2) – for the protection of ecosystems	Annual mean	1.3	3.1
UK EA Environmental Assessment Levels			
Carbon monoxide (CO)	Hourly maximum	0.1	0.1
Sulphur dioxide (SO_2)	15-minute mean	2.6	6.1
Benzene (C_6H_6)	Hourly maximum	0.3	0.3
Formaldehyde (CH_2O)	Annual mean	No data available	
	Hourly maximum	No data available	
Oxides of nitrogen (NO_X) – for the protection of ecosystems	Daily mean	12.4	15.7
Sulphur dioxide (SO_2) – for the protection of ecosystems	Annual mean	1.3	3.1
Convention on Long-Range Transboundary Air Pollution Critical Loads			
Nitrogen deposition	Annual mean	12 kg N/ha/yr	
Acid deposition	Annual mean	0.5 (N: 0.4 / S: 0.1) keq/ha/yr[1]	

Notes:
[1] No acid deposition data for Ireland obtained. Instead, a representative value has been used and obtained from APIS, based on modelled acid deposition rates at a rural location in the west of Wales, at British National Grid reference 214675,325608. However, Predicted Environmental Concentrations of acid deposition reported in this chapter should be treated with caution.

Calculating Nitrogen and Acid Deposition

The deposition of nutrient nitrogen and acid at sensitive nature conservation receptors has been calculated, using the modelled Process Contribution predicted at the receptor points. The deposition rates are determined using conversion rates and factors contained within EPA guidance (2020), which account for various deposition mechanisms in different types of habitat. The conversion rates and factors used in the assessment are detailed in Table 8-7.

Table 8-7 Deposition Conversion Factors

Pollutant	Deposition velocity grassland (m/s)	Deposition velocity woodland (m/s)	Nutrient Nitrogen Conversion Factor (µg/m3/s to kg/ha/yr)	Acid Nitrogen Conversion Factor (µg/m3/s to keq/ha/yr)
NO_2	0.0015	0.003	96	0.071428
SO_2	0.012	0.024	157.7	0.0625

Determination of Air Quality Sensitive Receptors

The impact of operational site emissions has been predicted at a series of discrete receptors, which represent locations of human exposure to the pollutants of concern in the vicinity of the Proposed Development.

Air quality sensitive receptors typically include residential dwellings, schools and medical facilities. In this instance, they represent residential dwellings and are summarised in Table 8-8 and shown on Figure F8-1 of Volume 3. Discrete receptors have been selected from review of aerial photography and represent both worst-case impacts and the spatial variation in impacts across the area. Each selected receptor is considered to representative of other sensitive receptors in their vicinity.

Table 8-8 Human Health Sensitive Receptors

Receptor ID[1]	Location		Receptor ID[1]	Location		Receptor ID[1]	Location	
	x	Y		x	y		x	y
R1	99123	146816	R17	102452	147480	R33	104028	147867
R2	100485	146548	R18	102487	147709	R34	104232	148110
R3	100942	146667	R19	102666	148243	R35	104459	147372
R4	101122	147146	R20	102692	147715	R36	104539	147613
R5	101122	146825	R21	102766	146841	R37	104551	151739
R6	101500	148159	R22	102838	147819	R38	104600	147821
R7	101561	152352	R23	102996	147572	R39	104829	147623
R8	101576	147554	R24	103018	147337	R40	105292	147729
R9	101612	147192	R25	103150	147787	R41	105742	147799
R10	101776	147423	R26	103209	148311	R42	105774	149111
R11	101823	145949	R27	103407	147690	R43	105844	148323
R12	102061	152465	R28	103450	148059	R44	105889	147796
R13	102079	147620	R29	103460	148143	R45	105973	152137
R14	102144	147683	R30	103528	147333	R46	106177	147864
R15	102257	147666	R31	103577	147106	R47	107245	148435
R16	102264	147753	R32	103703	147307	R48	106736	147702

The impact of operational site emissions has also been predicted at a series of discrete nature conservation receptors to represent sensitive ecological exposure to the pollutants of concern in the vicinity of the Proposed Development. The EPA's Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA 2020) does not provide guidance on what nature conservation sites should be included, beyond that they should be local and designated. The UK EA's air emissions risk assessment for your environmental permit guidance (Environment Agency, 2016) requires consideration of internationally designated sites within 10km of a facility and nationally designated sites within 2km of a facility. Nature conservation receptors that are within these distances from the Proposed Development are listed in Table 8-9 and shown on Figure F8-3 of Volume 3. Air quality impacts have the potential to harm flora within habitat that is sensitive to changes in loads of nitrogen and/or sulphur.

Fauna are not impacted directly, but indirectly as a consequence of the potential harm to the habitat they may rely on. Habitat information has been sourced from the National Parks and Wildlife Service Conservation Objectives report (2012). Critical Load data has been sourced from Air Pollution Information System (APIS) (Air Pollution Information System, 2016).

The closest nature conservation designations to the Proposed Development are the Lower River Shannon cSAC and the River Shannon and River Fergus Estuaries SPA. Whilst the cSAC and SPA cover the majority of the entire Shannon Estuary and a number of adjoining habitats, only some of the qualifying features that led to their designation are sensitive to the effects of air pollution and deposition. Discrete receptors have been selected to represent both worst-case impacts and the spatial variation in impacts across the habitats within the cSAC and SPA that are sensitive to air quality. Again, each selected receptor is considered to be representative of other sensitive receptors in their vicinity.

Table 8-9 Ecologically Sensitive Receptors

Receptor ID[1]	Location		Habitat ID	Habitat Description	Distance from Site (km)	Critical Loads	
	X	Y				Nitrogen Deposition (kg N/ha/yr)	Acid Deposition (keq/ha/yr)
River Shannon cSAC/SPA							
E1	100487	146450	1140	Mudflats	2.7	20 - 30[1]	Not sensitive
E2	100142	146783			2.8		
E3	99344	147393			3.1		
E4	99180	148139	1140 and 1330	Mudflats and Saltmarsh	3.1	20 - 30[1]	Not sensitive
E5	96324	154503	1140	Mudflats	8.3	20 - 30[1]	Not sensitive
E6	108374	152272			6.1		
E7	107535	149167			4.5		
E8	107597	148426			4.8		
E9	106810	147717			4.2		
E10	97494	152631	1150	Coastal lagoon	6.3	20-30[2]	Not sensitive
E11	95341	147141	1220	Perennial vegetation on stony banks	7.0	8-15	CLminN: 0.223 CLmaxN: 0.568 CLmaxS: 0.202
E12	102319	152410			3.1		
E13	106974	152264	1230	Vegetated sea cliffs	5.0	20-30[1]	Not sensitive
E14	100953	147779	1130, 1330 and 1410	Estuary and Saltmarsh	1.5	20-30[3]	Not sensitive
E15	100612	147428			2.0		
E16	100360	146849			2.5		
E17	100596	146344			2.8		
E18	99988	147121			2.7		
E19	98570	153207			5.8		
E20	97484	154407			7.4		
E21	106355	152093					
E22	108980	152786			6.9		
E23	107481	147597			4.8		

Receptor ID[1]	Location X	Location Y	Habitat ID	Habitat Description	Distance from Site (km)	Critical Loads: Nitrogen Deposition (kg N/ha/yr)	Critical Loads: Acid Deposition (keq/ha/yr)
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA							
E24	111302	143099	4010	Northern wet heath	>10km	10-20	CLminN: 0.499 CLmaxN: 0.842 CLmaxS: 0.2
E25	111831	143906			>10km		
E26	114279	143179			>10km		
E27	115165	145362			>10km		
E28	110945	142293			>10km		
E29	110654	140480			>10km		
E30	110733	138787			>10km		
Bunnaruddee Bog NHA							
E31	104486	135648	7110	Active raised bogs	>10km	5-10	CLminN: 0.321 CLmaxN: 0.683 CLmaxS: 0.362

Notes:

[1] Habitat considered low sensitivity to nitrogen deposition, but no Critical Load estimate available from APIS because of limited data. Critical Load for Saltmarsh used as a proxy.

[2] APIS provides the Saltmarsh Critical Load as being representative sensitivity at this habitat.

[3] Whilst the Estuary habitat covers large sections of the cSAC and SPA, APIS states that only sections of Estuary habitat that are Saltmarsh are sensitive to air quality impacts.

In addition to the discrete receptors listed in Table 8-8 and Table 8-9 above, operational process emissions have also been modelled on a receptor grid of variable spacing, in order to determine the location and magnitude of maximum ground level impacts, and to enable the generation of key pollutant isopleth plots.

A nested grid has been used. The inner grid extends 1000 m from the centre of the Proposed Development site in each direction, at a resolution of 20 m x 20 m. The middle grid extends from 1,000 m to 3,000 m in each direction, at a resolution of 50 m x 50 m. The outer grid extends from 3,000 m to 6,000 m in each direction, at a resolution of 200 m x 200 m. Details of the receptor grid are summarised in Table 8-10.

Table 8-10 Modelled Nester Receptor Grid

Grid spacing (m)	Dimensions (km)	Number of nodes in each direction	National grid reference of south west corner
20	2 x 2	100	96368,142613
50	6 x 6	120	99368,145613
200	12 x 12	60	101368,147613

8.3.2.5 Operational Phase Traffic Emissions Assessment

The operational phase impact on traffic flows is less than that anticipated during the construction phase. As such operational traffic emissions impacts alone do not have the potential to cause a significant effect, in line with industry standard guidance (Moorcroft and Barrowcliffe et al., 2017). However, because the operational phase includes both site emissions and road traffic emissions, the contribution of road traffic emissions impacts has been quantified to allow for the reporting of combined site and road traffic emissions impacts.

Because of the limited contribution to impacts and pollutant concentrations associated with road traffic emissions from the Proposed Development, the assessment is based on HE's simple assessment methodology, rather than a detailed assessment method using dispersion modelling software. This is considered to be a proportionate assessment for the consideration of road traffic emissions contributions.

This approach makes use of a spreadsheet-based tool to predict annual mean NO_X and PM_{10} concentrations based on the relationship between traffic flow characteristics (annual daily average flows, composition of flows and speed) and the distance of a receptor from the road. The tool does not provide outputs for $PM_{2.5}$, so for this assessment, PM_{10} outputs are conservatively assumed to represent $PM_{2.5}$ also.

The annual mean NO_X and PM_{10} (and $PM_{2.5}$) road contribution output from the tool has been multiplied by a factor of 3 to simulate the adjustment of the model for model-bias. Professional experience suggests this is a precautionary approach. The factored road contribution NO_X is converted to NO_2 using a tool made available by the UK Governmental Department for the Environment, Food and Rural Affairs (DEFRA), which uses assumptions on ozone (O_3), NO_X and NO_2 at Local Planning Authority (LPA) level to estimate an appropriate conversion rate. Because the tool is based on conditions within UK LPAs, an assumption has been made to use the conversion rate estimated for Armagh, Banbridge and Craigavon, in Northern Ireland. This was selected as being a predominantly rural location, representative of the study area, on the same landmass and sharing a border with the Ireland.

The assessment of road traffic emissions has considered the following scenarios:

- 2019 Existing Baseline;
- 2025 Future Baseline; and
- 2025 Future Operational.

Input data for the road traffic screening assessment spreadsheet is summarised in Table 8-11. The contribution of road traffic emissions to impacts and total pollutant concentrations has been quantified at receptors located within 200 m of the roads for which traffic data has been provided.

Table 8-11 Road Traffic Assessment Input Data and Air Quality Sensitive Receptors

Road Link	Traffic Flow Data						Traffic Speed (kph)[3]
	2019 Existing Baseline		2025 Future Baseline		2025 Future Operational		
	AADT[1]	%HDV[2]	AADT[1]	%HDV[2]	AADT[1]	%HDV[2]	
L1010 west of site entrance	352	0.4	372	0.4	387	0.4	- 45-80 on free-flowing sections - 20-45 at the approach to junctions
L1010 east of site entrance	352	0.4	372	0.4	502	0.4	
N67 north of Tarbert	1,607	2.6	1,698	0.4	1,719	0.4	
N69 Bridewell Street	5,261	2.4	5,559	2.6	5,667	2.6	
N69 east of Tarbert	5,838	3.6	6,170	2.4	6,227	2.4	
N69 south of Tarbert	4,883	2.8	5,160	3.6	5,210	3.6	
R551 southwest of Tarbert	2,909	2.5	3,074	2.8	3,074	2.8	

Notes:

[1] 24-hour Annual Average Daily Traffic (AADT) data (2-way flows)

[2] Heavy Duty Vehicles (all vehicles >3.5t in weight)

[3] Based on Highways England speed banding

It is noted that the contribution of road traffic emissions to combined impacts and total pollutant concentrations of pollutants associated with road traffic emissions can only be provided for pollutants with long-term (annual) averaging periods. This is because the traffic data used to inform the air quality assessment is based on average daily flows, and also because it is not standard practice to quantify short-term NO_2 contributions associated with vehicle movements. Instead, annual mean concentrations are compared against an annual mean proxy value of 60 $\mu g/m^3$ and 32 $\mu g/m^3$, values defined by research undertaken on the UK, to suggest potential for an exceedance of the hourly mean NO_2 and daily mean PM_{10} Air Quality Standards respectively (DEFRA, 2016).

8.3.3 Describing Significant Effects

The EPA AG4 guidance document on dispersion modelling (EPA, 2020) does not include the means by which to describe the impact or significance of changes in pollutant concentrations as a result of new emissions. The EPA guidance document on Environmental Impact Assessment (EPA, 2017) does contain a method to determine and describe the effect of a development, but that approach is not wholly appropriate for air quality. This is because the relationship between magnitude of change in air quality conditions and receptor sensitivity is not linear. Receptor sensitivity to air quality impacts does not have a graded scale and instead, receptors are considered either sensitive to air quality impacts or not sensitive. Furthermore, the impact description of a change in pollutant concentration is not based on the magnitude of change alone, but that change relative to the pollutant concentration experienced at a receptor once the Proposed Development is in operation. The reason for this is to take account that smaller changes in air quality conditions can constitute a greater level of impact than a large change in conditions, where they occur at receptors that are predicted to experience pollutant concentrations close to or in excess of an Air Quality Standard or Environmental Assessment Level.

For this reason, the IAQM/ EPUK (Moorcroft & Barrowcliffe et al., 2017) and the UK EA (2016) have developed approaches to determine whether or not an air quality effect is considered significant or not, and these have been utilised in this assessment. Where possible, the approaches described in the air quality specific guidance have been reported in a manner that is compatible with the requirements of the EPA guidance (2017).

8.3.3.1 Construction Phase Dust and Particulate Matter Assessment

For amenity effects from dust and particulates associated with construction activities, the aim of the guidance document referred to (Holman et al., 2014) is to bring forward a scheme, including additional mitigation measures where necessary, that will control impacts so that they give rise to negligible or minor effects (at worst) at the closest sensitive receptors. Determination of whether an effect is likely to be significant or not is based on professional judgement (from experience of similar projects), taking account of whether effects are permanent or temporary, direct or indirect, constant or intermittent and whether any secondary effects are caused (in this instance, secondary effects refer to dust that is generated and deposited (primary impact) and then re-suspended and deposited again by further activity).

The classification of amenity impacts (from dust soiling) and health effects on receptors exposed to impacts has been assessed using the relationship between the magnitudes of effects identified, in combination with receptor sensitivity and other related factors where appropriate (as described in the relevant guidance (IAQM 2014), which results in a classification of effects as defined in Table 8-12.

Table 8-12 Definition in Significance of Fugitive Dust and PM_{10} Effects

Magnitude of Effect[1]	Change in dust deposition and short term PM_{10} Concentrations	Significance of Effects
High	Dust impact is likely to be intolerable for any more than a very brief period of time and is very likely to cause complaints from local people. Increase in PM_{10} concentrations at a location where concentrations are already elevated and to the extent that the short term PM_{10} air quality objective is likely to be exceeded.	**Significant to Profound:** A significant Impact that is likely to be a material consideration in its own right.
Medium	Dust impact is likely to cause annoyance and might cause complaints but can be tolerated if prior warning and explanation has been given. Increase in PM_{10} concentrations at a location where concentrations are already elevated and to the extent that the short term PM_{10} air quality objective is at risk of being exceeded.	**Moderate:** A significant effect that may be a material consideration in combination with other significant impacts but is unlikely to be a material consideration in its own right.
Slight	Dust impact may be perceptible, but of a magnitude or frequency that is unlikely to cause annoyance to a reasonable person or to cause complaints. Limited increase in PM_{10} concentrations.	**Not significant to Slight:** An impact that is not significant but that may be of local concern.

Magnitude of Effect[1]	Change in dust deposition and short term PM_{10} Concentrations	Significance of Effects
Negligible	Dust impact is unlikely to be noticed by and/ or have an effect on sensitive receptors. Negligible increase in PM_{10} concentrations.	**Imperceptible:** An impact that is not significant.

Notes:
[1] Terminology adapted to align with EPA Guideline (2017)

8.3.3.2 Operational Phase Emissions

The EPA's Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA, 2020a), does not provide a criterion for determining significance from the predicted air quality impacts of industrial sources. Instead, this assessment uses guidance published by the UK EA (Environment Agency (UK) 2016) and IAQM (Moorcroft and Barrowcliffe et al., 2017) to determine whether the impact of the Proposed Development has an effect that is potentially significant or not. However, it should be noted that the UK EA guidance is intended for use in areas of the UK where pollutant concentrations are elevated close to or above the Air Quality Standards. For application in rural Ireland, it can be considered a conservative means of determining potential significance. It should also be noted that the IAQM guidance is predominantly for urban development projects where road traffic emissions are often the biggest contributor to air quality impacts, rather than industrial installations, although there is no reason why the significance criteria described within it cannot be adopted for industrial sites.

According to the UK EA guidance, an impact on human health sensitive receptors may be considered insignificant where:

- The short-term Process Contribution (PC – impact) is <=10% of the Air Quality Standard or Environmental Assessment Level; and
- The long-term Process Contribution (impact) is <=1% of the Air Quality Standard or Environmental Assessment Level.

Where an impact on human health sensitive receptors cannot be screened out at this stage, additional criteria are provided, including consideration of the Predicted Environmental Concentration (PEC – total pollutant concentration), where the PC is added to the background (or ambient) concentrations. The impact may be considered insignificant where:

- The short-term PC is <20% of the Air Quality Standard or Environmental Assessment Level minus the short-term background; and
- The long-term PEC is <70% of the Air Quality Standard or Environmental Assessment Level.

Where an impact on human health sensitive receptors still cannot be screened as insignificant at this stage, it does not necessarily mean that the effect is now significant. At this stage, model inputs are reviewed, and detail enhanced where it can be. The predicted PC and PEC are then reviewed relative to the appropriate Air Quality Standards and Environmental Assessment Levels and the headroom (gap between the PEC and the Standards and Assessment Levels) that remains once the Proposed Development is in operation – i.e. is there a risk of an exceedance of an Air Quality Standard and Environmental Assessment Level and/ or does the operation of the Proposed Development constrain future development of the area.

For this assessment, the 'insignificant' terminology used in the UK EA guidance applies to effects that can be described as 'Imperceptible' to 'Slight' in the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2017). It may also apply to effects that can be described as 'Moderate' in the EPA Guideline, where such effects relate to a limited number of sensitive receptors and/ or the Air Quality Standards and Environmental Assessment Levels remain not at risk of any exceedance.

Like the UK EA guidance, the IAQM approach does not define a graduating scale of human health receptor sensitivity. Instead, human health receptors are considered either sensitive or not, depending on the period of time for which they are exposed to emissions. The absolute magnitude of change in pollutant concentrations between the baseline and operational phase scenarios, in relation to the Air Quality Standards and Environmental Assessment Levels, is described and this is used to consider the risk of those Standards and Levels being exceeded.

For a change in annual mean concentrations of a given magnitude, IAQM have published recommendations for describing the impacts at individual receptors, as set out in Table 8-13. The description of impacts referred to in the IAQM guidance (Moorcroft and Barrowcliffe et al., 2017).

Table 8-13 IAQM Air Quality Impact Descriptors[1]

Long term average concentration at receptor in assessment year	% change in concentration relative to Air Quality Assessment Level (AQAL)[2]				
	<1 (Imperceptible)	1-2 (Very Low)	2-5 (Low)	6-10 (Medium)	>10 (Large)
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76% - 94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95% - 102% of AQAL	Negligible	Slight	Moderate	Moderate	Significant
103% - 109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

Notes:

[1] For this assessment, IAQM effect descriptions are aligned with EPA Guidelines as follows:

Negligible = Imperceptible; Slight = Not Significant to Slight; Moderate = Moderate; and Substantial = Significant to Profound

[2] For this assessment, IAQM magnitude of change, descriptions are now aligned with EPA Guidelines as magnitude of effect as follows:

Imperceptible = Negligible; Very Low = Low; Low = Low; Medium = Medium; and Large = High.

The IAQM guidance states that the descriptors are for individual receptors only and that overall significance is determined using professional judgement. It also states that it is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the objective value. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the objective value, rather than being exactly equal to it.

A change in predicted long-term (annual mean) concentrations of less than 0.5% of an Air Quality Standard or Environmental Assessment Level is considered to be 'imperceptible'. A PC (impact) that is 'Negligible', given normal bounds of variation, will not be capable of having a direct effect on local air quality that could be considered to be significant.

The guidance suggests the potential for 'Low' air quality impacts as a result of changes in pollutant concentrations between 2% and 5% of relevant Air Quality Standards and Environmental Assessment Levels. For example, for long-term NO_2 concentrations, this relates to changes in concentrations ranging from 0.6 – 2.1 µg/m^3. In practice, changes in concentration of this magnitude, and in particular changes at the lower end of this band are likely to be very difficult to distinguish due to the inter-annual effects of varying meteorological conditions. Therefore, in the overall evaluation of significance the potential for impacts to have significant air quality effect within this band will be considered in this context and will not be capable of having a direct effect on local air quality that can be considered to be significant.

Changes in concentration of more than 5% ('Medium' and 'High', the two highest bands) are considered to be of a magnitude which is far more likely to be discernible above the natural variation in baseline conditions and, as such, carry additional weight within the overall evaluation of significance for air quality. 'Moderate' impacts do not necessarily constitute a significant effect, where they do not contribute to an exceedance or risk of an exceedance of an Air Quality Standard or Environmental Assessment Level, particularly where such impacts relate to a small minority of receptors with the majority experiencing lesser impacts. A 'significant' to 'Profound' impact will almost certainly constitute a significant effect that will require additional mitigation to address.

The IAQM guidance (Moorcroft and Barrowcliffe et al., 2017) also provides thresholds for determining whether short-term impacts on human health sensitive receptors have the potential to cause a significant effect or not. Again, it is noted that the IAQM guidance is not specific to industrial facilities, but still provides a useful guide to scale the severity of impacts. This guidance deviates from the UK EA guidance in that the criteria it provides do not take account of background concentrations, although the guidance does state that this is not intended to play down the importance of total short-term concentrations; the IAQM guidance indicates that severity of peak short-term concentrations can be described without the need to reference background concentrations as the PC is used to measure impact, not the overall concentration at a receptor. The peak short-term PC from an elevated source has been adopted for this assessment as follows:

- PC <=10% of the Air Quality Standard or Environmental Assessment Level represents an impact that is 'Imperceptible' to 'Not significant';
- PC 11-20% of the Air Quality Standard or Environmental Assessment Level is small in magnitude representing a 'Slight' impact;
- PC 21-50% of the Air Quality Standard or Environmental Assessment Level is medium in magnitude representing a 'Moderate' impact; and
- PC >51% of the Air Quality Standard or Environmental Assessment Level is large in magnitude representing a 'Significant' to 'Profound' impact.

For impacts in nature conservation receptors, the UK EA guidance states that they may be considered insignificant ('not significant') where:

- The short-term PC is less than 10% of the short-term environmental standard for protected conservation areas; and
- The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas.

Where the long-term process contribution exceeds this criteria, ecologically sensitive receptors may also be considered insignificant ('not significant') where:

- The long-term PEC is <70% of the Air Quality Standard, Environmental Assessment Level or Critical Load.

Where an impact on nature conservation sensitive receptors still cannot be screened as insignificant at this stage, again it does not necessarily mean that the effect is now significant. Model inputs and assumptions shall be reviewed, and detail enhanced where it can be. The predicted PC and PEC are then reviewed relative to the appropriate Air Quality Standards and Environmental Assessment Levels and the headroom that remains once the Proposed Development is in operation – i.e. is there a risk of an exceedance of an Air Quality Standard and Environmental Assessment Level and/ or does the operation of the Proposed Development constrain future development of the area.

Again, the 'insignificant' terminology used in the UK EA guidance applies to effects that can be described as 'Imperceptible' to 'Slight' in the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2017). It may also apply to effects that can be described as 'Moderate' in the EPA Guideline, where such effects relate to a limited number of sensitive receptors and/ or the Air Quality Standards and Environmental Assessment Levels remain not at risk of any exceedance. Ultimately, the significance of air quality impacts on nature conservation sites shall be determined by a professional ecologist.

8.3.3.3 Significance of Effects

Following the assessment of each individual air quality effect (construction dust, traffic and operational plant), the significance of all of the reported effects is then considered for the Proposed Development in overall terms. The potential for the Proposed Development to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality are considered if relevant, but the principal focus is any change to the likelihood of future achievement of the Air Quality Standards and Environmental Assessment Levels (which also relate to compliance with Council goals for local air quality management and objectives are set for the protection of human health).

In terms of the significance of the effects (consequences) of any adverse impacts, an effect is reported as being either significant or not. If the overall effect of the Proposed Development on local air quality or on amenity is found to be 'Moderate' (where a large proportion of sensitive receptors are affected and/ or there is risk of Air Quality Standards and Environmental Assessment Levels being exceeded) or 'Significant' to 'Profound', this is deemed to be significant for EIAR purposes. Effects found to be 'Moderate' (where limited sensitive receptors are affected and there is no risk of exceedance of an Air

Quality Standard or Environmental Assessment Level) to 'Imperceptible' are not considered to be significant.

8.3.4 Limitations and Assumptions

The air quality assessment has followed an industry standard approach, with reference to relevant guidance documents and methodologies, to provide the best possible means of predicting potential air quality impacts associated with the Proposed Development at Offsite receptors, and the determination of significance. However, it is inevitable that there are limitations associated with any approach, and those relevant to this assessment are summarised below:

- Inherent uncertainties with dispersion modelling:
  - The dispersion model can only be as accurate as the data inputted into it, including the source emissions data. To minimise the uncertainties associated with such data, the assessment has used emissions information provided directly from the design team that has fed into the current version of the Proposed Development design, and where design information is not available, data has been soured from published environmental LNG facility assessments with representative emissions sources.
  - The same can also be said of the meteorological data used to inform the assessment. Meteorological data has been sourced from Shannon Airport, the nearest meteorological station to the Proposed Development site with the complete dataset required for dispersion modelling. It is located approximately 35 km to the east-northeast of the Proposed Development site. To reduce the uncertainty in the representativeness of the meteorological data, the assessment has modelled five years of meteorological data and reported the worst impact for each pollutant and averaging period over the five-year period for each receptor. The assessment has also accounted for the influence in varying terrain and surface roughness, to better represent local conditions in the vicinity of the Proposed Development site.
- Uncertainties in baseline conditions:
  - The assessment refers to background air quality monitoring data reported by the EPA, in line with the approach set out in EPA guidance (2020). However, no current or recent air quality monitoring has been undertaken in the vicinity of the Proposed Development site and the data used and referred to is gathered by the EPA from rural locations across the country. There is some uncertainty into how representative this data is of background pollutant concentrations.
  - In line with EPA guidance (2020) the assessment quantifies the impact (Process Contribution) of emissions from the Proposed Development on acid deposition rates at nearby nature conservation sites that are sensitive to this pollutant. However, it has not been possible to source any baseline information on acid deposition rates in the vicinity of the Proposed Development site, or anywhere else in Ireland. In the absence of baseline data in the study area, a proxy acid deposition background has been sourced from the APIS website for a coastal location in the southwest of Wales. The use of this background acid deposition data should be treated with caution, as should the total acid deposition rates (Predicted Environmental Concentration) reported in this assessment.

The air quality assessment has also made a number of assumptions where precise information or data is not available. Where possible, assumptions are informed by relevant guidance. Assumptions based on operational characteristics are precautionary. Key assumptions are summarised below:

- It is assumed in the assessment that the CCGT plant will be operational for all hours of the year. This is precautionary as in reality it will operate for less than that and the hours of operation will decrease year on year.
- In line with EPA guidance (2020), in the absence of a species information for THC and VOC, all such emissions have been assumed to be as benzene, for comparison against the benzene Air Quality Standard. Again, this is precautionary as only a proportion of these compounds will actually be benzene.
- It has been assumed that the LNGCs accessing the Proposed Development will be an even split of gas and liquid fuel-fired vessels. This is precautionary as industry publication (IGN, 2019) suggests the LNGC fleet is now predominantly made up of gas-fired vessels and the number of liquid fuel-fired vessels is decreasing.

- Various precautionary assumptions have been made for the sensitivity scenarios to demonstrate compliance with the Air Quality Standards and Environmental Assessment Levels even with unlikely and/ or impossible operating conditions.
- The rate of conversion of NO_X to NO_2 from modelled emissions sources has been assumed to be 100% for annual mean NO_2 and 50% for hourly mean NO_2 across the study area, in the absence of NO_X, NO_2 and O_3 data. In reality, at locations close to the source, the conversion of NO_X to NO_2 is likely to be less efficient than that.

8.4 Baseline Environment

8.4.1 Monitored Baseline

The existing environment has been described with reference to the most recently published EPA Air Quality Report and supplementary data (EPA, 2020b).

The EPA manages the national ambient air quality network, which consists of 30 monitoring stations located across the country that monitor a range of pollutants, including some of those of relevance to this assessment. The most recent EPA Air Quality Report available was published in 2020 and refers to monitoring data gathered in 2019 and earlier.

EU legislation on air quality requires that Member States divide their territory into zones for the assessment and management of air quality. The zones in place in Ireland during the most recently available report of monitoring (EPA, 2020b) are:

- Zone A – Dublin conurbation;
- Zone B – Cork conurbation;
- Zone C – large towns with a population >15,000; and
- Zone D – the remaining area of Ireland.

The EPA operate a network of air quality monitoring across the country. Data gathered by the nearest air quality monitoring undertaken to the Proposed Development site is summarised in Table 8-14. Data is also presented as the average across the representative Zone D sites.

Table 8-14 Air Quality Monitoring Data

Monitoring Station	Distance and Orientation from Site	Pollutant	Reported Concentration ($\mu g/m^3$)[1]				Relevant Air Quality Standard ($\mu g/m^3$)
			2016	2017	2018	2019	
Tralee, Co. Kerry (Zone C)	39 km SW	PM_{10}	-	-	-	28[2]	40[3]
		$PM_{2.5}$	-	-	-	23[2]	25[3]
Ennis, Co. Clare (Zone C)	42 km NE	PM_{10}	17.2	15.8	16	18	40[3]
		$PM_{2.5}$	12	10.6	10	14	25[3]
		SO_2	3.7	3.4	3.2	3.6	20[4]
Valentia, Co. Kerry (Zone D)	83 km SW	O_3[5]	69.1 (1)	65.7 (0)	68 (6)	72 (0)	120[3,6]
		O_3[7]	4,116[7]	2,682[7]	3,240[7]	-	18,000[4,8]
People's Park. Limerick (Zone C)	55 km E	NO_2	-	-	-	13	40[3]
		PM_{10}	-	-	-	13	40[3]
		$PM_{2.5}$	-	-	-	9	25[3]
Zone D Average[9]		NO_2	6.3	4.4	4.7	5.7	40[3]
		NO_X	10.0	5.7	6.7	7.8	30_4
		PM_{10}	11.9	9.9	10.7	12.3	40[3]
		$PM_{2.5}$	9.0	7.4	7.5	9.3	25[3]
		O_3[5]	59.7 (1)	62.4 (2)	63.4 (6)	64.1 (0)	120[3]

Monitoring Station	Distance and Orientation from Site	Pollutant	Reported Concentration (μg/m^3)[1]				Relevant Air Quality Standard (μg/m^3)
			2016	2017	2018	2019	
			4,226[7]	2,400[7]	3,177[7]	-	18,000[4,8]
		SO_2	2.1	2.0	2.6	3.1	20[4]
		CO[5]	600 (0)	150 (0)[10]	400 (0)[10]	100 (0)	10,000[3]

Notes:

[1] Values as reported by the EPA in the Supplementary Tables to Support the annual Air Quality in Ireland reports.

[2] Poor data capture (<50%).

[3] For the protection of human health

[4] For the protection of ecosystems (nature conservation receptors)

[5] Rolling 8-hour average – number of exceedances of the rolling 8-hour maximum Air Quality Standard provided in parenthesis)

[6] Allowable on 25 days per year (averaged over 3 years))

[7] μg/m^3 x hr (AOT40)

[8] AOT40 target value for 2010 is 18,000 μg/m^3.h; long-term objective for 2020 is 6,000 μg/m^3.h. AOT40 is calculated 1st May – 31st July.

[9] Zone D average data discounts sites with data capture of <50%.

[10] Average for Zone C – no Zone D data available

The EPA data summarised in Table 8-14above demonstrates that the existing airshed in the vicinity of the Proposed Development is unlikely to be constrained and concentrations are generally well below the respective Air Quality Standards and Environmental Assessment Levels for the protection of human health and ecosystems.

Of the pollutants listed, 8-hour maximum O_3 concentrations have been monitored in above the Air Quality Standard value for human health (120 μg/m^3), but not to the frequency that actually constitutes an exceedance of that actual standard (25 days per year, averaged over 3 years).

Monitored annual mean NO_X and SO_2 concentrations and the O_3 AOT40 values (Accumulated exposure Over a Threshold of 40 parts per billion) reported by the EPA for Zone D suggest that nature conservation sites considered in this assessment are not currently constrained by the pollutants associated with harm to ecosystems.

In addition to the monitoring data made available by the EPA, there is also data available from other air quality assessments undertaken in the vicinity of the Proposed Development, including the EIAR for the Foynes to Limerick Road (including Adare Bypass) project. That report included NO_2 concentration data measured at several locations in Co. Limerick, to the east of the Proposed Development, over a period of 2 winter months. Whilst a 2-month survey of data cannot be directly comparable to the annual mean, measured roadside concentrations of 5.7 to 12.8 μg/m^3 and background concentrations of 1.9 to 6.7 μg/m^3 over winter months continue to demonstrate that existing local air quality in the vicinity of the Proposed Development is not constrained.

8.4.2 Modelled Baseline

The baseline data described above is based on measurement data that is considered representative of the study area. However, that data does not account for baseline road traffic emissions on nearby roads. Such emissions are likely to affect baseline air quality at locations up to 200 m from a road. To account for this source in the assessment, traffic data has been provided by the Proposed Development transport consultant and modelled to predict baseline and future baseline concentrations of the primary pollutants associated with road traffic. Predictions have been made at the selected human health and nature conservation site receptors located within 200 m of the roads most likely to be affected by Proposed Development traffic movements. The range of modelled baseline concentrations at selected roadside air quality sensitive receptors are provided in Table 8-15 and

Table 8-16. A full set of baseline results at all selected receptors considered in this assessment is provided in Volume 4, Appendix A8-3.

Table 8-15 Range in Modelled Combined Baseline Pollutant Concentrations at Human Health Sensitive Receptors

Pollutant	Averaging Period	Air Quality Standard (µg/m³)	Range of Contribution from Road Sources (µg/m³)	Ambient Background Contribution (µg/m³)	Ambient Background + Road Source Contribution (µg/m³)
2019 Existing Baseline					
Nitrogen dioxide (NO_2)	Annual mean	40	<0.1 – 8.5	4.3	4.4 – 12.8
Particulate matter (PM_{10})	Annual mean	40	<0.1 – 1.9	9.0	9.0 – 10.9
Fine particulate matter ($PM_{2.5}$)	Annual mean	25	<0.1 – 1.9	4.0	4.0 – 5.9
2025 Future Baseline					
Nitrogen dioxide (NO_2)	Annual mean	40	<0.1 – 5.3	4.3	4.4 – 9.6
Particulate matter (PM_{10})	Annual mean	40	<0.1 – 1.9	9.0	9.0 – 10.9
Fine particulate matter ($PM_{2.5}$)	Annual mean	25	<0.1 – 1.9	4.0	4.0 – 5.9

Table 8-16 Range in Modelled Combined Baseline Pollutant Concentrations at Nature Conservation Sensitive Receptors

Pollutant	Averaging Period	Air Quality Standard	Range of Contribution from Road Sources	Ambient Background Contribution	Ambient Background + Road Source Contribution
2019 Existing Baseline					
Oxides of nitrogen (NO_X)	Annual mean	30 µg/m³	0.1 – 4.5 µg/m³	6.2 µg/m³	6.3 – 10.7 µg/m³
Nitrogen deposition	Annual deposition rate	Various – see Table 8.8	<0.1 – 0.4 kg N/ha/yr	12.0 kg N/ha/yr	12.0 – 12.4 kg N/ha/yr
Acid deposition	Annual deposition rate	Various – see Table 8.8	<0.1 – 0.03 keq/ha/yr	0.50 keq/ha/yr	0.50 – 0.53 keq/ha/yr
2025 Future Baseline					
Oxides of nitrogen (NO_X)	Annual mean	30 µg/m³	<0.1 – 2.8 µg/m³	6.2 µg/m³	6.2 – 9.0 µg/m³
Nitrogen deposition	Annual deposition rate	Various – see Table 8.8	<0.1 – 0.2 kg N/ha/yr	12.0 kg N/ha/yr	12.0 – 12.2 kg N/ha/yr
Acid deposition	Annual deposition rate	Various – see Table 8.8	<0.1 – 0.02 keq/ha/yr	0.50 keq/ha/yr	0.50 – 0.52 keq/ha/yr

8.5 Embedded Mitigation

The Proposed Development includes a number of embedded mitigation measures that will likely reduce the impact of emissions on nearby air quality sensitive receptors. Some of these measures are designed with the specific purpose of controlling emissions to air, and others are included primarily for other purposes, but have an additional benefit of reducing air quality impacts. These measures are summarised below.

- Emission release heights for the largest and most frequent sources of emissions to air have been designed to encourage good dispersion, through height above ground level and height above nearby buildings and structures;
- The layout of the onshore site maximises distance between the main continuous sources of emissions to air and the nearest air quality sensitive receptors;
- The layout of the Offshore site also provides a good setback distance between sources of emissions to air and the nearest air quality sensitive receptors;
- Whilst the air quality assessment has assumed continuous operation of the Power Plant (CCGT) throughout the year, in reality the Power Plant will only operate for the energy demand required at the time;
- The majority of plant and all continuous and frequently operational plant will be fuelled by natural gas. Liquid fuel will only be used for start-up, maintenance and emergency purposes; and
- Start-up and emergency plant will only operate with use of low and ultra-low sulphur liquid fuel.

8.6 Assessment of Impact and Effect

8.6.1 Construction Phase Dust and Particulate Matter Assessment

As described in Section 8.3, the construction dust and particulate matter assessment follows the step by step approach set out in relevant IAQM guidance (2014). This process is summarised in the sub-sections below.

8.6.1.1 Identify Receptors within the Screening Distance of the Site Boundary

The screening distances set by the IAQM guidance are:

- Receptors sensitive to amenity and human health impacts within 350 m of the construction site boundary and/ or within 50 m of a public road used by construction traffic that is within 500 m of the site entrance; and
- Nature conservation receptors located within 50 m of the construction site boundary and/ or within 50 m of a public road used by construction traffic that is within 500 m of the site entrance.

There are a limited number of amenity and human health sensitive receptors within 350 m of the construction site boundary. These include the residential dwellings >300 m to the south and southeast of the Proposed Development site. There are also a number of amenity and human health sensitive receptors within 50 m of a public road used by construction traffic that is within 500 m of the site entrance, including residential dwellings adjacent to the L1010.

The Shannon Estuary cSAC/ SPA is also within 50 m of the construction site boundary, although the aquatic elements of the cSAC/ SPA are not considered sensitive to dust impacts.

8.6.1.2 Identify the Magnitude of Effects

The magnitude of effect is informed by the scale of works associated with the following activities: demolition; earthworks; construction (i.e. the building and erection of structures); and trackout (the deposition of dust and particulate matter onto public roads by construction vehicles). A detailed description of the construction works is provided in Chapter 02 – Project Description.

Demolition

The Proposed Development includes no/ minimal demolition and the emissions magnitude of effect from this activity is considered negligible.

Earthworks

The Proposed Development site is anticipated to require extensive earthworks associated with levelling and also regrading to mitigate visual and noise-related impacts. For the purposed of this assessment, the area of earthworks is considered to exceed 10,000 m^2 and require the handling of up to 100,000 t of material. As such, the dust emissions magnitude of effect for earthworks is High.

Construction

The Proposed Development includes a number of buildings and structures. For the purpose of this assessment, the combined volume of these is considered to be in excess of 100,000 m^3. It is also considered that onsite concrete batching maybe required. As such, the dust emissions magnitude of effect for construction is High.

Trackout

The peak number of daily HGV construction vehicle movements associated with the Proposed Development site is anticipated to be greater than 50. There is also anticipated to be periods when onsite haul routes are not surfaced, particularly during the earlier phases of construction. As such, the dust emissions magnitude of effect for trackout is High.

8.6.1.3 Establish the Sensitivity of the Area

The sensitivity of the area is determined by the sensitivity, number and proximity of amenity, human health and nature conservation receptors to the construction site boundary and access roads.

In this instance, there is a single High sensitivity amenity and human health receptor approximately 330 m from the construction site boundary, and 6 High sensitivity receptors within between 25 m and 50 m of a public road used by construction traffic that is with 500 m of the site access (off the L1010). There are no amenity and human health sensitive receptors of Medium or Low sensitivity. This equates to a Low sensitivity for amenity impacts. Coupled with low ambient background PM_{10} concentrations (<24 $\mu g/m^3$), this also equates to a Low sensitivity for human health impacts.

With regards to dust impacts on nature conservation receptors, the adjacent SPA/ cSAC is classed as a High sensitivity receptor, due to its international level of designation, and is located within 20 m of the construction site boundary. The sensitivity of the area to nature conservation impacts is classed as High.

8.6.1.4 Determine the Risk of Significant Effects

The risk of dust impacts occurring is determined by comparison of the potential dust emission magnitude effect and the sensitivity of the area. For dust soiling and human health impacts, the High dust emission magnitude of effect identified for earthworks, construction and trackout is offset by the Low sensitivity of the area and equates to a not significant to slight risk of dust impacts.

For dust impacts on ecology the High dust emission magnitude of effect combined with the sensitivity of the area equates to a **moderate** to **significant** risk of dust impacts. However, it is noted that the majority of the cSAC/ SPA within 50 m of the construction site boundary is tidal estuary and should dust deposit beyond the Proposed Development site boundary, it is likely to be washed away naturally.

8.6.1.5 Determine the Level of Mitigation Required

The classification of dust impact risk is then used to inform the level of mitigation required to ensure the impact risk identified can be sufficiently mitigated, to the extent that a significant effect does not occur. The IAQM guidance relevant to the construction dust assessment lists measures that should be applied, if practical, relative to the risk identified.

In this instance, a high risk of dust impacts was identified due the potential dust emission magnitude and the ecological sensitivity of the area. Therefore, the list of IAQM recommended mitigation measures provided below is proportionate to the risk identified. The final list of mitigation and monitoring measures to be taken forward during the construction works will be defined within the Proposed Development's OCEMP application document.

IAQM recommended Dust (and particulate matter) mitigation measures for High risk sites are as follows:

- Develop and implement a stakeholder communications plan that includes community engagement before work commences onsite;
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary;
- Display the head or regional office contact information;
- Develop and implement a Dust Management Plan (DMP);
- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;

- Record any exceptional incidents that cause dust and/ or air emissions, either on- or off-site, and the action taken to resolve the situation in the logbook;
- Undertake daily onsite and offsite inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked;
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results;
- Increase the frequency of site inspections by the person accountable for air quality and dust issues onsite when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions;
- Agree a proportionate level of site boundary dust monitoring, relative to the risk of offsite dust impacts occurring and the potential for harm to amenity, with the Planning Authority. This could include passive dust deposition monitoring at potential locations shown on Figure 8-5, the data gathered by which could be used to inform the effectiveness of dust control measures and substantiate potential complaints;
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Erect solid screens/ barriers or enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- Keep site fencing, barriers and scaffolding clean using wet methods;
- Cover, seed or fence long-term stockpiles to prevent wind whipping;
- Ensure all vehicles switch off engines when stationary - no idling vehicles;
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable;
- Impose and signpost maximum-speed-limits on surfaced and unsurfaced haul roads and work areas;
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials;
- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression technique;
- Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation;
- Use enclosed chutes and conveyors and covered skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment if it is fitted;
- Ensure equipment is readily available onsite to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- Avoid bonfires and burning of waste materials;
- Re-vegetate earthworks and exposed areas/ soil stockpiles to stabilise surfaces as soon as practicable, or Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable;
- Only remove vegetation cover in small areas during work and not all at once;
- Avoid scabbling (roughening of concrete surfaces) if possible;
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust;

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- Inspect onsite haul routes for integrity, make a record and instigate necessary repairs to the surface as soon as reasonably practicable;
- Install hard surfaced haul routes, which are regularly damped down;
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). Ensuring that there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits; and
- Access gates to be located at least 10 m from receptors where possible.

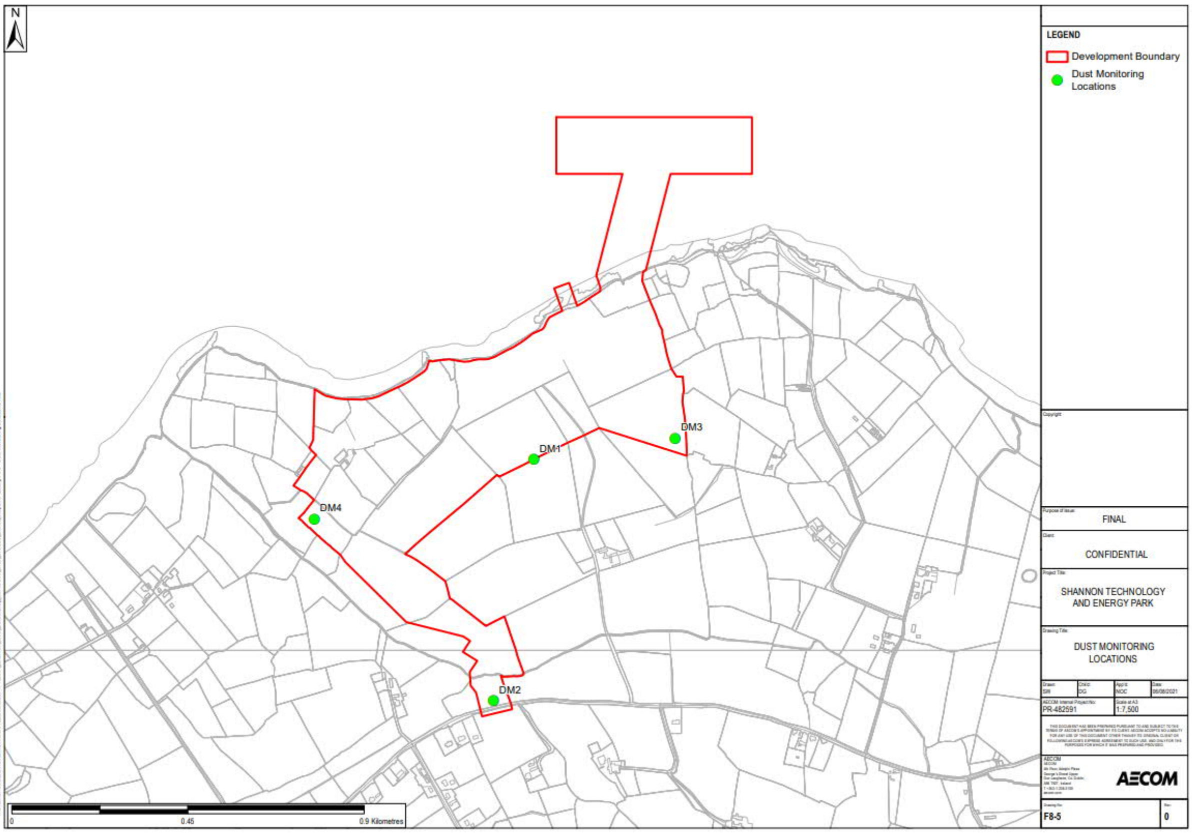

Figure 8-5 Dust Monitoring Locations

8.6.1.6 Summarise the Potential Residual Effects

In line with IAQM construction dust guidance, providing adequate dust mitigation measures are implemented onsite, all of which are common practice on all well managed construction sites across the country, then impacts can be adequately controlled to the extent that any effect is not significant ('**Imperceptible'** to '**Slight'**).

8.6.2 Construction Phase Road Traffic Emissions Assessment

Annual mean concentrations of NO_2 and PM_{10} have been quantified at receptors located close to roads used by construction traffic for a 2024 future baseline scenario and a 2024 peak construction phase scenario. $PM_{2.5}$ contribution have been precautionarily assumed to be the same as the PM_{10} output from the DMRB spreadsheet. The results are presented in Table 8-17 for the worst affected receptors, which are located at roadside locations adjacent to the L1010 toward Tarbert and Bridewwll Street in Tarbert.

The results show that the temporary impact of construction phase traffic emissions at the worst affected receptor locations do not cause an exceedance of an air quality standard or Environmental Assessment Level, or put such a Standard or Level at Risk of an exceedance.

Table 8-17 Predicted Process Contribution of Road Traffic Emissions and Predicted Environmental Concentration at Selected Receptors –Construction Phase Scenario

Pollutant and Averaging Period	AQ Standard (µg/m^3)	Road Traffic Emissions Process Cont. (µg/m^3)	Road Process Cont. as proportion of AQ Standard (%)	Combined Background (Ambient) and Baseline Road Cont. (µg/m^3)	Predicted Env. Conc. (µg/m^3)	Predicted Env Conc. as a Proportion of AQ Standard (%)
Human Health Receptor – worst affected receptor located within 200m of a road used by Proposed Development construction traffic						
Annual Mean Nitrogen Dioxide (NO_2)	40	1.2	3.0	4.7	5.9	14.8
Annual Mean Particulate Matter (PM_{10})	40	<0.1	0.1	9.1	9.2	23.0
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	<0.1	0.2	4.1	4.2	16.8
Nature Conservation Site Receptors – worst affected receptor located within 200m of a road used by Proposed Development traffic						
Annual Mean Oxides of Nitrogen (NO_X)	30	0.5	1.3	11.9	12.4	41.3
Nutrient Nitrogen Deposition[1]	20 (kg N/ha/yr)	<0.1	0.2	12.1 (kg N/ha/yr)	12.3 (kg N/ha/yr)	61.4
Acid Deposition[2]	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

[1] Worst affected receptor is E09 – mudflats habitat.

[2] No nature conservation site receptor within 200m of a road that is sensitive to acid deposition.

Bold rows represent pollutants and averaging periods that cannot be screened as insignificant following UK EA guidance.

The data provided by Sisk Ltd in the OCEMP and Outline Construction Traffic Management Plan (OCTMP) is understood to be representative of the proposed combination of construction activities.

8.6.3 Operational Phase Site Emissions Assessment

8.6.3.1 Normal Operational Scenario (Combined Loop Re-gasification and CCGT)

The PC (impact) and PEC (total pollutant concentration with Proposed Development in operation) as a result of site emissions are presented in Table 8-17 for the worst affected human health and worst affected nature conservation receptors (for each pollutant and averaging period), for the Normal Operational Scenario (Combined Loop Re-gasification and CCGT). The PC and PEC for all receptors considered in the assessment are provided in Volume 4, Appendix A8-3. Contour plots showing the spatial variation of predicted impacts for key pollutants across the study area are provided in Volume 3 for annual mean NO_2 (Figure 8-1), hourly mean NO_2 (Figure 8-2), annual mean NO_X (Figure 8-3) and annual nitrogen deposition rates (Figure 8-4).

Table 8-17 Predicted Process Contribution and Predicted Environmental Concentration at Worst Affected Receptors – Normal Operational Scenario (Combined Loop Re-gasification and CCGT)

Pollutant and Averaging Period	AQ Standard (µg/m³)	Process Cont. (µg/m³)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. (µg/m³)	Predicted Env. Conc. (µg/m³)	Predicted Env Conc. as a Proportion of AQ Standard (%)
Human Health Receptors						
Annual Mean Nitrogen Dioxide (NO_2)	40	5.7	14.2	4.3	10.0	25.0
Hourly Mean Nitrogen Dioxide (NO_2)	**200**	**59.7**	**29.8**	**8.7**	**68.4**	**34.2**
Annual Mean Particulate Matter (PM_{10})	40	0.1	0.2	9.0	9.1	22.8
Daily Mean Particulate Matter (PM_{10})	50	0.6	1.3	18.0	18.6	37.2
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	0.1	0.3	4.0	4.1	16.4
Rolling 8-hour Maximum Carbon Monoxide (CO)	10,000	239.8	2.4	100	339.8	3.4
Maximum Hourly Carbon Monoxide (CO)	30,000	261.1	0.9	100	361.1	1.2
Daily Mean Sulphur Dioxide (SO_2)	125	0.5	0.4	2.6	3.1	2.5
Hourly Mean Sulphur Dioxide (SO_2)	350	1.5	0.4	2.6	4.1	1.2
15-Minute Sulphur Dioxide (SO_2)	266	2.5	0.9	2.6	5.1	1.9
Annual Mean Benzene (C_6H_6)[1]	5	2.2	43.7	0.2	2.4	47.8
Hourly Maximum Benzene (C_6H_6)[1]	**195**	**58.0**	**29.8**	**0.2**	**58.2**	**29.8**
Annual Mean Formaldehyde (CH_2O)	5	0.1	2.6	No Data	0.1	2.6
Maximum Hourly Formaldehyde (CH_2O)	100	9.2	9.2	No Data	9.2	9.2
Nature Conservation Site Receptors						
Annual Mean Oxides of Nitrogen (NO_X)	30	1.1	3.6	6.2	7.3	24.3
Maximum Daily Oxides of Nitrogen (NO_X)[2]	**75**	**24.2**	**32.3**	**12.4**	**36.6**	**48.8**
Annual Mean Sulphur Dioxide (SO_2)	20	<0.1	<0.1	1.3	1.3	6.5
Nutrient Nitrogen Deposition[3]	20 kg N/ha/yr	0.2 (kg N/ha/yr)	0.8	12.0 (kg N/ha/yr)	12.2 (kg N/ha/yr)	61.0
Acid Deposition[4]	CLminN: 0.223 (keq/ha/yr) CLmaxN: 0.568 (keq/ha/yr) CLmaxS:	**<0.1 (keq/ha/yr)**	**1.8**	**0.5 (keq/ha/yr)[5]**	**0.51 (keq/ha/yr)**	**89.8**

Pollutant and Averaging Period	AQ Standard (µg/m³)	Process Cont. (µg/m³)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. (µg/m³)	Predicted Env. Conc. (µg/m³)	Predicted Env Conc. as a Proportion of AQ Standard (%)
	0.202 (keq/ha/yr)					

Notes:

[1] Assumed all THC and VOC emissions are as benzene (C_6H_6) (which is standard practice when THC/VOC composition is unknown). In reality, C_6H_6 is only likely to make up a proportion of total THC and VOC emissions amongst numerous other compounds. Where the conservative assumption that all THC and VOC emissions are C_6H_6 does not lead to an exceedance of the relevant Air Quality Standards for this pollutant, it is unlikely considered to represent a significant effect.

[2] Research cited in IAQM guidance (2020) states that the daily NO_X standard is of less importance than the annual NO_X standard at nature conservation sites. The daily NO_X standard is typically only of concern at a nature conservation site when SO_2 and O_3 concentrations are elevated close to or in excess of their Air Quality Standards for the protection of ecosystems. The SO_2 concentrations reported in this table and the O_3 data reported in Table 8.14 demonstrate that concentrations of neither SO_2 or O_3 are elevated close to those standards and as such, the nature conservation receptors included in this assessment are not considered sensitive to the daily NO_X impacts reported.

[3] Worst affected receptor is E09 – mudflats habitat.

[4] Worst affected receptor is E12 – perennial vegetation on stony banks habitat.

[5] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy. PEC of acid deposition reported in this chapter should be treated with caution and referred to as a guideline value only.

Bold rows represent pollutants and averaging periods that cannot be screened as insignificant following UK EA guidance.

Following UK EA guidance, the majority of pollutants and averaging periods at human health and nature conservation receptors reported for this scenario in Volume 4, Appendix A8-3 can be considered insignificant, due to the following reasons:

- PC to long-term (annual mean) pollutant concentrations at human health and nature conservation sensitive receptors being less than 1% of their Air Quality Standard and/ or Predicted Environmental Concentration being less than 70% of their Air Quality Standard;
- PC to short-term (<annual mean) pollutant concentrations at human health sensitive receptors being less than 10% of their Air Quality Standard and/ or PC being less than 20% of the Air Quality Standard minus the short-term background; and
- PC to short-term pollutant concentrations at nature conservation sensitive receptors being less than 10% of their Air Quality Standard.

Where pollutants and averaging periods cannot be screened as insignificant (‘Imperceptible’ to ‘Slight’ effects and ‘Moderate’ where those effects relate to a limited number of sensitive receptors and/ or the Air Quality Standards and Environmental Assessment Levels remain not at risk of any exceedance), the UK EA recommends that detailed modelling is undertaken to accurately reflect anticipated conditions at the site and further analysis of the Process Contribution and Predicted Environmental Concentrations is undertaken. This chapter already describes and reports the results of detailed modelling that is based on the current design information and precautionary assumptions where required. It is considered that the detail of the model is already fit for purpose and does not require any more detail than already included and described in this chapter. Instead, further analysis of the Process Contribution and Predicted Environmental Concentrations has been undertaken for these pollutants and averaging periods.

The footnotes provided for Table 8-17 describe why neither the hourly C_6H_6 PC nor the daily NO_X PC should be considered potentially significant. The C_6H_6 values reported are overly conservative in that it has been assumed that all THC and VOC emissions are as that pollutant, rather than the usual suite of various compounds that make up those pollutants. The daily NO_X Environmental Assessment Level is only considered to be a concern to nature conservation receptors where they are already under stress from elevated concentrations of SO_2 and O_3. In this instance, none of the nature conservation receptors experiences such conditions.

Hourly mean NO_2 PC and PEC at the worst affected human health sensitive receptor (R19) could not be screened as insignificant – with an impact (PC) that is in excess of 10% of the Air Quality Standard and of 20% of the Air Quality Standard minus the short-term background. The same was also the case for the next seven worst affected receptors (R8, R10, R13-R16 and R26 (see Volume 4, Appendix A8-3)), but not for the remaining 39 receptors considered, who experienced an hourly NO_2 impact (PC) of less than the criteria given in the UK EA guidance. Further review of the impact (PC) and total pollutant concentrations (PEC) at these worst affected receptors shows that with the Proposed Development in operation, there remains a headroom (the gap between the total pollutant concentration (PEC) and the Air Quality Standard) of between 68-79% of the Air Quality Standard for that pollutant. It can therefore be said with much confidence that the operation of the Proposed Development does not give rise to any risk of exceedance of the hourly mean NO_2 Air Quality Standard in the Normal Operational Scenario, nor is it likely to constrain any future development of the area.

The annual average acid deposition rate impact (PC) and total deposition rate (PEC) at the worst affected nature conservation site (receptor E12 - perennial vegetation on stony banks habitat) could not be screened as insignificant ('Imperceptible' to 'Slight' effects and 'Moderate' effects where those effects relate to a limited number of sensitive receptors and/ or the Air Quality Standards and Environmental Assessment Levels remain not at risk of any exceedance) – with an impact (PC) in excess of 1% of the Environmental Assessment Level and a total deposition rate (PEC) of more than 70%. No other nature conservation receptors sensitive to acid deposition considered in this assessment experience an impact (PC) of 1% or more of their respective Environmental Assessment Levels. At receptor E12, it is noted that the impact (PC) accounts for just 1.8% of the Air Quality Standard, and the elevated total deposition rate (PEC) is therefore primarily due to the ambient background contribution assumed in the assessment. That background contribution is a proxy obtained from what is considered to be a broadly representative location elsewhere (a location where acid deposition data is available), in the absence of site or region-specific data, and should be treated with caution and perhaps not primarily used for determining significance, due to its uncertainty. It should also be noted that the Air Quality Standard that the impact (PC) and total deposition rate (PEC) are being compared to is the lower end of a Critical Load Range and both will account for a smaller proportion of the upper Critical Load Range. Furthermore, background acid deposition rates in the study area are likely to fall in the near future, because of the cessation of coal burning and Heavy Fuel Oil burning at Moneypoint and Tarbert Power Stations respectively. In light of the above, it is determined that the operation of the Proposed Development will not give rise to an exceedance of the Air Quality Standard for annual mean acid deposition rates and that the impact will not cause a significant effect.

The impact (PC) and total pollutant concentrations (PEC) have also been evaluated against the IAQM guidance criteria (Morrow & Barrowcliffe, 2017). Whilst primarily intended for use with development planning for non-industrial sites, it still provides a useful gauge for estimating significance, as the criteria is based on the magnitude of impact and the risk of impacts causing an exceedance of an Air Quality Standard. In this instance and following this guidance, long-term (annual mean) impacts (PC) are described as slight-adverse to negligible for all pollutants and receptors (discounting the conservative C_6H_6 predictions) with the exception of annual mean NO_2 impacts at receptors R19 and R26, which are described as moderate adverse. In some circumstances, moderate adverse impacts (PC) can represent a significant effect, typically when there are numerous receptors predicted to experience such an impact and/ or the impact contributes to an Air Quality Standard being at risk of an exceedance. In this instance, the moderate adverse impact (PC) affects just 2 receptors, which, with the addition of the contribution from the Proposed Development, experience total annual mean NO_2 concentrations (PEC) that account for less than 50% of the Air Quality Standard. With reference to the IAQM guidance, the impacts on long-term pollutant concentrations, therefore, will not have a significant effect.

Following the IAQM guidance for short-term (<annual mean) impacts, potential significant effects are considered by the impact relative to the Air Quality Standard. The effect of short-term impacts are described as **imperceptible** to **slight adverse** at 45 of the 48 human health receptors considered for all pollutants, and **moderate adverse** at the remaining 3 receptors for hourly mean NO_2. However, even with this magnitude of effect, total hourly mean NO_2 concentrations remain well below the Air Quality Standard for that pollutant to the extent that the effect is not considered to be significant.

8.6.3.2 Sensitivity Scenario 1: Operational Scenario (Combined Loop Re-gasification and CTG)

The PC (impact) and PEC (total pollutant concentration with Proposed Development in operation) as a result of site emissions are presented in Table 8-18 for the worst affected human health and worst affected nature conservation receptors (for each pollutant and averaging period), for the Sensitivity Scenario 1: Operational Scenario (Combined Loop Re-gasification and CTG). The Process Contribution and Predicted Environmental Concentration for all receptors considered in the assessment are provided in Volume 4, Appendix A8-3.

Table 8-18 Predicted Process Contribution and Predicted Environmental Concentration at Worst Affected Receptors – Sensitivity Scenario 1: Operational Scenario (Combined Loop Re-gasification and CTG)

Pollutant and Averaging Period	AQ Standard (µg/m³)	Process Cont. (µg/m³)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. (µg/m³)	Predicted Env. Conc. (µg/m³)	Predicted Env Conc. as a Proportion of AQ Standard (%)
Human Health Receptors						
Annual Mean Nitrogen Dioxide (NO_2)	40	1.6	4.0	4.3	5.9	14.8
Hourly Mean Nitrogen Dioxide (NO_2)	200	30.9	15.4	8.7	39.6	19.8
Annual Mean Particulate Matter (PM_{10})	40	0.1	0.2	9.0	9.1	22.8
Daily Mean Particulate Matter (PM_{10})	50	0.6	1.3	18.0	18.6	37.2
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	0.1	0.3	4.0	4.1	16.4
Rolling 8-hour Maximum Carbon Monoxide (CO)	10,000	76.6	0.8	100	176.6	1.8
Maximum Hourly Carbon Monoxide (CO)	30,000	125.2	0.4	100	225.2	0.8
Daily Mean Sulphur Dioxide (SO_2)	125	0.5	0.4	2.6	3.1	2.5
Hourly Mean Sulphur Dioxide (SO_2)	350	1.5	0.4	2.6	4.1	1.2
15-Minute Sulphur Dioxide (SO_2)	266	2.5	0.9	2.6	5.1	1.9
Annual Mean Benzene (C_6H_6)[1]	5	0.4	7.3	0.2	0.6	12.0
Hourly Maximum Benzene (C_6H_6)[1]	195	19.6	10.1	0.2	19.8	10.2
Annual Mean Formaldehyde (CH_2O)	5	0.1	2.6	No Data	0.1	2.0
Maximum Hourly Formaldehyde (CH_2O)	100	9.2	9.2	No Data	9.2	9.2
Nature Conservation Site Receptors						
Annual Mean Oxides of Nitrogen (NO_X)	30	0.5	1.6	6.2	6.7	22.3
Maximum Daily Oxides of Nitrogen (NO_X)[2]	75	9.5	12.7	12.4	21.9	29.2
Annual Mean Sulphur Dioxide (SO_2)	20	<0.1	<1	1.3	1.3	6.5

Pollutant and Averaging Period	AQ Standard (µg/m^3)	Process Cont. (µg/m^3)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. (µg/m^3)	Predicted Env. Conc. (µg/m^3)	Predicted Env Conc. as a Proportion of AQ Standard (%)
Nutrient Nitrogen Deposition[3]	20 kg N/ha/yr	0.1	0.4	12.0 (kg N/ha/yr)	12.1 (kg N/ha/yr)	60.5
Acid Deposition[3]	CLminN: 0.223 (keq/ha/yr) CLmaxN: 0.568 (keq/ha/yr) CLmaxS: 0.202 (keq/ha/yr)	**<0.1 (keq/ha/yr)**	**1.8**	**0.5 (keq/ha/yr)[3]**	**0.51 (keq/ha/yr)**	**89.8**

Notes:

[1] Assumed all THC and VOC emissions are as benzene (C_6H_6) (which is standard practice when THC/ VOC composition is unknown). In reality, C_6H_6 is only likely to make up a proportion of total THC and VOC emissions amongst numerous other compounds. Where the conservative assumption that all THC and VOC emissions are C_6H_6 does not lead to an exceedance of the relevant Air Quality Standards for this pollutant, it is unlikely considered to represent a significant effect.

[2] Research cited in IAQM guidance (2020) states that the daily NO_X standard is of less importance than the annual NO_X standard at nature conservation sites. The daily NO_X standard is typically only of concern at a nature conservation site when SO_2 and O_3 concentrations are elevated close to or in excess of their Air Quality Standards for the protection of ecosystems. The SO_2 concentrations reported in this table and the O_3 data reported in Table 8.14 demonstrate that concentrations of neither SO_2 or O_3 are elevated close to those standards and as such, the nature conservation receptors included in this assessment are not considered sensitive to the daily NO_X impacts reported.

[3] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy.

[3] Worst affected receptor is E09 – mudflats habitat.

[4] Worst affected receptor is E12 – perennial vegetation on stony banks habitat.

[5] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy. PEC of acid deposition reported in this chapter should be treated with caution and referred to as a guideline value only.

Bold rows represent pollutants and averaging periods that cannot be screened as insignificant following UK EA guidance.

Sensitivity Scenario 1: Operational Scenario (Combined Loop Re-gasification and CTG) will only occur should the LNG facility be operational without the presence of the Power Plant. The impact (PC) and total pollutant concentration (PEC) at the worst affected receptor for all pollutants and averaging periods are either less (NO_2, CO, THC and VOC, NO_X, nitrogen deposition and acid deposition) or no worse than (particulate matter, SO_2 and CH_2O) those reported for the Normal Operational Scenario (Combined Loop Re-gasification and CCGT). The impact of Sensitivity Scenario 1: Operational Scenario (Combined Loop Re-gasification and CTG) is such that effects are not considered significant.

8.6.3.3 Sensitivity Scenario 2: Operational Scenario (Closed Loop Re-gasification and CCGT)

The PC (impact) and PEC (total pollutant concentration with Proposed Development in operation) as a result of site emissions are presented in Table 8- for the worst affected human health and worst affected nature conservation receptors (for each pollutant and averaging period), for the Sensitivity Scenario 2: Operational Scenario (Closed Loop Re-gasification and CCGT). The Process Contribution and Predicted Environmental Concentration for all receptors considered in the assessment are provided in Volume 4, Appendix A8-3.

Table 8-20 Predicted Process Contribution and Predicted Environmental Concentration at Worst Affected Receptors – Sensitivity Scenario 2: Operational Scenario (Closed Loop Re-gasification and CCGT)

Pollutant and Averaging Period	AQ Standard (µg/m³)	Process Cont. (µg/m³)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. (µg/m³)	Predicted Env. Conc. (µg/m³)	Predicted Env Conc. as a Proportion of AQ Standard (%)
Human Health Receptors						
Annual Mean Nitrogen Dioxide (NO_2)	40	5.9	14.7	4.3	10.2	25.5
Hourly Mean Nitrogen Dioxide (NO_2)	**200**	**59.7**	**29.8**	**8.7**	**68.4**	**34.2**
Annual Mean Particulate Matter (PM_{10})	40	0.1	0.2	9.0	9.1	22.8
Daily Mean Particulate Matter (PM_{10})	50	0.6	1.3	18.0	18.6	37.2
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	0.1	0.4	4.0	4.1	16.4
Rolling 8-hour Maximum Carbon Monoxide (CO)	10,000	239.8	2.4	100	339.8	3.4
Maximum Hourly Carbon Monoxide (CO)	30,000	261.1	0.9	100	361.1	1.2
Daily Mean Sulphur Dioxide (SO_2)	125	0.5	0.4	2.6	3.1	2.5
Hourly Mean Sulphur Dioxide (SO_2)	350	1.5	0.4	2.6	4.1	1.2
15-Minute Sulphur Dioxide (SO_2)	266	2.5	0.9	2.6	5.1	1.9
Annual Mean Benzene (C_6H_6)[1]	5	2.2	43.7	0.2	2.4	48.0
Hourly Maximum Benzene (C_6H_6)[1]	**195**	**58.0**	**29.8**	**0.2**	**58.2**	**29.8**
Annual Mean Formaldehyde (CH_2O)	5	0.1	2.6	No Data	0.1	2.6
Maximum Hourly Formaldehyde (CH_2O)	100	9.2	9.2	No Data	9.2	9.2
Nature Conservation Site Receptors						
Annual Mean Oxides of Nitrogen (NO_X)	30	1.2	3.9	6.2	7.4	24.7
Maximum Daily Oxides of Nitrogen (NO_X)[2]	**75**	**24.2**	**32.3**	**12.4**	**36.6**	**48.8**
Annual Mean Sulphur Dioxide (SO_2)	20	<0.1	<0.1	1.3	1.3	6.5
Nutrient Nitrogen Deposition	20 kg N/ha/yr	0.2 (kg N/ha/yr)	0.8	12.0 (kg N/ha/yr)	12.2 (kg N/ha/yr)	61.0
Acid Deposition	CLminN: 0.223 (keq/ha/yr) CLmaxN: 0.568 (keq/ha/yr)	**<0.1 (keq/ha/yr)**	**1.8**	**0.5 (keq/ha/yr)[3]**	**0.51 (keq/ha/yr)**	**89.8**

Pollutant and Averaging Period	AQ Standard (µg/m³)	Process Cont. (µg/m³)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. (µg/m³)	Predicted Env. Conc. (µg/m³)	Predicted Env Conc. as a Proportion of AQ Standard (%)
	CLmaxS: 0.202 (keq/ha/yr)					

Notes:

[1] Assumed all THC and VOC emissions are as benzene (C_6H_6) (which is standard practice when THC/ VOC composition is unknown). In reality, C_6H_6 is only likely to make up a proportion of total THC and VOC emissions amongst numerous other compounds. Where the conservative assumption that all THC and VOC emissions are C_6H_6 does not lead to an exceedance of the relevant Air Quality Standards for this pollutant, it is unlikely considered to represent a significant effect.

[2] Research cited in IAQM guidance (2020) states that the daily NO_X standard is of less importance than the annual NO_X standard at nature conservation sites. The daily NO_X standard is typically only of concern at a nature conservation site when SO_2 and O_3 concentrations are elevated close to or in excess of their Air Quality Standards for the protection of ecosystems. The SO_2 concentrations reported in this table and the O_3 data reported in Table 8.14 demonstrate that concentrations of neither SO_2 or O_3 are elevated close to those standards and as such, the nature conservation receptors included in this assessment are not considered sensitive to the daily NO_X impacts reported.

[3] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy.

[3] Worst affected receptor is E09 – mudflats habitat.

[4] Worst affected receptor is E12 – perennial vegetation on stony banks habitat.

[5] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy. PEC of acid deposition reported in this chapter should be treated with caution and referred to as a guideline value only.

Bold rows represent pollutants and averaging periods that cannot be screened as insignificant following UK EA guidance.

Sensitivity Scenario 2: Operational Scenario (closed Loop Re-gasification and CCGT) differs from the Normal Operational Scenario in that it is assumed the re-gasification boilers on the FSRU will be required to operate all year round, rather than for just 6 months per year. It is noted that such a scenario is not anticipated to occur, with the intention for seawater to be utilised for re-gasification for the 6 warmest months of the year. Nevertheless, the result of this unlikely scenario is an increase in impact (PC) from the Normal Operational Scenario, at the worst affected receptor, of <1% of the long-term (annual mean) Air Quality Standards for NO_2, particulate matter, THC and VOC, NO_X, nitrogen deposition and acid deposition. Short-term (<annual mean) impact (PC) remain unchanged from those reported in the Normal Operational Scenario. The limited change in impact (PC) and total pollutant concentration (PEC) from that reported in the Normal Operational Scenario (Combined Loop Re-gasification and CCGT) is such that the impact and associated effect of Sensitivity Scenario 2: Operational Scenario (Closed Loop Re-gasification and CCGT) are also not considered significant.

8.6.3.4 Sensitivity Scenario 3: Operational Scenario (Conservative)

The PC (impact) and PEC (total pollutant concentration with Proposed Development in operation) as a result of site emissions are presented in Table 8-19 for the worst affected human health and worst affected nature conservation receptors (for each pollutant and averaging period), for the Sensitivity Scenario 3: Operational Scenario (Conservative). The Process Contribution and Predicted Environmental Concentration for all receptors considered in the assessment are provided in Volume 4, Appendix A8-3.

Table 8-19 Predicted Process Contribution and Predicted Environmental Concentration at Worst Affected Receptors – Sensitivity Scenario 3: Operational Scenario (Conservative)

Pollutant and Averaging Period	AQ Standard ($\mu g/m^3$)	Process Cont. ($\mu g/m^3$)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. ($\mu g/m^3$)	Predicted Env. Conc. ($\mu g/m^3$)	Predicted Env Conc. as a Proportion of AQ Standard (%)
Human Health Receptors						
Annual Mean Nitrogen Dioxide (NO_2)	40	6.6	16.4	4.3	10.9	27.3
Hourly Mean Nitrogen Dioxide (NO_2)	**200**	**60.0**	**30.0**	**8.7**	**68.7**	**34.4**
Annual Mean Particulate Matter (PM_{10})	40	0.1	0.3	9.0	9.1	22.8
Daily Mean Particulate Matter (PM_{10})	50	0.7	1.4	18.0	18.7	37.4
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	0.1	0.4	4.0	4.1	16.4
Rolling 8-hour Maximum Carbon Monoxide (CO)	10,000	223.2	2.2	100	323.2	3.2
Maximum Hourly Carbon Monoxide (CO)	30,000	261.1	0.9	100	361.1	1.2
Daily Mean Sulphur Dioxide (SO_2)	125	2.1	1.7	2.6	4.7	3.8
Hourly Mean Sulphur Dioxide (SO_2)	350	6.6	1.9	2.6	9.2	2.6
15-Minute Sulphur Dioxide (SO_2)	266	11.0	4.1	2.6	13.6	5.1
Annual Mean Benzene (C_6H_6)[1]	5	2.2	44.7	0.2	2.4	48.0
Hourly Maximum Benzene (C_6H_6)[1]	**195**	**58.0**	**29.8**	**0.2**	**58.2**	**29.8**
Annual Mean Formaldehyde (CH_2O)	5	0.1	1.6	No Data	0.1	2.0
Maximum Hourly Formaldehyde (CH_2O)	100	9.2	9.2	No Data	9.2	9.2
Nature Conservation Site Receptors						
Annual Mean Oxides of Nitrogen (NO_X)	30	1.4	4.7	6.2	7.6	25.3
Maximum Daily Oxides of Nitrogen (NO_X)[2]	**75**	**28.1**	**37.4**	**12.4**	**40.5**	**54.0**
Annual Mean Sulphur Dioxide (SO_2)	20	<0.1	0.2	1.3	1.3	6.5
Nutrient Nitrogen Deposition[3]	20 (kg N/ha/yr)	0.2	1.0	20 (kg N/ha/yr)	12.2	61
Acid Deposition[3]	CLminN: 0.223 (keq/ha/yr) CLmaxN: 0.568 (keq/ha/yr) CLmaxS:	**<0.1 (keq/ha/yr)**	**3.5**	**0.5 (keq/ha/yr)[3]**	**0.52 (keq/ha/yr)**	**91.5**

Pollutant and Averaging Period	AQ Standard (µg/m^3)	Process Cont. (µg/m^3)	Process Cont. as proportion of AQ Standard (%)	Background (Ambient) Cont. (µg/m^3)	Predicted Env. Conc. (µg/m^3)	Predicted Env Conc. as a Proportion of AQ Standard (%)
	0.202 (keq/ha/yr)					

Notes:

[1] Assumed all THC and VOC emissions are as benzene (C_6H_6) (which is standard practice when THC/ VOC composition is unknown). In reality, C_6H_6 is only likely to make up a proportion of total THC and VOC emissions amongst numerous other compounds. Where the conservative assumption that all THC and VOC emissions are C_6H_6 does not lead to an exceedance of the relevant Air Quality Standards for this pollutant, it is unlikely considered to represent a significant effect.

[2] Research cited in IAQM guidance (2020) states that the daily NO_X standard is of less importance than the annual NO_X standard at nature conservation sites. The daily NO_X standard is typically only of concern at a nature conservation site when SO_2 and O_3 concentrations are elevated close to or in excess of their Air Quality Standards for the protection of ecosystems. The SO_2 concentrations reported in this table and the O_3 data reported in Table 8.14 demonstrate that concentrations of neither SO_2 or O_3 are elevated close to those standards and as such, the nature conservation receptors included in this assessment are not considered sensitive to the daily NO_X impacts reported.

[3] Worst affected receptor is E09 – mudflats habitat.

[4] Worst affected receptor is E12 – perennial vegetation on stony banks habitat.

[5] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy. PEC of acid deposition reported in this chapter should be treated with caution and referred to as a guideline value only.

Bold rows represent pollutants and averaging periods that cannot be screened as insignificant following UK EA guidance.

Sensitivity Scenario 3: Operational Scenario (Conservative) is based on a number of assumptions that are considered unrealistic and, in all likelihood, will never occur. These assumptions are summarised as follows:

- The Power Plant and CTG plant in operation at the same time (in reality, the CTG plant will only ever operate when the Power Plant is not present);
- All 3 CTG plant are in operation (only 2 of 3 CTG plant are anticipated to be in operation at any one time);
- Closed-Loop re-gasification (re-gasification boiler operating for the full year, rather than 6 months of the year as anticipated);
- More reliance (50%) on liquid fuel for the FSRU main engine (in reality, liquid fuel is anticipated to be required for just 5% of operation); and
- Greater frequency of LNGC visits (8,760 hours of the year) and associated tug movements (LNGCs are anticipated to be berthed at the facility for 2,310 hours per year).

Table 8-19 demonstrates that the impact (PC) and total pollutant concentration with the Proposed Development in Operation (PEC) associated with Sensitivity Scenario 3: Operational Scenario (Conservative) are higher than those reported in the Normal Operational Scenario (Combined Loop re-gasification and CCGT). However, even with that greater impact (PC), pollutant concentrations (PEC) remain well below the Air Quality Standard for the majority of pollutants and averaging considered (<50% of the Air Quality Standard and Environmental Assessment Levels), with the exception of acid deposition. For that pollutant, the proxy ambient background contribution accounts for 96% of the Predicted Environmental Concentration reported.

8.6.4 Operational Phase Combined Emissions Assessment

Table 8-20 provides the combined PC (impact) of both site emissions and road traffic emissions contributions and resultant PEC (total pollutant concentration with Proposed Development in operation) at the following locations for the Normal Operational Scenario (Combined Loop Re-gasification and CCGT):

- Worst affected human health and nature conservation site receptors located within 200 m of a road used by Proposed Development traffic; and
- Human health and nature conservations receptors with the largest Process Contribution from road traffic emissions.

Combined PC and PEC for all receptors located with 200 m of a modelled road are provided in Volume 4, Appendix A8-3. Receptors located beyond 200 m of the road are unlikely to be affected by emissions from road traffic and concentrations are as reported in Table 8-17 and Volume 4, Appendix A8-3.

Table 8-20 Predicted Process Contribution of Site and Road Traffic Emissions Combined and Predicted Environmental Concentration at Selected Receptors – Normal Operational Scenario (Combined Loop and CCGT)

Pollutant and Averaging Period	AQ Standard ($\mu g/m^3$)	Road Traffic Emissions Process Cont. ($\mu g/m^3$)	Site Emissions Process Cont. ($\mu g/m^3$)	Combined Process Cont. as proportion of AQ Standard (%)	Combined Background (Ambient) and Baseline Road Cont. ($\mu g/m^3$)	Predicted Env. Conc. ($\mu g/m^3$)	Predicted Env Conc. as a Proportion of AQ Standard (%)
Human Health Receptor – worst affected receptor located within 200m of a road used by Proposed Development traffic							
Annual Mean Nitrogen Dioxide (NO_2)	40	<0.1	3.0	7.5	4.4	7.4	18.5
Annual Mean Particulate Matter (PM_{10})	40	<0.1	0.1	0.3	9.1	9.2	23.0
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	<0.1	0.1	0.4	4.1	4.2	16.8
Human Health Receptor – largest Process Contribution from road traffic emissions							
Annual Mean Nitrogen Dioxide (NO_2)	40	0.1	1.9	4.8	4.7	6.7	16.8
Annual Mean Particulate Matter (PM_{10})	40	<0.1	<0.1	0.3	9.1	9.2	23.0
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	<0.1	<0.1	0.4	4.1	4.2	16.8
Nature Conservation Site Receptors – worst affected receptor located within 200m of a road used by Proposed Development traffic							
Annual Mean Oxides of Nitrogen (NO_X)	30	<0.1	1.1	3.7	7.4	8.5	28.3
Nutrient Nitrogen Deposition[1]	20 (kg N/ha/yr)	<0.1	0.2 (kg N/ha/yr)	0.8	12.1 (kg N/ha/yr)	12.3 (kg N/ha/yr)	61.5
Acid Deposition[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nature Conservation Site Receptors – largest Process Contribution from road traffic emissions							
Annual Mean Oxides of Nitrogen (NO_X)	30	0.1	1.1	4.0	9	10.1	33.7
Nutrient Nitrogen Deposition[1]	20 (kg N/ha/yr)	<0.1	0.2 (kg N/ha/yr)	0.8	12.2 (kg N/ha/yr)	12.4 (kg N/ha/yr)	61.0
Acid Deposition[2]	Various – see Table 8.9	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
[1] Worst affected receptor is E09 – mudflats habitat.

Pollutant and Averaging Period	AQ Standard (µg/m³)	Road Traffic Emissions Process Cont. (µg/m³)	Site Emissions Process Cont. (µg/m³)	Combined Process Cont. as proportion of AQ Standard (%)	Combined Background (Ambient) and Baseline Road Cont. (µg/m³)	Predicted Env. Conc. (µg/m³)	Predicted Env Conc. as a Proportion of AQ Standard (%)

[2] No nature conservation site receptor within 200m of a road that is sensitive to acid deposition.

Bold rows represent pollutants and averaging periods that cannot be screened as insignificant following UK EA guidance.

Table 8-20 demonstrates that for the Normal Operational Scenario (Combined Loop Re-gasification and CCGT), the addition of the contribution from Proposed Development road traffic emissions to the impact (PC) from the site emissions alone makes little to no difference to the assessment nor potential significance of effect.

8.7 Cumulative Impacts and Effects

8.7.1 Cumulative Baseline

The baseline data described in Section 8.4 is based on measurement data gathered and reported by the EPA that is considered representative of the study area. However, that data does not necessarily account for local sources, including emissions from nearby industrial facilities, such as Moneypoint Power Station and Tarbet Power Station. To account for these sources in the assessment, emissions data has been obtained and modelled to predict concentrations for a baseline (including road traffic emissions contributions) + cumulative sources scenario. The range of modelled baseline concentrations at selected air quality sensitive receptors are provided in Table 8-21 and Table 8-22, for the pollutants of which emissions data could be sought for the cumulative sites. A full set of cumulative baseline results at all selected receptors considered in this assessment is provided in Volume 4, Appendix A8-3.

The tables demonstrate that the contribution of cumulative sources is less than that associated with the ambient background (including road traffic emissions contributions) for long-term (annual mean) pollutants. The cumulative source is similar to or greater than the ambient background for short-term (<annual mean) pollutants. The range of cumulative contributions added to the ambient background contributions show that cumulative baseline concentrations are well below the respective Air Quality Standards, with the exception of the annual mean acid deposition rate, which at the Perennial vegetation on stony banks habitat of the SCA/ SPA, is already elevated close to the Critical Load for the habitat. However, it is again noted that there is much uncertainty in the ambient background acid deposition rate used to inform this assessment.

Table 8-21 Range in Modelled Cumulative Baseline Pollutant Concentrations at Human Health Sensitive Receptors

Pollutant	Air Quality Standard (µg/m³)	Range of Contribution from Road Sources (µg/m³)	Range of Contribution from Cumulative Sources (µg/m³)	Ambient Background Contribution (µg/m³)	Ambient Background + Road Source + Cumulative Contribution (µg/m³)
2019 Existing Baseline					
Annual mean Nitrogen dioxide (NO_2)	40	<0.1 – 8.5	0.1 – 0.5	4.3	4.4 – 12.9
Hourly mean Nitrogen dioxide (NO_2)	200	N/A[1]	2.9 – 8.6	8.7	11.6 – 17.3
Annual mean Particulate matter (PM_{10})	40	<0.1 – 1.9	<0.1 – 0.1	9.0	9.0 – 10.9
Daily mean Particulate matter (PM_{10})	50	N/A[1]	<0.1 – 0.2	18.0	18.0 – 18.2

Pollutant	Air Quality Standard ($\mu g/m^3$)	Range of Contribution from Road Sources ($\mu g/m^3$)	Range of Contribution from Cumulative Sources ($\mu g/m^3$)	Ambient Background Contribution ($\mu g/m^3$)	Ambient Background + Road Source + Cumulative Contribution ($\mu g/m^3$)
Annual mean Fine particulate matter ($PM_{2.5}$)	25	<0.1 – 1.9	<0.1 – 0.1	4.0	4.0 – 5.9
Daily mean Sulphur dioxide (SO_2)	125	N/A[1,2]	1.7 – 3.8	2.6	4.3 – 6.4
Hourly mean Sulphur dioxide (SO_2)	350	N/A[1,2]	9.2 – 15.8	2.6	11.8 – 18.4
15-minute mean Sulphur dioxide (SO_2)	266	N/A[1,2]	12.3 – 22.5	2.6	14.9 – 25.1
2025 Future Baseline					
Annual mean Nitrogen dioxide (NO_2)	40	<0.1 – 5.4	0.1 – 0.5	4.3	4.4 – 9.7
Hourly mean Nitrogen dioxide (NO_2)	200	N/A[1,2]	2.9 – 8.6	8.7	11.6 – 17.3
Annual mean Particulate matter (PM_{10})	40	<0.1 – 1.9	<0.1 – 0.1	9.0	9.0 – 10.9
Daily mean Particulate matter (PM_{10})	50	N/A[1,2]	<0.1 – 0.2	18.0	18.0 – 18.2
Annual mean Fine particulate matter ($PM_{2.5}$)	25	<0.1 – 1.9	<0.1 – 0.1	4.0	4.0 – 5.9
Daily mean Sulphur dioxide (SO_2)	125	N/A[1,2]	1.7 – 3.8	2.6	4.3 – 6.4
Hourly mean Sulphur dioxide (SO_2)	350	N/A[1,2]	9.2 – 15.8	2.6	11.8 – 18.4
15-minute mean Sulphur dioxide (SO_2)	266	N/A[1,2]	12.3 – 22.5	2.6	14.9 – 25.1

Notes:
[1] Short-term (<annual average) contributions not predicted for road traffic emissions.
[2] SO_2 not considered a key pollutant from road traffic emissions.

Table 8-22 Range in Modelled Cumulative Baseline Pollutant Concentrations at Nature Conservation Sensitive Receptors

Pollutant	Air Quality Standard	Range of Contribution from Road Sources	Range of Contribution from Cumulative Sources ($\mu g/m^3$)	Ambient Background Contribution ($\mu g/m^3$)	Ambient Background + Road Source + Cumulative Contribution
2019 Existing Baseline					
Annual mean Oxides of nitrogen (NO_X)	30 $\mu g/m^3$	0.1 – 4.5 $\mu g/m^3$	<0.1 – 0.5 $\mu g/m^3$	6.2 $\mu g/m^3$	6.2 – 10.9 $\mu g/m^3$
Daily mean Oxides of nitrogen (NO_X)	75 $\mu g/m^3$	N/A[1]	1.8 – 7.5 $\mu g/m^3$	12.4 $\mu g/m^3$	14.2 – 19.9 $\mu g/m^3$
Annual mean Sulphur dioxide (SO_2)	20 $\mu g/m^3$	N/A[2]	0.1 – 1.0 $\mu g/m^3$	1.3 $\mu g/m^3$	1.4 – 1.9 $\mu g/m^3$
Annual deposition Nitrogen rate	Various – see Table 8.9	<0.1 – 0.4 kg N/ha/yr	<0.1 – 0.1 kg N/ha/yr	12.0 kg N/ha/yr	12.0 – 12.4 kg N/ha/yr
Annual deposition Acid rate	Various – see Table 8.9	N/A[3]	0.01 – 0.07 keq/ha/yr	0.50 keq/ha/yr	0.51 – 0.57 keq/ha/yr

Pollutant	Air Quality Standard	Range of Contribution from Road Sources	Range of Contribution from Cumulative Sources ($\mu g/m^3$)	Ambient Background Contribution ($\mu g/m^3$)	Ambient Background + Road Source + Cumulative Contribution
2025 Future Baseline					
Annual mean Oxides of nitrogen (NO_X)	30 $\mu g/m^3$	<0.1 – 2.8 $\mu g/m^3$	<0.1 – 0.5 $\mu g/m^3$	6.2 $\mu g/m^3$	6.2 – 9.2 $\mu g/m^3$
Daily mean Oxides of nitrogen (NO_X)	75 $\mu g/m^3$	N/A[1]	1.8 – 7.5 $\mu g/m^3$	12.4 $\mu g/m^3$	14.2 – 19.9 $\mu g/m^3$
Annual mean Sulphur dioxide (SO_2)	20 $\mu g/m^3$	N/A[2]	0.1 – 1.0 $\mu g/m^3$	1.3 $\mu g/m^3$	1.4 – 1.9 $\mu g/m^3$
Annual deposition Nitrogen rate	Various – see Table 8.9	<0.1 – 0.2 kg N/ha/yr	<0.1 – 0.1 kg N/ha/yr	12.0 kg N/ha/yr	12.0 – 12.2 kg N/ha/yr
Annual deposition Acid rate	Various – see Table 8.9	N/A[3]	0.01 – 0.07 keq/ha/yr	0.50 keq/ha/yr[4]	0.51 – 0.57 keq/ha/yr

Notes:

[1] Short-term (<annual average) contributions not predicted for road traffic emissions.

[2] SO_2 not considered a key pollutant from road traffic emissions.

[3] Habitats within 200m of modelled roads not sensitive to acid deposition

[4] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy. PEC of acid deposition reported in this chapter should be treated with caution and referred to as a guideline value only.

8.7.2 Cumulative Impact and Effect

8.7.2.1 Construction Phase Dust and Particulate Matter Assessment

As described in Chapter 02 – Project Description, it is anticipated that the upgrade of the Coast Road (L1010) from Tarbert to the Proposed Development site, by Kerry Co. Council, will overlap with the earthworks and site preparation at the Proposed Development site, to allow the better vehicular access required for the main construction works to proceed.

With the exception of the Proposed Development construction site's access road, the construction site itself is located approximately 750 m away from the L1010, meaning that cumulative dust impacts from both sites impacting on the same receptor are extremely unlikely.

During earthworks and site preparation phase at the Proposed Development site, the traffic associated with the those works will largely be confined within the Proposed Development site boundary and will not involve the import or exportation of material to and from the Proposed Development site. Proposed Development traffic on the public road at this phase will largely consist of deliveries to the site, which will be co-ordinated with the road upgrade works. Any dust impact associated with the trackout of mud from vehicles leaving Proposed Development site is therefore considered unlikely.

All phases of the Proposed Development construction works will be undertaken in line with the project's OCEMP, including the implementation of standard good practice measures for the control of dust emissions. Such measures are standard practice on all well managed construction sites and there is no reason to believe that such measures will not be implemented by Kerry County Council (KCC) contractors working on the Coast Road. As such, the cumulative impact of construction dust emissions is not considered to have a significant effect.

Cumulative construction impacts are also possible where the construction of the Proposed Development coincides with the construction of any one of the 220 kV connection, medium voltage (10/ 20 kV) connection, Shannon Pipeline or potential data centre projects. Due to the distance of the limited number of receptors to the main construction activities associated with the Proposed Development, and the commitment of the Applicant to control dust emissions as far as reasonably practicable, the risk of the Proposed Development to contribute to cumulative dust effect is considered **low** and **not significant**.

8.7.2.2 Operational Phase Emissions Assessment

For the cumulative assessment of the Normal Operational Scenario (Combined Loop Re-gasification and CCGT), the PC (impact) from the Proposed Development is added to the cumulative baseline contribution (ambient background + emissions from Moneypoint and Tarbert Power Stations – see Section 8.7.1 above) to calculate the PEC (total pollutant concentration with Proposed Development in operation). As such, the actual PC from the Proposed Development remains unchanged to that reported in Section 8.6 for the Normal Operational Scenario. However, the PEC will be higher than that reported in Section 8.6, due to the additional contribution from those cumulative sources.

Table 8-23 provides a breakdown of the contributions associated with the Proposed Development (Normal Operational Scenario (Combined Loop Re-gasification and CCGT)) and the ambient background + cumulative sources, for the pollutants for which emissions data was available for those cumulative sources. The contributions and total pollutant concentrations are provided for the following selected receptors (cumulative impacts and concentrations for all receptors are provided in Volume 4, Appendix A8-3):

- Worst affected human health and nature conservation site receptors following the addition of the cumulative source contribution; and
- Human health and nature conservations receptors with the largest contribution from cumulative sources.

Table 8-23 Predicted Cumulative Operational Impacts – Normal Operational Scenario (Combined Loop Re-gasification and CCGT)

Pollutant and Averaging Period	AQ Standard (µg/m³)	Combined (Site + Road Traffic Emissions) Process Cont. (µg/m³)	Combined Process Cont. as proportion of AQ Standard (%)	Cumulative Source Cont. (µg/m³)	Cumulative Baseline (Background (Ambient) + Baseline Road Cont.) (µg/m³)	Cumulative Predicted Env. Conc. (µg/m³)	Cumulative Predicted Env. Conc. as a Proportion of AQ Standard (%)
Human Health Receptor – largest contribution from Proposed Development							
Annual Mean Nitrogen Dioxide (NO_2)	40	5.7	14.2	0.1	4.4	10.1	25.4
Hourly Mean Nitrogen Dioxide (NO_2)	200	59.7	29.8	8.1	16.8	68.4[1]	34.2
Annual Mean Particulate Matter (PM_{10})	40	0.2	0.5	<0.1	9.1	9.3	23.3
Daily Mean Particulate Matter (PM_{10})	50	0.9	1.8	<0.1	18.0	19.1[1]	37.4
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	0.2	0.4	<0.1	4.1	4.2	16.9
Daily Mean Sulphur Dioxide (SO_2)	125	0.5	0.4	3.6	6.2	6.4[1]	5.1
Hourly Mean Sulphur Dioxide (SO_2)	350	1.5	0.4	15.8	18.4	18.8[1]	5.4
15-minute Mean Sulphur Dioxide (SO_2)	266	2.5	0.9	20.8	23.4	23.8[1]	9.0

Pollutant and Averaging Period	AQ Standard (µg/m^3)	Combined (Site + Road Traffic Emissions) Process Cont. (µg/m^3)	Combined Process Cont. as proportion of AQ Standard (%)	Cumulative Source Cont. (µg/m^3)	Cumulative Baseline (Background (Ambient) + Baseline Road Cont.) (µg/m^3)	Cumulative Predicted Env. Conc. (µg/m^3)	Cumulative Predicted Env. Conc. as a Proportion of AQ Standard (%)
Human Health Receptor – largest contribution from cumulative sources							
Annual Mean Nitrogen Dioxide (NO_2)	40	1.0	2.5	0.5	4.8	5.8	14.4
Hourly Mean Nitrogen Dioxide (NO_2)	200	48.4	24.2	8.6	17.3	57.1[1]	28.6
Annual Mean Particulate Matter (PM_{10})	40	<0.1	0.1	0.1	9.1	9.1	22.8
Daily Mean Particulate Matter (PM_{10})	50	0.2	0.5	0.2	18.4	18.5	36.9
Annual Mean Fine Particulate Matter ($PM_{2.5}$)	25	<0.1	0.1	0.1	4.1	4.1	16.6
Daily Mean Sulphur Dioxide (SO_2)	125	0.1	0.1	3.8	6.4	6.4[1]	5.1
Hourly Mean Sulphur Dioxide (SO_2)	350	1.5	0.4	15.8	18.4	18.8[1]	5.4
15-minute Mean Sulphur Dioxide (SO_2)	266	0.9	0.3	22.5	25.1	25.2[1]	9.5
Nature Conservation Receptor – largest contribution from Proposed Development							
Annual Mean Oxides of Nitrogen (NO_X)	30	1.1	3.8	0.1	9.2	10.3	34.4
Daily Maximum Oxides of Nitrogen (NO_X)	75	24.2	32.3	4.2	16.6	36.9[1]	49.2
Annual Mean Sulphur Dioxide (SO_2)	20	<0.1	<0.1	0.5	1.8	1.9	9.3
Nutrient Nitrogen Deposition[2]	20 (kg N/ha/yr)	0.2	0.8	<0.1	12.2	12.4	61.9
Acid Deposition[3]	CLminN: 0.223 (keq/ha/yr) CLmaxN: 0.568 (keq/ha/yr) CLmaxS: 0.202 (keq/ha/yr)	**0.01**	**1.8**	**0.03**	**0.53**	**0.54[4]**	**95.1**

Pollutant and Averaging Period	AQ Standard ($\mu g/m^3$)	Combined (Site + Road Traffic Emissions) Process Cont. ($\mu g/m^3$)	Combined Process Cont. as proportion of AQ Standard (%)	Cumulative Source Cont. ($\mu g/m^3$)	Cumulative Baseline (Background (Ambient) + Baseline Road Cont.) ($\mu g/m^3$)	Cumulative Predicted Env. Conc. ($\mu g/m^3$)	Cumulative Predicted Env. Conc. as a Proportion of AQ Standard (%)
Nature Conservation Receptor – largest contribution from cumulative sources							
Annual Mean Oxides of Nitrogen (NO_X)	30	1.0	3.2	0.5	6.7	7.7	25.6
Daily Maximum Oxides of Nitrogen (NO_X)	75	9.2	12.3	7.5	19.9	21.6[1]	28.8
Annual Mean Sulphur Dioxide (SO_2)	20	<0.1	<0.1	0.5	1.8	1.9	9.3
Nutrient Nitrogen Deposition[2]	20 (kg N/ha/yr)	0.1	0.7	0.1	12.1	12.2	61.1
Acid Deposition[3]	CLminN: 0.223 (keq/ha/yr) CLmaxN: 0.568 (keq/ha/yr) CLmaxS: 0.202 (keq/ha/yr)	**0.01**	**1.8**	**0.03**	**0.50**	**0.54[4]**	**95.1**

Notes:

[1] The Predicted Cumulative Environmental Concentration for short-term pollutants is not the sum of all contributions. Short-term pollutant impacts are calculated based on conditions at a certain point in each meteorological year considered (i.e. the 19th worst hour of the year for hourly mean NO_2 at each receptor). When emissions from sources are modelled individually, the 19th worst hour at each receptor will almost most certainly be different for each source. Therefore, the Predicted Cumulative Environmental Concentration is based on a model run that includes both Proposed Development sources and cumulative sources together.

[2] Worst affected receptor is E09 – mudflats habitat.

[3] Worst affected receptor is E12 – perennial vegetation on stony banks habitat.

[4] In the absence of publicly available background acid deposition data for Ireland, a background acid deposition value reported by APIS for a rural location in the west of Wales (UK) has been used as a proxy. PEC of acid deposition reported in this chapter should be treated with caution and referred to as a guideline value only.

Bold rows represent pollutants and averaging periods that cannot be screened as insignificant following UK EA guidance.

Table 8-23 demonstrates that with the cumulative contribution the total pollutant concentrations (PEC) does increase at the worst affected human health and nature conservation receptors, but not to the extent that it alters the description of impact (PC) and effect described in Section 8.6.2 and 8.6.3. It also demonstrates that the cumulative sources have the greatest influence on the total pollutant concentration (PEC) for SO_2 (and SO_2-related acid deposition).

Hourly mean NO_2 impact (PC) and cumulative total Pollutant Concentration (PEC) at the worst affected human health sensitive receptor (R19) could not be screened as insignificant and the same was also the case for the next seven worst affected receptors (R8, R10, R13-R16 and R26 (see Volume 4, Appendix A8-3)). However, the remaining 39 receptors considered experienced an hourly NO_2 impact (PC) of less than the criteria given in the UK EA guidance. The cumulative total pollutant concentration (PEC) at these worst affected receptors shows that with the Proposed Development in operation, there remains a headroom (the gap between the total pollutant concentration (PEC) and the Air Quality Standard) of between 66-76% of the Air Quality Standard for that pollutant. It can therefore be said with much confidence that the operation of the Proposed Development does not give rise to any risk of exceedance of the hourly mean NO_2 Air Quality Standard in the Normal Operational Scenario, nor is it likely to constrain any future development of the area.

The annual average acid deposition rate impact (PC) and cumulative total deposition rate (PEC) at the worst affected nature conservation site (receptor E12 - perennial vegetation on stony banks habitat) could not be screened as insignificant, although no other nature conservation receptors sensitive to acid deposition considered in this assessment experience an impact (PC) of 1% or more of their respective Environmental Assessment Levels. At receptor E12, the elevated cumulative total deposition rate (PEC) is primarily due to the proxy ambient background contribution assumed in the assessment and should be treated with caution and perhaps not primarily used for determining significance, due to its uncertainty. As previously noted, background acid deposition rates in the study area are likely to fall in the near future, because of the cessation of coal burning and Heavy Fuel Oil burning at Moneypoint and Tarbert Power Stations respectively. In light of the above, it is determined that the operation of the Proposed Development will not give rise to an exceedance of the Air Quality Standard for annual mean acid deposition rates and that the impact will not cause a significant effect.

The impact (PC) and cumulative total pollutant concentration (PEC) has also been evaluated against the the IAQM guidance criteria (Moorcroft and Barrowcliffe, et al., 2017). Long-term (annual mean) impacts (PC) are described as slight-adverse to negligible for all pollutants and receptors in the cumulative assessment with the exception of annual mean NO_2 impacts (PC) at receptors R19 and R26, which are described as moderate adverse. In some circumstances, moderate adverse impacts can represent a significant effect, typically when there are numerous receptors predicted to experience such an impact (PC) and/ or the impact (PC) contributes to an Air Quality Standard being at risk of an exceedance. In this instance, the moderate adverse impact affects just 2 receptors, which, with the addition of the contribution from the Proposed Development, experience total annual mean NO_2 concentrations (PEC) that account for less than 50% of the Air Quality Standard. With reference to the IAQM guidance, the impacts on long-term pollutant concentrations, therefore, will not have a significant effect.

Following the IAQM guidance for short-term (<annual mean) impacts, the effects are described as 'Imperceptible' to 'Slight' adverse at 45 of the 48 human health receptors considered for all pollutants, and 'Moderate' adverse at the remaining 3 receptors for hourly mean NO_2. However, even with this magnitude of effect, total hourly mean NO_2 concentrations remain well below the Air Quality Standard for that pollutant to the extent that the effect is not considered to be significant.

Cumulative operational phase impacts are also possible where the operation of the Proposed Development coincides with the operation of the potential Data Centre Campus. No operational emissions associated with the 220 kV connection, medium voltage (10/ 20 kV) connection and Shannon Pipeline are considered likely. The design of the potential Data Centre Campus is not advanced to the stage where the quantity of emissions and impact/ effect of those emissions is known. It is therefore not possible to confirm the cumulative effect of this source alongside the Proposed Development at this time. The cumulative effects of these two developments will therefore need to be accounted for in the assessment to accompany the Data Centre Campus planning application.

8.8 Do Nothing Scenario

In the Do-Nothing Scenario no development of the Shannon Technology and Energy Park will occur, i.e. neither the LNG facility or Power Plant will be developed. In such a scenario air quality will remain similar to that described in Section 8.4 and listed in Table 8-14 to

Table 8-16. Air quality concentrations for all pollutants and averaging periods of reference to this assessment will remain well below their respective Air Quality Standards and Environmental Assessment Levels, although there is some uncertainty in the annual mean deposition rates for acid. This will however, likely decrease is future years with the cessation of coal burning at Moneypoint Power Station and Heavy Fuel Oil burning at Tarbert Power Station.

8.9 Residual Impacts

8.9.1 Construction Phase Dust and Particulate Matter Assessment

In line with IAQM construction dust guidance, providing adequate dust mitigation measures are implemented onsite, all of which are common practice on all well managed construction sites across the country, then impacts can be adequately controlled to the extent that any effect is **not significant**.

In line with EPA guidance (2017), construction phase effects are described as **negative/ adverse**, **not significant** and limited to locations within 350 m of the construction site boundary. They are considered transient and intermittent in nature and unlikely, due to the distance from dust generating activities to the nearest receptors. They are also considered short-term – only having the potential to occur during the construction phase, only likely during working hours onsite, when construction activities are being undertaken within the site at locations closest to a receptor, and when the wind is blowing from the activity towards the receptors, at a speed that can transport the dust from the activity to the receptor.

8.9.2 Operational Phase Site Emissions Assessment

The assessment of operational phase emissions has identified that whilst the Proposed Development will have some impact on local air quality, the extent of that effect is either **slight** to **imperceptible**, or **moderate** at limited locations, where that impact does not put compliance with an Air Quality Standard or Environmental Assessment Level at risk.

In light of the above, no additional mitigation is suggested as being required beyond that inherent within the Proposed Development design (source release height) and compliance with the Emission Limits that will be set by the EPA within the facility's IE licence. Impacts and associated effects are as reported in Section 8.6 and Section 8.7.

In line with EPA guidance (2017), operational phase effects will be described as **negative/ adverse**, **not significant** at the majority of receptors, but with **significant** to **moderate** effects at limited individual receptors closest to the Proposed Development boundary. Overall, the effect is considered to be **slight**, **continuous**, **likely to occur** and **long-term**, for the duration of the Proposed Development's operation.

8.10 Decommissioning

As outlined in Chapter 02 – Project Description, in the event of decommissioning, measures will be undertaken by the Applicant to ensure that there will be no significant, negative environmental effects during the decommissioning phase. Examples of the measures that will be implemented are outlined in Section 2.11, Chapter 02 – Project Description. As a result, additional potential impacts and associated effects arising during the decommissioning phase are not anticipated above and beyond those already assessed during the construction phase.

8.11 Summary

Air quality dispersion modelling of emissions from the Proposed Development (LNG facility and Power Plant) has been undertaken. The Process Contribution (PC) (impact) and Predicted Environmental Concentration (PEC) (total pollutant concentrations) have been quantified at a number of receptors, including nearby (air quality sensitive) human health receptors (residential dwellings) and the nearest nature conservation habitats sensitive to air quality impacts (including habitats within the Shannon Estuary Special Area of Conservation and Special Protection Area).

Existing air quality has been reviewed and it is considered that the standard of baseline air quality is likely to be good with no risk of exceedance of than Air Quality Standard or Environmental Assessment Level (set for the protection of human health or sensitive habitat) for the vast majority of pollutants and averaging periods included in this assessment. It is considered that there is the potential for elevated baseline conditions for the annual mean rate of acid deposition. There is some uncertainty in the existing rate of acid deposition, due to an absence of site or even regional-specific baseline data. It is also noted that the annual mean rate of acid deposition is likely to fall within the study area over coming years, as will deposition rates and airborne concentrations of other pollutants, with the cessation of coal and Heavy Fuel Oil-fired operations at Moneypoint Power Station and Tarbert Power Station respectively.

A construction dust assessment has considered the risk of dust impacts occurring and has suggested a level of mitigation required to ensure any effect is not significant. The assessment is precautionary and likely over-estimates the level of mitigation required.

Dispersion modelling of operational emissions considered a number of scenarios based on various modes of operation of the Proposed Development, with the anticipated typical mode of operation forming the main assessment and subsequent sensitivity scenarios considering various alternative modes of operation and/ or precautionary assumptions.

The assessment of normal operation identified limited impacts at the vast majority of receptors considered for the majority of pollutants and averaging periods. Elevated impact (PC) were identified for hourly mean nitrogen dioxide, hourly maximum benzene and daily maximum oxides of nitrogen at the worst affected receptor locations. Of those, hourly maximum benzene impacts were screened out, due to the precautionary assumption that all total hydrocarbon and volatile organic compound emissions were released as that compound, when in reality, benzene will form only a proportion of such emissions and actual benzene impacts will likely be much lower. As was the daily maximum oxides of nitrogen impact, due to this pollutant and averaging period being of concern for nature conservation sites only where those sites are already constrained by other pollutants (sulphur dioxide and ozone), which in this instance, they were not.

At the limited receptor locations where hourly mean nitrogen dioxide impact (PC) was elevated, some receptors also experienced elevated total pollutant concentrations (PEC) above levels that air quality assessment guidance suggests can be screened as insignificant. However, review of hourly mean nitrogen dioxide impacts (PC) and total concentrations (PEC) at these locations, relative to the Air Quality Standard, identified that total concentrations (PEC) arising from the Proposed Development in operation were well below the relevant Air Quality Standard at the worst-affected receptor and, therefore, there was no risk of an exceedance and it will not constrain future development in the area.

The assessment of normal operation also identified an impact (PC) and total deposition rate (PEC) of concern for the annual mean rate of acid deposition at the worst affected nature conservation site receptor for that pollutant. Whilst the impact (PC) is relatively minor, the proportion of the total deposition rate (PEC) to the Environmental Assessment Level is elevated due to a particularly low Critical Load, accounting for the high sensitivity of that particular habitat to acid. However, the total deposition rate (PEC) is founded on an assumed ambient background rate of acid deposition, in the absence of site- or regional-specific data, which accounts for 88% of the Environmental Assessment Level alone. Ambient background rates of acid deposition are also likely to fall in the near future, due to changes in operation at nearby power stations. It is therefore suggested that the PEC reported for the rate of acid deposition is treated with caution, and greater weight is given to the PC predicted. In this instance, the PC accounts for just 1.8% of the Environmental Assessment Level at the worst affected nature conservation site receptor and less than 1% at all others.

The consideration of alternative modes of operation and precautionary assumptions in the sensitivity scenarios identified no additional issues and did not worsen the limited issues identified in the normal mode of operation to the extent that they become a constraint to the development.

The assessment has also considered the cumulative impact and effect of the Proposed Development alongside emissions from Moneypoint and Tarbert Power Stations, even though these facilities are due to cease current operations before or shortly after the Proposed Development is due to become operational. The cumulative assessment identified the same issues highlighted during the assessment of the normal mode of operation. Total pollutant concentrations (PEC) were slightly more elevated, but not to the extent that they became a constraint to the development.

Overall, it is considered that the Proposed Development will impact on local air quality in the study area and have an adverse effect. However, this will not contribute to an exceedance of an Air Quality Standard or Environmental Assessment Level, and pollutant concentrations will remain well below the limits set by the Government for the protection of human health. Concentrations are below the Air Quality Standards and Environmental Assessment Levels to the extent that the operation of the Proposed Development will not constrains future development of the area. The effect of the Proposed Development is not considered significant overall and is compliant with local and national planning policy.

Table 8-24 Summary

Proposed Development Stage	Aspect/ Impact Assessed	Existing Environment/ Receptor Sensitivity	Effect/ Magnitude	Significance (Prior to Mitigation)	Mitigation and Monitoring Measures (the Proposed Development design embedded environmental controls and all mitigation and monitoring measures detailed herein are included in the OCEMP)	Residual Impact Significance
Construction	Dust	High	Negligible	Slight	Standard practice dust mitigation measures as recommended by the Institute of Air Quality Management and listed in Section 8.6.1 (excluding those that are not practical for this site) and the section 9.2.9 of the OCEMP. These include, but are not limited to: • Production of and adherence to a site-specific dust minimisation control plan (AKA Dust Management Plan), setting out the control measures to implemented across the site and associated procedures; and • A proportionate level of dust monitoring relative to the risk of dust impacts, to ascertain the effectiveness of measures included with in the OCEMP and dust minimisation control plan. Dust deposition monitoring will be in place during construction. This could include passive dust deposition monitoring at potential locations shown on Figure 8-5.	Negligible
Operation	Site and road traffic emissions	High	Negligible to moderate	Negligible to slight adverse	Design embedded mitigation measures including: • Emission release heights for the largest and most frequent sources of emissions to air have been designed to encourage good dispersion, through height above ground level and height above nearby buildings and structures;	Negligible to slight adverse

- The layout of the onshore site maximises distance between the main continuous sources of emissions to air and the nearest air quality sensitive receptors;
- The layout of the offshore site also provides a good setback distance between sources of emissions to air and the nearest air quality sensitive receptors;
- Whilst the air quality assessment has assumed continuous operation of the Power Plant throughout the year, in reality the CCGT plant will only operate for the energy demand required at the time;
- The majority of plant and all continuous and frequently operational plant will be fuelled by natural gas. Liquid fuel will only be used for start-up, maintenance and emergency purposes; and
- Start-up and emergency plant will only operate with use of low and ultra-low sulphur liquid fuel.

8.12 References

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