8 AIR QUALITY AND CLIMATE

8.1 INTRODUCTION

This section describes the potential impacts to ambient air quality and climate from the proposed development. Particular attention is given to sensitive receptors, including local houses and ecosystems adjacent to the project, and to the potential exposure of these receptors to airborne pollutants resulting from the proposed development.

There will be no direct impacts on local air quality as a result of the operation of the proposed Corrib Onshore Pipeline development. Impacts to air quality will arise during the construction phase, such as from the generation of construction dust, construction plant emissions and from emissions of construction traffic. The construction activities have been examined to identify those that have the potential for air emissions. Where applicable, a series of suitable mitigation measures have been listed.

There will be no direct impacts on climate as a result of the operation of the proposed Corrib Onshore Pipeline development, although activities during the construction phase of the development have the potential to generate greenhouse gases. These emissions are produced by the generation of construction materials, construction machinery, etc. as well as through the disturbance of peat for pipe laying. Greenhouse gas emissions from these sources have been quantified using standard procedures.

8.2 METHODOLOGY

The methodology to assess the impacts on air quality and climate involved a series of site visits and desktop assessments as described in Sections 8.2.1 and 8.2.2.

8.2.1 Site Visits

A series of site visits were conducted in the period 2007 to 2010 to determine the nearest sensitive receptors, the land use along the proposed route and the local topography. In addition, existing sources of air pollution were noted.

8.2.2 Desk-top Assessment

A desktop assessment was carried out to determine the potential impacts of the proposed development on the local and regional air quality and on greenhouse gas emissions. This involved a review of:

- Existing air monitoring data to determine baseline air quality;
- Relevant assessment criteria (see Section 8.2.2.1) to estimate and evaluate the impact of the proposed scheme on air quality (at sensitive receptors) and climate;
- Construction details (see Chapter 5) and it's potential for generation of dust (see Section 8.2.2.2);
- Construction details and the potential for construction plant emissions to impact on local residential and ecological receptors (see Section 8.2.2.3);
- Construction related traffic (see Section 8.2.2.4 and Chapter 7). Predictive air quality modelling of predicted impacts of construction traffic (regional and local) has been carried out;
- Construction details (see Chapter 5) and levels of peat disturbance were assessed to determine potential greenhouse gas emissions (see Section 8.2.2.5).

8.2.2.1 Assessment Criteria – Air Quality

Certain combustion products have the potential to affect health and European Union air quality standards are specified to ensure air emissions do not exceed levels that are designed to protect human health and ecosystems.

The European Commission (EC) has formally adopted the Air Quality Framework Directive (96/62/EC). The first daughter Directive, 99/30/EC (adopted April 1999), set specific limits for four air pollutants: nitrogen dioxide, sulphur dioxide, Particulate Matter (PM_{10}) and lead. In December 2001, the EC adopted the second daughter Directive, 2000/69/EC, relating to limit values for benzene and carbon monoxide (CO) in ambient air. These Directives have been transposed into Irish legislation by the Air Quality Standards Regulations, 2002 (SI No. 271 of 2002). Two further daughter Directives have come into force relating to ozone (third daughter Directive) and polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury (fourth daughter Directive) in ambient air under separate national legislation.

The original Air Quality Framework Directive and first three daughter Directives are due to be replaced by one over-riding European Directive (2008/50/EC published in May 2008 and known as the “CAFE Directive”) which is due to be transposed into Irish law by June 2010. However, the specified limits for the protection of human health will remain unchanged from those specified in SI No. 271 of 2002. In addition to the limits for the existing parameters, this new Directive sets an annual “target value” for the smaller particulate fraction ($PM_{2.5}$) for the protection of human health.

The above standards have been set by environmental and health professionals across Europe following extensive worldwide research and are designed to protect the most sensitive of receptors, including for example elderly humans with existing respiratory ailments and areas valued for their flora and fauna.

The effects on human health and ecosystems of the various compounds discussed in this Chapter are summarised in Section 8.4.

Various international initiatives, protocols and Directives also exist to limit and reduce emissions at a national level.

The following criteria were considered in the assessment of impact on air quality:

- Air Quality Standards Regulations (S.I. No. 271 of 2002).
- Directive 2001/81/EC on National Emission Ceilings for certain pollutants (NECs) (S.I. No. 10 of 2004).
- There are no statutory limits for deposition of dusts and industry guidelines are typically employed to determine any impact. The TA Luft (German Government ‘Technical Instructions on Air Quality’) states a guideline of 350 mg/m^2/day for the deposition of non-hazardous dusts. This value was used to determine the impact of residual dust as an environmental nuisance.
- The National Roads Authority (NRA) has published guidance for assessing dust impacts from road construction (‘Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes’). This has been used to determine the potential impacts from the proposed construction site operations.

In terms of impacts on climate, the EIS aims to identify and assess the sources and describe the measures in place to minimise releases of compounds with global warming potential. The residual generation of these compounds during the construction phase has been quantified. Many natural and human activities generate releases that can contribute to global warming. Due to the diverse and diffusive nature of sources, the effect that releases from the proposed development have on global warming cannot be specifically quantified within this EIS, however, a conservative quantification of total greenhouse gas emissions is presented.

Reference is made to Ireland's commitment to reduce greenhouse gases nationally. The National Kyoto Target for the first commitment period 2008 – 2012 sets the cap on GHG Emissions at 13% above 1990 levels, equivalent to 62.837 million tonnes of CO_{2eq}. The most recent data submitted by Ireland to the UNFCC in April 2010 indicated that National GHG Emissions in 2008 were 67.44 million tonnes (7.3% above the Kyoto target).

Appendix G provides further details on the aforementioned standards.

8.2.2.2 Construction Dust

Construction dust has the potential to cause local impacts through dust nuisance at the nearest houses and also to sensitive ecosystems.

The potential for dust generation from the construction activities associated with the proposed development has been assessed on the basis of a review of the construction methodologies for the project (see Chapter 5) and the proximity of these methodologies to sensitive receptors. Construction activities such as material importation, excavation, earth moving, material export and backfilling may generate quantities of dust, particularly in dry weather conditions. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction (see Section 8.3.2).

A dust risk assessment has been undertaken using the procedures presented in the National Roads Authority (NRA) "Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes".

8.2.2.3 Construction Plant Emissions

In order to power the tunnel boring machine and associated separation plant, it is proposed to include three large diesel generators at the tunnelling compound in Na hEachú (Aghoos). These generators will operate continuously throughout the tunnel boring and will emit combustion gases such as oxides of nitrogen, particulate matter and carbon monoxide. The potential impact of the emissions from the generator system employed to power the tunnel boring machine and separation plant have been quantified using a refined air dispersion model

The air dispersion model employed is the US EPA AERMOD model, which is the approved regulatory model in the US and widely used in Europe. The model has incorporated standard emission factors, local meteorological conditions and local topography to simulate the dispersion characteristics to determine the impact on sensitive receptors. All results presented are compared to the statutory limits for the protection of human health and ecosystems (S.I. 271 of 2002).

8.2.2.4 Construction Traffic

Emissions from construction related traffic have been assessed in terms of their potential for local impact on human health and sensitive ecosystems and the regional impact.

The main pollutants of concern from traffic emissions in terms of local impact are carbon monoxide, benzene, hydrocarbons, nitrogen oxides and particulate matter PM_{10}, and these are compared to the relevant statutory limits on air quality. On a regional scale the main pollutants of concern from traffic are oxides of nitrogen and hydrocarbons and these are presented in terms of Ireland's commitments under the trans-boundary air pollution regulations.

A prediction of the local impact of traffic-derived pollution was carried out using the Local Assessment model in the Design Manual for Road and Bridges (DMRB), Volume 11, Section 3, Part 1 as per the NRA guidelines for assessment of impacts to air from road transport. Construction traffic data was provided in the form of Annual Average Daily Traffic (AADT) for the existing scenario and maximum construction operations (see Chapter 7).

The regional impact of the construction phase of the project has been assessed in terms of the total mass of pollutants emitted using the Regional Assessment model in the Design Manual for Road and

Bridges (DMRB). This calculation is based on the AADT figures provided in the Traffic Impact Assessment (see Chapter 7) for the road network under both the existing scenario and the peak construction scenarios.

8.2.2.5 Greenhouse Gas Emissions

This assessment has been carried out to identify sources and quantify total greenhouse gas (GHG) emissions generated from the construction activities. The assessment has been carried out using the carbon calculator tool developed by the Environment Agency in the UK specifically for construction projects. The carbon calculator calculates the embodied carbon dioxide (CO_2) of materials plus CO_2 associated with their transportation. It also considers personal travel, site energy use and waste management.

In addition to the above construction activities, the disturbance of peat may also have a climate impact through net carbon losses to atmosphere. In June 2008, the Scottish Government published a methodology for "Calculating Carbon Savings from Wind Farms on Scottish Peatlands – a new approach", prepared by the University of Aberdeen. While this methodology is principally aimed at wind farms, it does contain detailed calculations for the quantification of carbon losses from peat disturbance that may be applied to any construction project in peat areas such as the Corrib Onshore Pipeline.

8.3 EXISTING ENVIRONMENT

The following section describes the existing environment in terms of air quality and climate, including meteorological conditions and existing sources of air pollution in the vicinity of the proposed pipeline route. Information on the nearest sensitive receptors is also outlined.

8.3.1 Existing Air Quality

The EU Air Framework Directive deals with each EU Member State in terms of Zones and Agglomerations for Air Quality. For Ireland, four zones, A, B, C and D have been defined and are included in the Air Quality Standards (AQS) Regulations (SI No 271 of 2002). County Mayo has been classified as falling within Zone D - Rural Ireland.

While there is some availability of recent and historic data for air quality in Castlebar, there is limited data available from the national air quality monitoring database for air quality specifically in this rural part of County Mayo. As such, available data from the EPA Monitoring Site at Kilkitt in Monaghan, which is a similar Zone D (rural) location, has been referenced for Nitrogen Oxides, Sulphur Dioxide and PM_{10} levels (see Appendix G for background data) and is considered representative of background air quality in the study area. The following sub-sections provide details on the sources of these emissions and the background levels at Kilkitt. In addition, baseline air quality data reported in the Bellanaboy Bridge Gas Terminal EIS has been examined to verify the data.

8.3.1.1 Nitrogen Oxides

Nitrogen dioxide is classed as both a primary pollutant and a secondary pollutant. As a primary pollutant NO_2 is emitted in small concentrations from all combustion processes (such as a gas/oil fired boiler or a car engine). As a secondary pollutant NO_2 is derived from the atmospheric oxidation of NO_x.

Air quality data from Kilkitt show levels are below the relevant air quality limits for each year in the period 2003 to 2008. The annual average concentration of 2-3$\mu g/m^3$ is typical of rural background locations and this is considered indicative of the area of the proposed development. This is supported by the baseline air quality assessment undertaken for the Gas Terminal EIS in which monitoring in 2001, 2002 and 2003 indicated an annual average NO_2 concentration in the region of 2$\mu g/m^3$. Therefore, it has been assumed with some confidence that background NO_2 levels in the area are less than 5$\mu g/m^3$ compared to the annual limit for the protection of human health of 40$\mu g/m^3$.

8.3.1.2 Sulphur Dioxide

Sulphur dioxide is classed as a primary pollutant. It is principally emitted from the combustion of fossil fuels (diesel, coal, oil, etc.). As a traffic based pollutant, SO_2 is mainly emitted from vehicles running on diesel fuel, which will include most light goods vehicles (LGVs) and heavy goods vehicles (HGVs). The "Air Pollution Act 1987 (Environmental Specifications for Petrol and Diesel Fuels) Regulations 2003" (SI No. 541 of 2003) provided for the marketing of petrol and diesel fuels with a maximum sulphur content of 10mg/kg ("sulphur free") from 1 January 2005 and since January 2009 all petrol and diesel sold in the state is required to be "sulphur-free". As such, sulphur dioxide emissions from diesel powered engines (road vehicles, mobile plant, generators, etc.) are not considered significant. SO_2 emissions from burning of solid fossil fuels are the main cause of "sulphurous smog" in urban areas.

The air quality data from Kilkitt show background SO_2 concentrations (annual averages 2-3 $\mu g/m^3$) below the relevant air quality limits for all averaging periods in the years 2003 to 2008. Levels are typical of rural background SO_2 concentrations and represent the annual average concentrations in rural areas in Ireland where there is an absence of major sources of SO_2. These levels are verified by the baseline SO_2 monitoring undertaken for the Gas Terminal EIS where an average background SO_2 concentration of 2 $\mu g/m^3$ was detected in three monitoring periods between 2001 and 2003. Therefore it has been assumed with some confidence that background SO_2 levels in the area are less than 5$\mu g/m^3$ compared to the annual limit for the protection of human health of 20$\mu g/m^3$.

8.3.1.3 Particulate Matter (PM_{10})

Particulate matter (PM_{10}) is considered a primary pollutant. It arises from road vehicle exhausts and other machinery. Point sources such as combustion, i.e. domestic fires, industrial boilers etc. are also sources of PM_{10}. In addition, natural sources of PM_{10} include re-suspended dusts and sea salts in coastal areas such as the location of the proposed pipeline route. PM_{10} may also be formed as secondary pollutants from the condensation or reaction of chemical vapours in the atmosphere.

The concentrations of PM_{10} measured at Kilkitt indicate an annual average of 10-15 $\mu g/m^3$ in the period from 2006 to 2008. This is verified by the levels detected during the baseline monitoring carried out for the Terminal EIS where the average PM_{10} levels detected were 12.4$\mu g/m^3$. EPA monitoring undertaken at Castlebar between 2005 to 2008 indicate annual averages of the range of 14-16 $\mu g/m^3$. However, these levels are considered more representative of an urban environment and not indicative of the site of the proposed development. It has been assumed with some confidence that background PM_{10} levels in the area are of the order of 10-15$\mu g/m^3$ compared to the annual limit for the protection of human health of 40$\mu g/m^3$.

8.3.1.4 Particulate Matter ($PM_{2.5}$)

Particulate Matter ($PM_{2.5}$) has similar effects on health as PM_{10}, however, $PM_{2.5}$ is a better indicator of anthropogenic (man-made) emissions. Fine particulate matter $PM_{2.5}$ can be responsible for significant negative impacts on human health.

Currently the EPA only carries out $PM_{2.5}$ monitoring at one location nationally. This is the Old Station Road monitoring location in Cork (Zone B) and not representative of the area of the proposed works. The EPA have published a research report entitled "Nature and Origin of PM_{10} and Smaller Particulate Matter in Urban Air" in 2006 which examined the relationship between PM_{10} and $PM_{2.5}$ in Ireland. The study found that consistently between urban, rural and coastal locations in Ireland, the $PM_{2.5}$ fraction of PM_{10} is approximately 60%. Applying this fraction to the PM_{10} concentrations determined in Kilkitt would lead to an approximate $PM_{2.5}$ annual average of 6-9$\mu g/m^3$ compared to the annual target value for the protection of human health of 25$\mu g/m^3$ (2008/50/EC). This range of 6-9$\mu g/m^3$ (as an annual average $PM_{2.5}$) is considered indicative of the air quality in the area of the proposed development.

8.3.1.5 Total Suspended Particulates (Dust)

Health affects associated with dusts are typically associated with finer particulates such as PM_{10} discussed above. More commonly, dusts are associated with causing an environmental nuisance to residential, ecological and agricultural receptors. A guideline level for the prevention of dust nuisance is the TA Luft guideline of 350 mg/m^2/day as an annual average of monthly results. Background levels of dust in rural areas would typically demonstrate levels of 50-150 mg/m^2/day, dependent on the weather and seasonal agricultural practices in the area (e.g. ploughing, harvest time, etc.).

Dust is not a pollutant regulated by national or European legislation and is therefore not included in the national monitoring network. However, ongoing dust monitoring is carried out at the site of the Bellanaboy Gas Terminal site since February 2005 and the results are published on the Mayo County Council website. Monitoring is undertaken on a monthly basis at the four boundary locations of the site and average results over the period range from 138 mg/m^2/day at the north of the site to 151 mg/m^2/day to the south and east of the site. Dust levels at the site are maintained below the guideline for dust nuisance through a dedicated dust management plan and dust mitigation measures. In the five years of monthly monitoring undertaken at these four locations, only five validated measurements have been reported over the TA Luft guideline of 350 mg/m^2/day, representing a 97% compliance rate.

8.3.2 Meteorological Conditions

8.3.2.1 Microclimate

The landscape along the route and the surrounding area is gently undulating with rounded grassland that is extremely open due to the lack of topographical features and tall vegetation. The prevailing wind direction is from the west-southwest. However, localised land-sea effects, land to lake effects and the influence of hills on wind direction can be expected. Such effects are likely to lead to higher localised winds than would otherwise be the case, again aiding dispersion.

Poor dispersion can occur under certain weather characteristics known as inversions that form in very light or calm wind and stable atmospheric conditions. The wind rose illustrated in Figure 8.1 identifies that such wind conditions are very infrequent (2.8% of hours in the year 2009).

8.3.2.2 Meteorological Data

The nearest meteorological station to the area is the Met Éireann Station in Béal an Mhuirthead (Belmullet) which lies approximately 14km south west of the area of Gleann an Ghad (Glengad).

The weather in the area is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction in Ireland is from a quadrant centred on west-southwest. These are relatively warm winds from the Atlantic and frequently bring rain. Easterly winds are weaker and less frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer.

The 30-year averages from the station at Béal an Mhuirthead (Belmullet) are presented in Table 8.1 below.

Table 8.1: 30-year Average Meteorological Data from Béal an Mhuirthead (Belmullet) (Annual Values from 1961-1990, source: www.met.ie.

Parameter	30-year Average
Mean Temperature (^{0}C)	9.6
Mean Relative Humidity at 0900UTC (%)	83
Mean Daily Sunshine Duration (hours)	3.5
Mean Annual Total Rainfall (mm)	1142.7
Mean Wind Speed (knots)	13.1

The prevailing wind direction for the area is between west to southwest as presented in the windrose for Belmullet Met Station in 2009 in Figure 8.1. Southerly and easterly winds tend to be very infrequent. Wind characteristics vary between a moderate breeze to gales (average 30.5 days with gales per annum). Monthly average wind speeds range between 11.3 and 14.7 knots with highest wind speeds occurring during winter months (December and January). Lowest wind speeds were recorded in the June, July and August period.

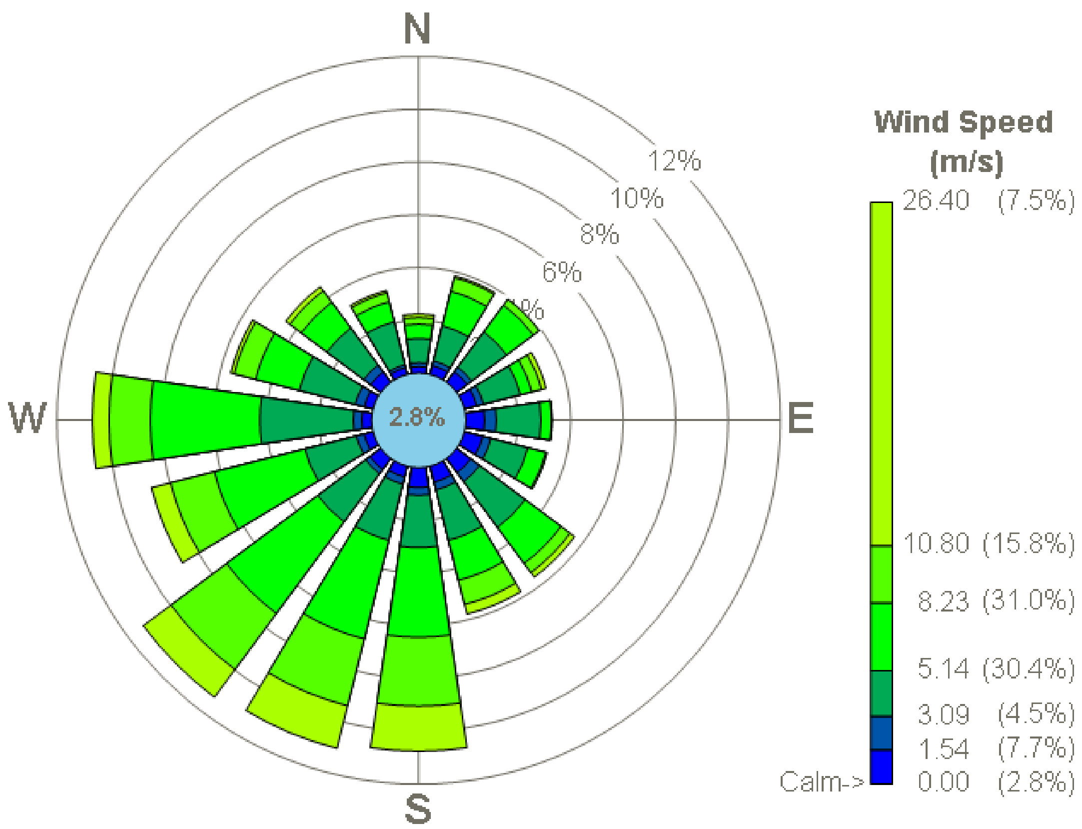


Figure 8.1: Windrose for Belmullet Met Station 2009

8.3.3 Existing Sources of Air Pollution

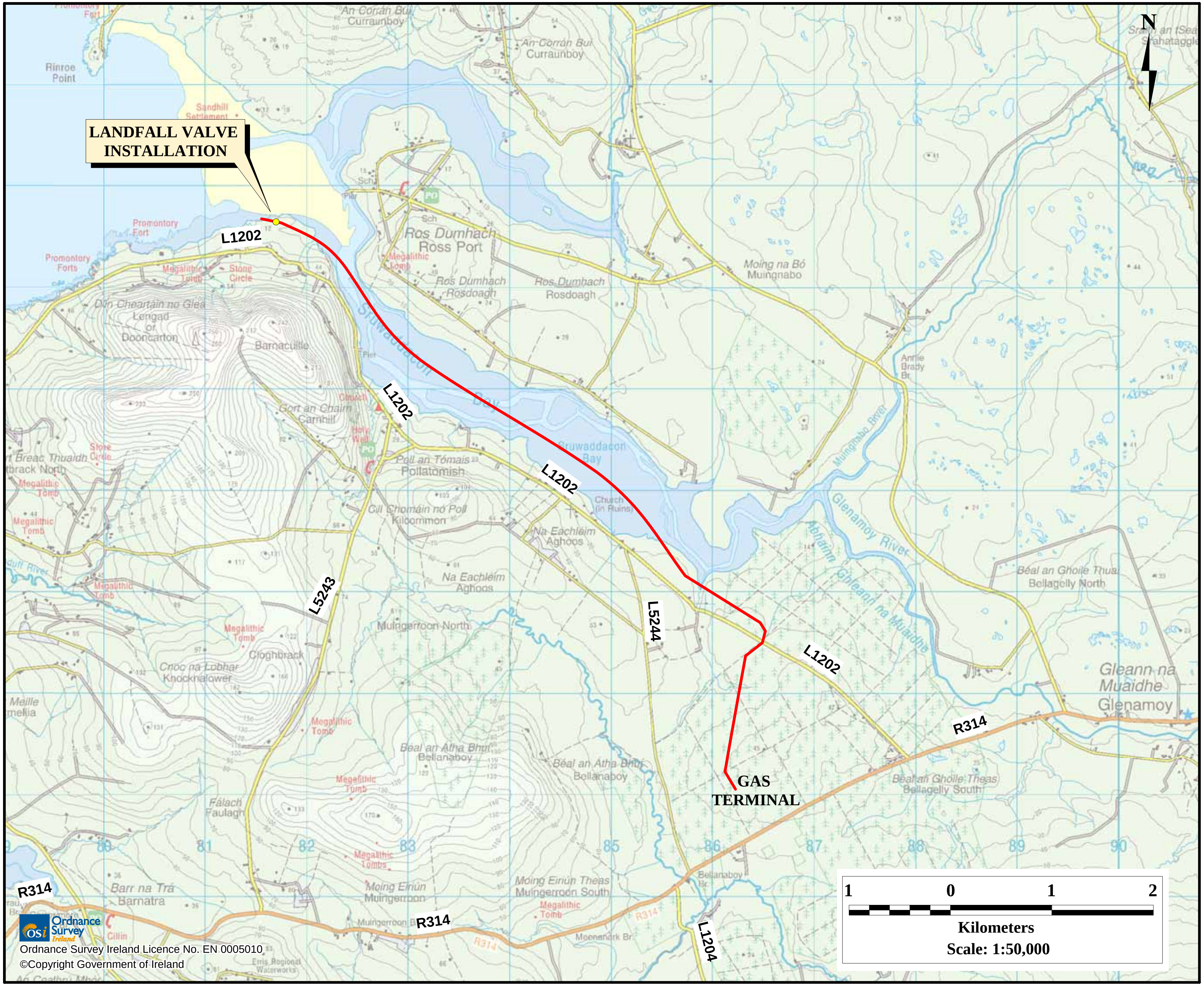
Given the location of the site on the west coast and the nature of the prevailing westerly winds, the area is expected to experience clean Atlantic air with only background levels of pollutants. There are no major sources of air pollution in the area, apart from agricultural activities and road traffic. The only major non-agricultural source of greenhouse gas emissions in the area, the 40MW peat fired power station in Bellacorick, ceased operation in 2004. As such, air quality in the area is considered very good.

The main source of air pollution in the area is emissions from vehicles using the local road network. There is a network of third class roads around the area of Sruwaddacon Bay and the R314 running east/west south of the bay (see Chapter 7 and Figure 8.2). The low volumes of traffic on these roads may have a minor impact on air quality, however, as the traffic is free flowing the potential for traffic congestion and elevated levels of pollution is not considered high.

8.3.4 Sensitive Receptors

There are a number of houses along the L1202 road around Gleann an Ghad (Glengad) at a distance 250m south of the proposed construction compounds at Gleann an Ghad, i.e. Site Compounds SC1 (LVI installation) and SC2 (the tunnel reception compound). Similarly, at the proposed tunnelling compound in Na hEachú (Aghoos) (tunnelling compound SC3), the nearest sensitive residential receptors are approximately 350 metres to the west of the compound.

In addition, to the site compounds, houses along the proposed haul routes (see Chapter 7 and Figure 7.7) will also be subject to any changes in local air quality during the construction stage. The proposed haul route is from the Gleann an Ghad Site Compounds (SC1 - LVI installation and SC2 - the tunnel reception compound) to Na hEachú (Aghoos) (Site Compound SC3) along the L1202 to the



LEGEND:

Proposed Route

Air Quality -
Local Road Network

Figure 8.2

File Ref: COR25MDR0470Mi2150A03
Date: May 2010

CORRIB ONSHORE PIPELINE

CORRIB natural gas

RPS

R314 to the southeast of the bay. From the R314 construction traffic will travel along the L1204 to the R313 west of Baingear (Bangor).

There are several designated conservation sites in the area (see Preface to Section C ‘Natural Environment’ in this EIS), which are also considered to be sensitive receptors.

8.4 POTENTIAL IMPACTS

8.4.1 Operation Phase – Air Quality and Climate

There are no planned emissions from the proposed development during operation and therefore there will be no impacts on air quality.

8.4.2 Construction Phase – Air Quality and Climate

The following sections describe the potential impacts on air quality resulting from the construction phase of the proposed development. The impacts have been assessed on a local scale to determine impact on human health. An assessment of the emissions in the context of national emission targets has also been carried out.

The aspects considered include:

- Construction dust and its potential to impact on sensitive receptors and to cause an environmental nuisance;
- Construction plant emissions and their potential to cause significant impact on human health and/or sensitive ecosystems; and
- Construction traffic related emissions and their potential for impacts on sensitive receptors along haul routes.
- Greenhouse gas emissions from construction operations and peat disturbance.

The impacts are assessed in the following sections with respect to the relevant assessment criteria where appropriate.

8.4.3 Local Impacts to Air Quality

8.4.3.1 Construction Dust

Construction activities such as excavation, earth moving and backfilling can generate dust, particularly in dry weather conditions. The extent of dust generation will depend on the nature of the dust (soils, peat, sands, gravels, silts etc.), location of the main site compounds and the construction activity. In addition, the potential for dust dispersion depends on the local meteorological factors such as rainfall, wind speed and wind direction (see Section 8.3.2). Vehicles transporting material to and from the site also have the potential to cause dust generation along the selected haul routes from the construction areas (see Chapter 7).

Table 8.2 presents a list of distances within which dust could be expected to result in a nuisance from construction sites for impacts such as soiling (dust nuisance), PM_{10} deposition and vegetation effects. This data has been taken from guidance published by the National Roads Authority for roads schemes but is considered applicable to this linear project. These distances present the potential for dust impact with standard mitigation in place.

Table 8.2: Assessment criteria for the impact of dust from construction, with standard mitigation in place (Source: National Roads Authority, 2006)

Source		Potential distance for significant effects (distance from source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation effects**
Major	Large constructions sites, with high use of haul roads.	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul roads.	50m	15m	15m
Minor	Minor construction sites, with limited use of haul roads.	25m	10m	10m

Using this screening assessment tool, at a large construction site there is a risk that dust may cause an impact at sensitive receptors within 100m of the source of the dust generated. In Table 8.3, a list of the provisional site compounds for the proposed construction phase have been presented in conjunction with the scale of each site as outlined in Table 8.2. The provisional location of each compound is presented in Figure 5.2 in Chapter 5 but described briefly in the table. Also listed in the table are the approximate distances to the nearest sensitive residential and ecological receptor.

Table 8.3: Scale and location of proposed temporary site compounds and approximate distances to sensitive receptors

Temporary Source	Scale	Location	Approx distance to Residential Receptor	Approx. distance to Ecological Receptor
Site Compound 1	Moderate	LVI at Gleann an Ghad (Glengad).	250m	Within cSAC
Site Compound 2	Moderate	Tunnel Reception Compound – Gleann an Ghad (Glengad).	250m	Within cSAC
Site Compound 3	Major	Tunnel Launch Compound – Na hEachú (Aghoos).	350m	50m
Site Compound 4	Moderate	Support Compound – Na hEachú (Aghoos)	500m	600m
Site Compound 5	Moderate	Terminal	700m	2,000m

All site compounds and the temporary working area along the route can be considered of moderate to major scale and therefore potential distance of significant effects would be maximum 100m (see Table 8.2).

Site compounds 1 and 2 in Gleann an Ghad (Glengad) are partially located within the Glenamoy Bog Complex cSAC. Similarly Site compound 3 in Na hEachú (Aghoos) is located adjacent to the Glenamoy Bog Complex cSAC. Given the proximity of construction in these areas to the designated site, there is a risk of dust impacts on the cSAC. However, stockpiling of materials will be minimised in those compounds located within the cSAC thereby reducing the potential for dust generation at these locations. Additional mitigation measures have been specified for these higher risk construction areas in Section 8.5.1.1.

As all construction site compounds are located at sufficient distances (i.e. greater than 100 metres) away from residential receptors, dust related impacts to residential receptors will be minimal.

In terms of dust impacts on local agricultural properties, it is predicted that the levels of dust generated by the construction activity will be similar to the existing background levels generated by typical agricultural activities and the impact is considered negligible.

8.4.3.2 Construction Plant Emissions

The tunnelling process requires the use of a series of three diesel generators at the Na hEachú (Aghoos). For the purposes of this assessment it has been assumed that these generators (two 1MW generators and a 0.5MW generator) will operate full time for the duration of tunnelling works to power to tunnel boring machine, separation plant and site compound.

The results of the modelling, incorporating background concentrations, are presented in Table 8.4. All results presented are compared to the statutory limits for the protection of human health (S.I. 271 of 2002), with the exception of $PM_{2.5}$, which is compared to the annual target value presented in Directive 2008/50/EC.

Table 8.4: Predicted impact of generator emissions from the Aghoos Tunnel Compound (SC3)

Parameter	Averaging Period	Background	Predicted Impact from Generators	Total Predicted Impact	Limit for the Protection of Human Health
Nitrogen Dioxide (NO2)	Annual Average	3 μg/m3	0.74 μg/m3	3.74 μg/m3	40μg/m3
	Hourly Maximum	6 μg/m3	52μg/m3	58 μg/m3	200μg/m3
Nitrogen Oxides (NOx)	Annual Average	4 μg/m3	1.49 μg/m3	5.49 μg/m3	30μg/m3
Particulate Matter PM10	Annual Average	10 μg/m3	0.09 μg/m3	10.09 μg/m3	40μg/m3
	24-hour Average	10 μg/m3	1.49 μg/m3	11.49 μg/m3	50μg/m3
Carbon Monoxide	8-hour limit	0.4 mg/m3	0.02 mg/m3	0.42 mg/m3	10 mg/m3
Particulate Matter PM2.5	Annual Average	6 μg/m3	0.09 μg/m3	6.09 μg/m3	25 μg/m3

The results indicate that the predicted impact to air quality of the operation of the generators on the Aghoos tunnelling compound on the nearest residential dwellings will be a slight adverse impact in the short term. This is based on a "large" increase in annual average NO_2, albeit well below the limit for the protection of human health. The nearest residential receptors are those approximately 350 metres west of the compound.

It should be noted that the results indicate that the annual average levels of nitrogen dioxide at these houses will be less than 10% of the annual limit for the protection of human health. In addition, based on the EPA air quality index, the air quality in this area will remain in the range of "good" to "very good" with the generators in operation.

8.4.3.3 Construction Traffic Emissions

Construction traffic can impact on local air quality. In particular, the proposed haul routes used for deliveries and any sensitive receptors that line these routes may experience the impacts to local air quality. The potential impact of this construction traffic was quantified by employing the peak month traffic figures presented in Chapter 7 as a worst case scenario. The detailed results of the modelling exercise are presented in Appendix G and the summary impacts for each road in the network are presented in Table 8.5.

Table 8.5: Predicted impact of traffic pollutants on the road network during peak construction and post construction

Road Section	Impact During Peak Construction	Impact Post Construction
R313 west of junction with R314	Negligible	Negligible
R313 east of junction with R314	Negligible	Negligible
R313 west of Junction with L1204	Slight Adverse	Negligible
R313 east of junction with L1204	Slight Adverse	Negligible
R314 north of junction with R313	Negligible	Negligible
R314 west of junction with L5243	Negligible	Negligible
R314 west of junction with L1204	Negligible	Negligible
R314 west of junction with L1202	Moderate Adverse	Negligible
R314 east of junction with L1202	Negligible	Negligible
R314 east of junction with L1203	Negligible	Negligible
L1204 north of junction with R313	Moderate Adverse	Negligible
L1202 west of junction with R314 up to Na hEachú (Aghoos) Compound	Moderate Adverse	Negligible
L1202 west of Na hEachú (Aghoos) Compound	Slight Adverse	Negligible
L1202 south of An tInbhear (Inver)	Negligible	Negligible
L1203 west of junction with R314	Negligible	Negligible
L5243	Negligible	Negligible
L5244	Negligible	Negligible

The results of the air quality modelling predict varying impacts along the proposed haul routes with peak month construction traffic in operation. At all locations the predicted air quality levels associated with the construction traffic are significantly lower than the relevant air quality limits (see Appendix G, Table 1A.1) for the protection of human health.

The proposed haul routes for the gas pipeline are along the R313 east and west of the junction with the L1204, north along the L1204 to the R314, along the R314 to the L1202 for traffic up to the main tunnelling compound at Na hEachú (Aghoos) with some minor traffic continuing to the tunnel reception compound and LVI site at Gleann an Ghad (Glengad) (refer Chapter 7, Figure 7.7). The proposed haul route for the removal of peat to the An Srath Mór (Srahmore) site is also along the L1202 onto the R314 and south along the L1204 to the R313.

For the section of haul route along the R313 (both east and west of the junction with the L1204) the impact as a result of peak construction traffic is considered "large" (NRA terminology) and as such, the worst-case receptors along this road will experience a "slight adverse" impact to air quality during the peak month of construction traffic. Along the L1204, along the R314 between the junctions with the L1202 and L1204 and finally along the L1202 to the main tunnelling compound at Na hEachú (Aghoos), the impact as a result of the construction traffic is considered to be "very large" (NRA terminology) during peak construction. All sensitive receptors along this route will experience a "moderate adverse" impact to air quality in the short term (1-2 years). It should be noted that the levels of pollutants at all sensitive receptors along these routes will remain well below the limits for the protection of human health, even during peak construction traffic.

There is some construction traffic proposed for L1202 between the compounds at Na hEachú (Aghoos) and Gleann an Ghad (Glengad). As these traffic volumes are considerably lower than the main haul routes above, the resultant impact to air quality along this route is considered "small" (NRA terminology) and the magnitude of impact is considered "slight adverse" in the short term. Sensitive receptors (including the primary school in Poll an tSómais (Pollatomish)) along this section of the

L1202 will experience a “slight adverse” impact to air quality in the short term (1-2 years) but the levels of pollutants will remain well below the limits for the protection of human health, even under peak construction traffic.

For all other roads in the local network that are not proposed as haul roads the impact to air quality is considered negligible. Similarly, once construction is completed the impacts to air quality from traffic associated with the project on all roads are considered negligible.

In summary, the impacts of the construction traffic on the local road network and proposed haul routes (see Chapter 7) is predicted to range from negligible to moderate adverse over the short term of the construction period. It should be noted that these predictions are based on peak estimated construction traffic and represent the maximum impact. In addition, the predicted ground level concentrations of all pollutants are predicted to be within the relevant statutory limits for the protection of human health at all times.

8.4.3.4 Cumulative Combustion Emissions

There are a number of residential dwellings along the construction haul route at the southern section of the L1202 road that will be near enough to experience an impact from the construction plant emissions as well as traffic emissions from construction vehicles. The residential receptors concerned are those along the L1202 directly north of the Na hEachú (Aghoos) site entrance and directly west of the site compound.

The potential cumulative impact of both sources is assessed against the statutory limits for the protection of human health (S.I. 271 of 2002). The assessment concentrates on nitrogen dioxide and particulate matter (PM_{10}) as these are the pollutants of greatest concern to human health.

The residential receptors concerned are those along the L1202 directly north of the Na hEachú (Aghoos) site entrance and directly west of the site compound. The results for the worst case receptor (i.e. the receptor predicted to experience the greatest impact) are presented in Table 8.6. All other sensitive receptors in the area are predicted to experience levels lower than those presented in this table.

Table 8.6: Predicted cumulative impact (worst case) at receptors on the section of the L1202 north of the site entrance.

Parameter	Averaging Period	Background (μg/m3)	Impact from Plant Emissions (μg/m3)	Impact from Traffic Emissions (μg/m3)	Total Cumulative Impact (μg/m3)	Limit for the Protection of Human Health
Nitrogen Dioxide (NO2)	Annual Average	3	0.74	0.49	4.23	40μg/m3
Particulate Matter PM10	Annual Average	10	0.09	0.11	10.20	40μg/m3

The results indicate that the predicted annual average NO_2 concentration will increase by 41% as a worst case (peak construction and all generators operating). This percentage increase on the existing baseline levels is considered to be “very large” (NRA terminology) and will lead to a moderate adverse impact on these receptors over the short term of the construction operation. It should be noted that the results indicate that the annual average levels of nitrogen dioxide at these houses will be less than 11% of the annual limit for the protection of human health.

8.4.3.5 Potential Impact on Sensitive Ecosystems

The principal pollutants of concern for sensitive ecosystems are nitrogen oxides. Nitrogen oxides may have a positive or negative impact by acting as a fertiliser or a phytotoxicant. The potential impact of exposure of plants to nitrogen oxides are mainly on growth, photosynthesis and nitrogen assimilation/metabolism.

The National Roads Authority (NRA) has developed guidelines for the assessment of the significance of impact of construction projects on sensitive ecosystems. These guidelines state that should the predicted concentrations exceed the annual NO_x limit (30μg/m^3 – Appendix G Table 1A.1) then the sensitivity of the relevant species should be assessed by the project ecologist.

The construction traffic associated with the pipeline is not predicted to cause NO_x levels that would breach this limit along haul routes and the highest levels of NO_x along the proposed haul routes is predicted to remain below 41% of this limit during peak construction (calculated on the basis of the peak month of construction traffic).

The operation of the generators at the Aghoos tunnelling compound have the potential to breach the NO_x limit at the Glenamoy Box Complex cSAC. The cSAC hosts habitat adjacent to the compound and is approximately 50 metres from the proposed location of the generators in the compound. The dispersion modelling results for the generator plant emissions indicate that levels of NO_x has the potential to breach the annual average limit at a small section of the cSAC at the nearest point to the compound.

An assessment of the dry deposition of nitrogen on the cSAC has been undertaken using the procedures outlined in the NRA guidelines. The levels of nitrogen deposition from the generators on the cSAC using the NRA procedures are predicted to be up 7 kg N ha^{-1} yr^{-1} for the period of tunnelling at the immediate boundary of the cSAC to the compound.

The UNECE (United Nations Economic Commission for Europe) have devised a series of critical loads for nitrogen deposition on a range of ecosystems and these critical loads are applied in the NRA Guidelines for the air quality assessment. In the area of the cSAC adjacent to the compound and affected by the elevated NO_x emissions, the habitats are estuarine and salt marsh. The UNECE critical load for nitrogen deposition on “pioneer and low-mid salt marshes” is 30-40 kg N ha^{-1} yr^{-1}.

These results indicate that nitrogen deposition on the cSAC as a result of construction will be well below (i.e. less than 24%) the critical load for such salt marsh and as such the impact is considered imperceptible.

8.4.4 Regional Impacts to Air Quality

8.4.4.1 Construction Traffic

Construction traffic gives rise to emissions of compounds with potential significance in a regional or national context. The construction of the proposed pipeline development will involve mobilisation of heavy vehicles through road transport of materials and plant to the site for the duration of the works. Details of the construction traffic are presented in Chapter 7 and this data has been used to quantify the emissions.

Table 8.7: Total Annual Emissions of Certain Pollutants from Road Transport during the Construction Phase of the Project

Source	Total Carbon Monoxide CO (tonnes)	Total Nitrogen Oxides NO_x (tonnes)	Volatile Organic Compounds (tonnes)	Total Particulate Matter (tonnes)
2011 Do-Nothing Traffic	25.2	17.6	3.6	0.5
2011 Do Something Traffic (Peak Construction)	30.6	30.1	5.1	0.8

The results presented in Table 8.7 indicate an increase in the total pollutant emissions when the proposed construction traffic is included. This is due to the increased number of vehicles on the local road network as well as the predicted increase in the number of HGVs on the network.

The predicted levels of NO_x arising from the construction traffic (12.5 tonnes) are less than 0.02% of the National Emissions Ceiling Target for 2010. The predicted levels of VOCs are less than 0.01% of the National Emissions Ceiling Target for 2010.

8.4.4.2 Carbon Losses from Peat Disturbance

Project specific data for the Corrib Onshore pipeline such as volumes and areas of peat, timeframes for construction, etc are presented in Table 8.8. This data has been compiled from the various sections of the EIS. It should be noted that these calculations have assumed a worst case scenario whereby all peat up to 100 metres from the disturbed peat will be impacted by drainage.

Table 8.8 Input Data for Corrib Onshore Pipeline Carbon Losses Calculator

Parameter	Description	Approx. Value
A_{direct}	Area of Peat directly disturbed by construction	6.5 ha
$A_{indirect}$	Area of Peat where drainage may be affected by construction (construction site with 100m (max impact) drainage impact boundary).	70 ha
A_{forest}	Area of trees felled	3.5 ha
V_{direct}	Maximum volume of Peat removed during construction.	75,000 m^3
t	Time – is the time to restoration (years)	2 year

This input data has been applied to the Scottish Parliament methodology for calculating carbon losses from the various sources during construction. A more detailed description of these calculations is presented in Appendix G. The estimated total carbon losses from the Corrib Onshore Pipeline are presented in Table 8.9 below:

Table 8.9 Summary of Carbon Losses from the Corrib Onshore Pipeline

Item	Carbon Losses (tCO_2eq)
Loss of Carbon Fixing Potential of Peat Lands	142
Changes in Carbon Stored in Peat Lands – Removed Peat	0
Changes in Carbon Stored in Peat Lands – Drained Peat	3,061
Loss of Carbon Dioxide due to Leaching of Dissolved and Particulate Organic Carbon	764
Loss of Carbon due to Peatslide	0
Loss of Carbon due to Forestry Clearance	92
Carbon Dioxide Saving due to Improvement of Peat Land Habitat	0
Total Carbon Losses	**4,059**

This assessment indicates that carbon losses from the disturbance of peat during the construction of the onshore pipeline amount to 4,059 tonnes CO_{2eq}. Based on the fact that the highest predicted emissions are from drained peat and the worst case assumption for area affected by peat drainage, this figure can be considered a worst-case carbon loss from the project.

8.4.4.3 Construction Emissions of Greenhouse Gases

Emissions with the potential to cause climate change will arise from embodied carbon dioxide in site materials as well as vehicles delivering this material to the construction site. These emissions have been quantified using the Environment Agency carbon calculator for construction sites and the results are presented in Table 8.10. Carbon losses from peat removal are included from the results presented in Table 8.9.

Table 8.10: Summary of Greenhouse Emissions for Construction (Tonnes of Carbon Dioxide Equivalent).

Item	Estimated GHG Emissions (tCO_2eq)[1]
Quarried Material	2,043
Concrete, Mortars, Cement	12,405
Metals (pipeline Steel)[2]	5,956
Plant Emissions	1,464
Peat Removal	4,059
Material Transport	4,451
Personnel Transport	212
TOTAL	**30,590**

1. Tonnes Carbon Dioxide Equivalent

2. Already Fabricated

The results indicate that the main emissions of greenhouse gas are from the precast concrete segments and materials (bentonite, grout, etc.) used in the tunnelling, production of the pipeline steel (already fabricated) and the transport of materials to the site. The total estimated greenhouse gas emissions associated with the proposed construction is calculated at 30,590 tonnes of $CO_{2eq.}$

8.4.5 'Do Nothing' Scenario

If the proposed development did not proceed the air quality would remain unchanged.

8.5 MITIGATION MEASURES

The following sections describe the mitigation measures to be implemented during construction to minimise the potential impacts on air quality. As no negative impacts are predicted during the operational phase, mitigation measures have not been proposed.

8.5.1 Air Quality

8.5.1.1 Construction Dust

In order to minimise dust nuisance during construction a series of mitigation measures and good working practices will be implemented such as those successfully implemented at the construction of the Bellanaboy Bridge Gas Terminal. These measures will be included in the Environmental Management Plan for the Construction phase, and will include standard mitigation measures outlined below.

The UK British Research Establishment (BRE) document 'Control of Dust from Construction and Demolition Activities' (February 2003) and the Construction Industry Research and Information Association (CIRIA) 'Environmental Good Practice on Site' are best practice international guidance documents for dust minimisation plans. In addition, the NRA has published general guidance entitled 'Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan' that contains details on environmental control measures for air pollutants during construction projects.

Mitigation measures to minimise dust will include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions (also applies to vehicles delivering material with dust potential).

- The designated public roads outside each site compound will be regularly inspected for cleanliness, and cleaned as necessary.

- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind.

- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.

Additional measures include:

- The transport of soils or other material, which has the potential to cause dust will be undertaken in tarpaulin-covered vehicles where necessary.

- All construction related traffic will have speed restrictions on un-surfaced roads.

- Water misting or bowsers will operate at the site on a daily basis to mitigate dust in dry weather conditions.

- Monthly dust monitoring will be undertaken in order to monitor the efficiency of dust management, an ambient dust deposition survey is recommended for the duration of the construction phase. The TA Luft (German Government 'Technical Instructions on Air Quality') states a guideline of 350 $mg/m^2/day$ for the deposition of non-hazardous dusts. This value will be used to determine the impact of construction dust as an environmental nuisance. Any breaches of this guideline will require a review of operations and dust mitigation in the area to ensure any dust nuisance does not continue in future months.

- Daily inspection of construction sites to examine dust measures and their effectiveness.

8.5.1.2 Construction Traffic Emissions

- Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform most efficiently.

- Implementation of the Traffic Management Plan to minimise congestion.

- Where possible haul roads within the temporary working area will be used to minimise traffic on the local road network.

8.5.2 Greenhouse Gas Emissions

Mitigation measures to minimise CO_2 emissions include the following:

- Implementation of the Traffic Management Plan. This will outline measures to minimise congestion and queuing, reduce distances of deliveries and eliminate unnecessary loads.

- Reducing the idle times by providing an efficient material handling plan that minimises the waiting time for loads and unloads. Reducing idle times could save up to 10% of total emissions during construction phase.

- Turning off engines when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons

- Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform the most efficiently.

8.6 RESIDUAL IMPACT

There will be no residual impact on air quality as a result of the proposed Corrib Onshore Pipeline development.

It is not possible to quantify the actual impact of specific greenhouse gas sources or sinks on the climate or environment as a whole, but the contribution of greenhouse gas emissions arising from the construction of the onshore pipeline in the context of the national emission levels is negligible.