Appendix G

Air Quality and Climate

Corrib Onshore Gas Pipeline

Air Quality and Climate Impact Assessment

(SUPPLEMENTARY INFORMATION TO CHAPTER 8)

ASSESSMENT CRITERIA

The relevant Irish ambient air standards have been adopted from the European Commission Directives 96/62/EC, 1999/30/EC and 2000/69/EC and are cited as the Air Quality Standards Regulations(1), which came into force on 17th June 2002 (Irish Legislation S.I. No. 271 of 2002). These regulations are presented in Table 1.A1.

The Air Quality Standards Regulations specify limit values in ambient air for sulphur dioxide (SO_2), lead, benzene, particulate matter (PM_{10}) (Stage I) and carbon monoxide (CO), which came into effect on 1st January 2005. For nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x), particulate matter (PM_{10}) (Stage II) and benzene the effective date is 1st January 2010.

The original Air Quality Directives will be replaced by one over-riding European Directive (2008/50/EC) which was published in May 2008 and due to come into force in June 2010. The specified limits for the protection of human health and ecosystems that are currently regulated through S.I. 271 of 2002 remain unchanged and an additional annual "target value" for the smaller particulate fraction ($PM_{2.5}$) is included.

Directive 2001/81/EC on National Emission Ceilings for certain pollutants (NECs) sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (SO_2, NO_x, VOCs and ammonia). In Ireland this Directive was transposed into Irish law through S.I. No. 10 of 2004(2). Ireland is currently on schedule to achieve the targets for SO_2 and NH_3 and ahead of schedule for VOCs with a target date in 2010. However, Ireland is well behind the target for NO_x and are not predicted to achieve this target in 2010. These figures are prepared by the Department of the Environment, Heritage and Local Government and presented in the "National Programme for Ireland(3) and presented in summary in Table 1A.2.

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(4)) states a guideline of 350 mg/m^2/day for the deposition of non-hazardous dusts. This value should be used to determine the impact of residual dust as an environmental nuisance.

There are no statutory limits for GHG Emissions covering gas pipeline construction and operation activities but 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} per annum. The last official inventory report showed that National GHG Emissions were 7% over the target in 2008 (i.e. 20% above the 1990 levels).

AIR QUALITY LEGISLATION

Table 1A.1: Ambient Air Quality Limits as specified in S.I. 271 of 2002

Pollutant	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	50% until 2001 reducing linearly to 0% by 2010	200 $\mu g/m^3$ NO_2
	Annual limit for protection of human health	50% until 2001 reducing linearly to 0% by 2010	40 $\mu g/m^3$ NO_2
	Annual limit for protection of vegetation	None	30 $\mu g/m^3$ NO + NO_2
Sulphur Dioxide	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	43% until 2001 reducing linearly until 0% by 2005	350 $\mu g/m^3$
	Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 $\mu g/m^3$
	Annual & Winter limit for the protection of ecosystems	None	20 $\mu g/m^3$
Particulate Matter (PM_{10})	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50% until 2001 reducing linearly to 0% by 2005	50 $\mu g/m^3$ PM_{10}
	Annual limit for protection of human health	20% until 2001 reducing linearly to 0% by 2005	40 $\mu g/m^3$ PM_{10}
Benzene	Annual limit for protection of human health	100% until 2003 reducing linearly to 0% by 2010	5 $\mu g/m^3$
Carbon Monoxide	8-hour limit (on a rolling basis) for protection of human health	50% until 2003 reducing linearly to 0% by 2005	10 mg/m^3

Table 1A.2: National Emissions Ceilings and levels of targeted pollutants (in kilotonnes) as specified in S.I. No. 10 of 2004

Pollutant	2001	2002	2003	2004	2005	2010 Target
SO_2	130	100	78	72	70	42
NO_x	123	116	111	109	110	65
VOCs	78	71	68	64	62	55
NH_3	117	115	114	113	113	116

EXISTING AIR QUALITY

Nitrogen Oxides

The EPA used a continuous chemiluminescent analyser to determine Nitrogen Oxides (NO_x) concentrations at the Kilkitt station. The results of monitoring from 2003 to 2008 are outlined in Table 1A.3.

Table 1A.3: Results of NO_2 monitoring carried out by the EPA in a representative Zone D site (Kilkitt Co. Monaghan)

Parameter	Statistic	Kilkitt 2003	Kilkitt 2004	Kilkitt 2005	Kilkitt 2006	Kilkitt 2007	Kilkitt 2008	AQ Limit[1]
Nitrogen Dioxide (NO_2)	Annual Mean ($\mu g/m^3$)	3	3	2	3	2	3	40
	Max 1-hour ($\mu g/m^3$)	71	43	33	58	82	80	200
	NO_2 Values >200$\mu g/m^3$	0	0	0	0	0	0	18
Nitrogen Oxides (NO_x)	Annual Mean ($\mu g/m^3$)	3	4	4	4	3	4	30

Note: (1) Ambient Air Quality Limits specified in S.I. 271 of 2002

Sulphur Dioxide

EPA monitoring from Kilkitt has again been used with reference to SO_2 and the results of this monitoring are outlined in Table 1A.4.

Table 1A.4: Results of SO_2 monitoring carried out by the EPA in a representative Zone D site (Kilkitt Co. Monaghan)

Parameter	Statistic	Kilkitt 2003	Kilkitt 2004	Kilkitt 2005	Kilkitt 2006	Kilkitt 2007	Kilkitt 2008	AQ Limit
Sulphur Dioxide (SO_2)	Annual Mean ($\mu g/m^3$)	7	3	3	2	2	4	20
	Max 1-hour ($\mu g/m^3$)	51	35	10	13	18	42	350
	1-hour Values >350$\mu g/m^3$	0	0	0	0	0	0	24
	24-hour Values >125$\mu g/m^3$	0	0	0	0	0	0	3

Note: (1) Ambient Air Quality Limits specified in S.I. 271 of 2002

Particulate Matter (PM_{10})

The EPA measured results for PM_{10} are presented in Table 1A.5 below.

Table 1A.5: Results of PM_{10} monitoring carried out by the EPA in Castlebar and Kilkitt

Parameter	Statistic	Castlebar 2005	Castlebar 2006	Castlebar 2007	Castlebar 2008	Kilkitt 2006	Kilkitt 2007	Kilkitt 2008	AQ Limit
Particulate Matter (PM_{10})	Annual Mean ($\mu g/m^3$)	16	16	14	16	10	10	10	40
	Max 24-hour ($\mu g/m^3$)	61	62	87	73	47	74	57	50
	24-hour Values >50$\mu g/m^3$	4	2	8	10	0	2	1	35

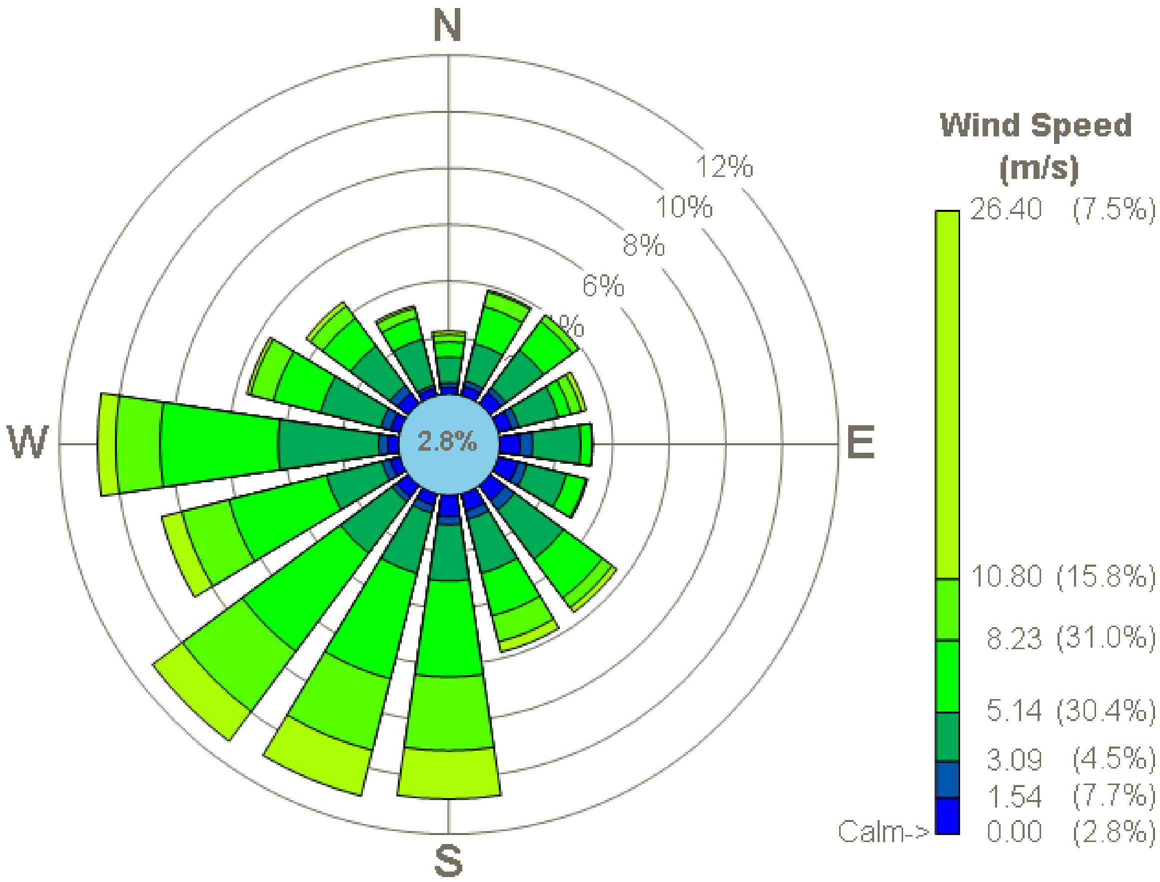
Note: (1) Ambient Air Quality Limits specified in S.I. 271 of 2002

CONSTRUCTION PLANT EMISSIONS

The model used for Air Dispersion Modelling was the US EPA approved AERMOD Prime model, which is the current regulatory model in the US and a recommended model under Irish EPA guidance. This model is a third generation model utilising advanced boundary-layer physics similar to the previous regulatory ISC model. AERMOD is run with a sequence of hourly meteorological conditions to predict concentrations at receptors for averaging times of one hour up to a year. It is necessary to use many years of hourly data to develop a better understanding of the statistics of calculated short-term hourly peaks or of longer time averages. Utilities associated with the dispersion model allow computation of ground level concentrations of pollutants over defined statistical averaging periods, consideration of building wake/downwash effects and the effects of elevated terrain in the vicinity of the site.

The modelling procedure followed the EPA Draft "Guidance Note on Air Dispersion Modelling from Industrial Installations" (AG4) which was published in 2009.

The most important parameters governing dispersion in the atmosphere are wind speed, wind-direction and the stability or turbulence of the atmosphere. These parameters along with the ambient temperature and inferred mixing heights for each hour were included in the modelling using data from and appropriate met station with validated met data. Meteorological data employed in the model was the hourly sequenced data gathered for the Belmullet Met Station for the years 2005 to 2009 inclusive. All years were tested in the model and the highest concentrations were detected using the 2009 met data and as such this year was used throughout the modelling as a worst case scenario. The windrose for the Belmullet 2009 data is presented below:



Generators for the Tunnelling Operation

Source data has been determined from the construction details and the site layout plans. Emission factors for each of the parameters have been derived from the EMEP/EEA Emission Inventory Guidebook 2009, Section 1.A.4 non-road mobile sources and machinery. This document contains generic European emission factors for a range of sources including generator sets (SNAP 080816). On the Aghoos site it is proposed to use two 1MW generators and one 0.5 MW generators. It has been assumed that all generators will conform with Stage IIIA emission standards and will operate at 50% capacity continuously. This is a worst case assumption as it significantly overestimates the project fuel consumption at this site. The emission factors employed are presented in Table 1A.6 below:

Table 1A.6: Emission Factors from EMEP/EEA Inventory Guidebook 2009

Pollutant	Emission Factor
Carbon Monoxide (CO)	6,866 g/tonnes fuel
Oxides of Nitrogen (NO_x)	16,364 g/tonnes fuel
Particulate Matter PM_{10}	957 g/tonnes fuel
Particulate Matter $PM_{2.5}$	957g/tonnes fuel

Sensitive residential receptors were included in the model from the geo-directory mapping for the area and included as discrete receptors. The Glenamoy Bog Complex SAC is also modelled using discrete receptors at the SAC boundary adjacent to the compound.

CONSTRUCTION TRAFFIC

Local Traffic - Construction

Construction traffic associated with the proposed pipeline development may have an impact on air quality over and above the existing traffic volumes in the area. In particular, the proposed haul routes employed during deliveries to the site and the sensitive receptors that line these routes may experience the greatest impacts to local air quality. The potential impact of this construction traffic was quantified in this section of the report employing the traffic figures presented for the construction traffic (in Chapter 7 of this EIS).

Background concentrations of traffic pollutants were incorporated into the model and these backgrounds are used to represent the existing air quality in the area. The background concentrations used in this model survey are data taken from the EPA monitoring data in Kilkitt and similar rural sites as presented earlier in this report.

The construction traffic predictions focused on the existing network including the main haul routes for the proposed construction period. AADT have been presented for the existing 2011 scenario ("do-nothing") and the peak month of construction 2011 ("do-something"). In addition, the % HGV have also been presented for each link in the network. Traffic speeds have been assumed at 20km/hr for all scenarios to assume worst case.

The results of the predictive air quality modelling for 2011 using the DMRB model are outlined in Table 1A.7. Air quality modelling was carried out for CO, benzene, hydrocarbons, NO_x and PM_{10}. The DMRB model has the ability to assess average annual concentrations at each specified receptor. The results presented in Table 1A.7 indicate the annual average concentrations at any receptor located 10 metres from the road network. All other receptors in the region will experience pollutant concentrations less than the levels indicated in this table.

Local Traffic - Operation

Using an identical approach to that outlined above, operational phase traffic impacts have been predicted based on the traffic impact assessment. Traffic predictions for the route network for 2013 (post construction opening year) and 2028 (design year) have been used in this model and the results are presented in Table 1A.8 and 1A.9. As above, the results indicate the annual average concentrations at any receptor located 10 metres from the road network. All other receptors in the region will experience pollutant concentrations less than the levels indicated in these tables.

Table 1A.7: Predicted Annual Averages of Traffic Pollutants, Proposed Corrib Onshore Pipeline (Construction Phase 2011)

Location	2011 Scenario	CO (mg/m^3)	Benzene ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	% Increase in Annual NO_2	Impact
-	Background	0.40	0.30	4.00	3.00	10.00	-	-
R313 west of junction with R314	Do Nothing	0.43	0.33	9.61	5.10	10.66	1%	Negligible
	Peak Construction	0.43	0.33	9.73	5.14	10.69		
R313 east of junction with R314	Do Nothing	0.42	0.32	8.37	4.68	10.49	0%	Negligible
	Peak Construction	0.42	0.32	8.39	4.69	10.49		
R313 west of Junction with L1204	Do Nothing	0.42	0.31	7.30	4.30	10.36	15%	Slight Adverse
	Peak Construction	0.42	0.32	9.14	4.94	10.51		
R313 east of junction with L1204	Do Nothing	0.42	0.32	8.91	4.87	10.53	22%	Slight Adverse
	Peak Construction	0.43	0.32	12.25	5.96	10.81		
R314 north of junction with R313	Do Nothing	0.41	0.31	5.38	3.57	10.19	2%	Negligible
	Peak Construction	0.41	0.31	5.52	3.63	10.22		
R314 west of junction with L5243	Do Nothing	0.41	0.31	5.32	3.55	10.16	1%	Negligible
	Peak Construction	0.41	0.31	5.45	3.60	10.19		
R314 west of junction with L1204	Do Nothing	0.41	0.31	5.12	3.47	10.14	1%	Negligible
	Peak Construction	0.41	0.31	5.26	3.52	10.16		
R314 west of junction with L1202	Do Nothing	0.41	0.31	5.04	3.44	10.13	55%	Moderate Adverse
	Peak Construction	0.41	0.31	10.32	5.34	10.58		
R314 east of junction with L1202	Do Nothing	0.41	0.31	5.31	3.54	10.16	1%	Negligible
	Peak Construction	0.41	0.31	5.43	3.59	10.18		
R314 east of junction with L1203	Do Nothing	0.41	0.31	4.92	3.39	10.12	1%	Negligible
	Peak Construction	0.41	0.31	5.05	3.44	10.14		
L1204 north of junction with R313	Do Nothing	0.41	0.31	5.73	3.71	10.18	49%	Moderate Adverse
	Peak Construction	0.41	0.31	10.88	5.52	10.60		
L1202 west of junction with R314	Do Nothing	0.40	0.30	4.32	3.14	10.04	44%	Moderate Adverse
	Peak Construction	0.41	0.30	7.90	4.51	10.33		
L1202 west of Pollatomish	Do Nothing	0.40	0.30	4.51	3.22	10.06	8%	Slight Adverse
	Peak Construction	0.40	0.30	5.16	3.49	10.11		
L1202 south of Inver	Do Nothing	0.41	0.31	4.90	3.38	10.11	0%	Negligible
	Peak Construction	0.41	0.31	4.91	3.38	10.12		
L1203 west of junction with R314	Do Nothing	0.41	0.31	4.95	3.40	10.11	0%	Negligible
	Peak Construction	0.41	0.31	4.95	3.40	10.11		
L5243	Do Nothing	0.40	0.30	4.40	3.17	10.05	0%	Negligible
	Peak Construction	0.40	0.30	4.40	3.17	10.05		
L5244	Do Nothing	0.40	0.30	4.29	3.13	10.04	0%	Negligible
	Peak Construction	0.40	0.30	4.26	3.11	10.04		
	Limits	10[2]	5[1]	30[3]	40[1]	40[1]	-	-

1. Statutory Instrument 271 of 2002 for the protection of human health 2. 8-hour limit for the protection of human health 3. Annual limit for the protection of ecosystems

Table 1A.8: Predicted Annual Averages of Traffic Pollutants, Proposed Corrib Onshore Pipeline (Opening Year 2013)

Location	2011 Scenario	CO (mg/m3)	Benzene (µg/m3)	NOx (µg/m3)	NO2 (µg/m3)	PM10 (µg/m3)	% Increase in Annual NO2	Impact
-	Background	0.40	0.30	4.00	3.00	10.00	-	-
R313 west of junction with R314	Do Nothing	0.43	0.33	8.95	4.88	10.57	0%	Negligible
	Peak Construction	0.43	0.33	8.98	4.89	10.58		
R313 east of junction with R314	Do Nothing	0.42	0.32	7.84	4.49	10.42	0%	Negligible
	Peak Construction	0.42	0.32	7.84	4.49	10.42		
R313 west of Junction with L1204	Do Nothing	0.42	0.31	6.90	4.15	10.31	0%	Negligible
	Peak Construction	0.42	0.31	6.90	4.15	10.31		
R313 east of junction with L1204	Do Nothing	0.42	0.32	8.30	4.66	10.45	0%	Negligible
	Peak Construction	0.42	0.32	8.33	4.67	10.46		
R314 north of junction with R313	Do Nothing	0.41	0.31	5.25	3.52	10.17	0%	Negligible
	Peak Construction	0.41	0.31	5.26	3.52	10.17		
R314 west of junction with L5243	Do Nothing	0.41	0.31	5.18	3.49	10.15	0%	Negligible
	Peak Construction	0.41	0.31	5.19	3.50	10.15		
R314 west of junction with L1204	Do Nothing	0.41	0.31	5.01	3.42	10.12	0%	Negligible
	Peak Construction	0.41	0.31	5.01	3.42	10.12		
R314 west of junction with L1202	Do Nothing	0.41	0.31	4.94	3.39	10.12	0%	Negligible
	Peak Construction	0.41	0.31	4.96	3.40	10.12		
R314 east of junction with L1202	Do Nothing	0.41	0.31	5.16	3.48	10.14	0%	Negligible
	Peak Construction	0.41	0.31	5.18	3.49	10.14		
R314 east of junction with L1203	Do Nothing	0.41	0.31	4.83	3.35	10.10	0%	Negligible
	Peak Construction	0.41	0.31	4.84	3.36	10.11		
L1204 north of junction with R313	Do Nothing	0.41	0.31	5.51	3.62	10.15	0%	Negligible
	Peak Construction	0.41	0.31	5.53	3.63	10.15		
L1202 west of junction with R314	Do Nothing	0.40	0.30	4.28	3.12	10.03	0%	Negligible
	Peak Construction	0.40	0.30	4.28	3.12	10.03		
L1202 west of Pollatomish	Do Nothing	0.40	0.30	4.44	3.19	10.05	0%	Negligible
	Peak Construction	0.40	0.30	4.44	3.19	10.05		
L1202 south of Inver	Do Nothing	0.41	0.31	4.81	3.34	10.10	0%	Negligible
	Peak Construction	0.41	0.31	4.80	3.34	10.10		
L1203 west of junction with R314	Do Nothing	0.41	0.31	4.84	3.35	10.10	0%	Negligible
	Peak Construction	0.41	0.31	4.84	3.35	10.10		
L5243	Do Nothing	0.40	0.30	4.36	3.15	10.04	0%	Negligible
	Peak Construction	0.40	0.30	4.36	3.15	10.04		
L5244	Do Nothing	0.40	0.30	4.27	3.12	10.04	0%	Negligible
	Peak Construction	0.40	0.30	4.27	3.12	10.04		
	Limits	102	51	303	401	401	-	-

1. Statutory Instrument 271 of 2002 for the protection of human health 2. 8-hour limit for the protection of human health 3. Annual limit for the protection of ecosystems

Table 1A.9: Predicted Annual Averages of Traffic Pollutants, Proposed Corrib Onshore Pipeline (Design Year 2028)

Location	2011 Scenario	CO (mg/m3)	Benzene (μg/m3)	NOx (μg/m3)	NO2 (μg/m3)	PM10 (μg/m3)	% Increase in Annual NO2	Impact
-	Background	0.40	0.30	4.00	3.00	10.00	-	-
R313 west of junction with R314	Do Nothing	0.43	0.33	8.56	4.75	10.54	0%	Negligible
	Peak Construction	0.43	0.33	8.55	4.74	10.54		
R313 east of junction with R314	Do Nothing	0.42	0.32	7.47	4.36	10.38	0%	Negligible
	Peak Construction	0.42	0.32	7.47	4.36	10.38		
R313 west of Junction with L1204	Do Nothing	0.42	0.32	6.62	4.05	10.28	0%	Negligible
	Peak Construction	0.42	0.32	6.62	4.05	10.28		
R313 east of junction with L1204	Do Nothing	0.42	0.32	7.86	4.50	10.41	0%	Negligible
	Peak Construction	0.42	0.32	7.89	4.51	10.41		
R314 north of junction with R313	Do Nothing	0.41	0.31	5.19	3.50	10.17	0%	Negligible
	Peak Construction	0.41	0.31	5.19	3.50	10.17		
R314 west of junction with L5243	Do Nothing	0.41	0.31	5.09	3.46	10.14	0%	Negligible
	Peak Construction	0.41	0.31	5.10	3.46	10.14		
R314 west of junction with L1204	Do Nothing	0.41	0.31	4.92	3.39	10.12	0%	Negligible
	Peak Construction	0.41	0.31	4.93	3.39	10.12		
R314 west of junction with L1202	Do Nothing	0.41	0.31	4.87	3.37	10.11	0%	Negligible
	Peak Construction	0.41	0.31	4.89	3.38	10.12		
R314 east of junction with L1202	Do Nothing	0.41	0.31	5.07	3.45	10.13	0%	Negligible
	Peak Construction	0.41	0.31	5.09	3.46	10.14		
R314 east of junction with L1203	Do Nothing	0.41	0.31	4.76	3.32	10.10	0%	Negligible
	Peak Construction	0.41	0.31	4.79	3.33	10.10		
L1204 north of junction with R313	Do Nothing	0.41	0.31	5.35	3.56	10.13	0%	Negligible
	Peak Construction	0.41	0.31	5.36	3.56	10.14		
L1202 west of junction with R314	Do Nothing	0.40	0.30	4.26	3.11	10.03	0%	Negligible
	Peak Construction	0.40	0.30	4.26	3.11	10.03		
L1202 west of Pollatomish	Do Nothing	0.40	0.30	4.40	3.17	10.04	0%	Negligible
	Peak Construction	0.40	0.30	4.40	3.17	10.04		
L1202 south of Inver	Do Nothing	0.41	0.31	4.75	3.32	10.10	0%	Negligible
	Peak Construction	0.41	0.31	4.75	3.32	10.10		
L1203 west of junction with R314	Do Nothing	0.41	0.31	4.77	3.33	10.10	0%	Negligible
	Peak Construction	0.41	0.31	4.77	3.33	10.10		
L5243	Do Nothing	0.40	0.30	4.33	3.14	10.04	0%	Negligible
	Peak Construction	0.40	0.30	4.33	3.14	10.04		
L5244	Do Nothing	0.40	0.30	4.26	3.11	10.04	0%	Negligible
	Peak Construction	0.40	0.30	4.26	3.11	10.04		
	Limits	102	51	303	401	401	-	-

1. Statutory Instrument 271 of 2002 for the protection of human health 2. 8-hour limit for the protection of human health 3. Annual limit for the protection of ecosystems

The significance criteria for determining the extent of this impact is presented in Tables 1A.10 and 1A.11 which are derived by the UK National Society for Clean Air and are used in Ireland on NRA road schemes.

Table 1A.10: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of change	Annual mean NO_2 and PM_{10}
Very large	Increase >25%
Large	Increase >15<25%
Medium	Increase >10<15%
Small	Increase >5<10%
Very small	Increase >1<5%
Extremely small	Increase <1%

Table 1A.11: Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Standard	**Change in Concentration**					
	Extremely small	**Very small**	**Small**	**Medium**	**Large**	**Very large**
Decrease with Scheme						
Above Standard with Scheme	Slight beneficial	Slight beneficial	Substantial beneficial	Substantial beneficial	Very Substantial beneficial	Very Substantial beneficial
Above Standard in Do-min, Below with Scheme	Slight beneficial	Moderate beneficial	Substantial beneficial	Substantial beneficial	Very Substantial beneficial	Very Substantial beneficial
Below Standard in Do-min, but not Well Below	Negligible	Slight beneficial	Slight beneficial	Moderate beneficial	Moderate beneficial	Substantial beneficial
Well Below Standard in Do-min	Negligible	Negligible	Slight beneficial	Slight beneficial	Slight beneficial	Moderate beneficial
Increase with Scheme						
Above Standard with Do-min	Slight adverse	Slight adverse	Substantial adverse	Substantial adverse	Very substantial adverse	Very substantial adverse
Below Standard in Do-min, Above with Scheme	Slight adverse	Moderate adverse	Substantial adverse	Substantial adverse	Very substantial adverse	Very substantial adverse
Below Standard with Scheme, but not Well Below	negligible	Slight adverse	Slight adverse	Moderate adverse	Moderate adverse	Substantial adverse
Well Below Standard with Scheme	negligible	negligible	Slight adverse	Slight adverse	Slight adverse	Moderate adverse

Note: Well below the standard is defined as <75% of the limit

CARBON LOSSES FROM PEAT DISTURBANCE

The following sections provide an assessment of the carbon losses arising from the construction of the Corrib Onshore Pipeline including the disturbance of peat land. 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.

The following aspects of peat disturbance are included in the methodology:

- Loss of Carbon Fixing Potential of Peat Lands.
- Changes in Carbon Stored in Peat Lands – Removed Peat.
- Changes in Carbon Stored in Peat Lands – Drained Peat.
- Loss of Carbon Dioxide due to Leaching of Dissolved and Particulate Organic Carbon.
- Loss of Carbon due to Peatslide.
- Loss of Carbon due to Forestry Clearance.
- Carbon Dioxide Saving due to Improvement of Peat Land Habitat.

The calculations presented in this appendix have been carried out in accordance with the published methodology and associated spreadsheet tool. Total carbon losses for the project are presented as the sum of the above list of sources for the proposed onshore pipeline. Each of the sources of carbon loss are presented below:

Loss of Carbon Fixing Potential of Peat Lands

The Loss of Carbon Fixing Potential (L_{fix}) of Peat Lands is calculated using the following equation:

$$L_{fix} = (A_{direct} + A_{indirect}) \times G_{bog} \times t_{restore}$$

A_{direct} (in hectares) is the total area of peat disturbed during construction. The total area of peat disturbed is calculated as 6.512 hectares including the site compound SC3, stringing area, access road and stone roads.

$A_{indirect}$ (in hectares) is the total area of peat that will be affected by temporary alterations to drainage in the area around the excavations during construction. As lowering the water table and draining the peat (either intentionally or unintentionally) may cause carbon losses, as described in Chapters 5 and 15 of the EIS, construction methods have been developed which will minimise alterations to drainage in the area around excavations. Drainage may be affected in both the areas where turving is used and where it is not so the full area of peat affected is included. As the extent of potential drainage is unknown, the methodology recommends a worst-case extent to drainage of 100m around each area of construction. The worst case total area of peat affected by drainage is calculated as 70.542 hectares.

G_{bog} is a default global average for carbon accumulation in peat lands set at 0.92 tCO_2/ha/yr.

$T_{restore}$ is the time required for habitat restoration. This is assumed to be approximately two years given the use of turves and other procedures to ensure that the surface layer of the peat is preserved.

Based on the above data the Loss of Carbon Fixing Potential (L_{fix}) from the project equates to 142 tCO_2eq.

Changes in Carbon Stored in Peat Lands – Removed Peat

The Loss of Carbon from Removed Peat ($L_{removed}$) is calculated using the following equation:

$$L_{removed} = 3.667/100 \times pC_{dry\ peat} \times Bd_{dry\ soil} \times V_{direct}$$

$pC_{dry\ peat}$ is the carbon content of dry peat (%) given the default value of 55%.

$Bd_{dry\ soil}$ is the dry soil bulk density (g/cm^3) given the default value of 0.1g/cm^3.

V_{direct} is the total volume of peat removed during construction (m^3). Up to 75,000m^3 of peat will be removed from the site. The remaining peat will not be removed from site and will be reused in reinstatement.

Based on the above data the Loss of Carbon from Removed Peat ($L_{removed}$) from the project equates to 15,126 tCO_2eq if 100% of the carbon in the peat was lost to the atmosphere as assumed in the methodology.

The standard calculation in the methodology assumes 100% loss of carbon from the peat which is removed. However, this is not predicted to be the case for the Onshore Pipeline as it is proposed to move the peat to a licensed deposition site for rehabilitation, the preferred site being Srahmore (subject to planning). The site at Srahmore is operated by Bord na Móna who are required under licence from the EPA (Waste Licence Register no 199-1) to restore the bog through a rehabilitation plan (condition 9.3). As such, the removal of peat from the onshore pipeline and subsequent deposition at the Srahmore site is predicted to cause negligible carbon losses (0 tCO_2eq). However, in the event that this peat cannot be restored in Srahmore, the peat will be deposited in a licensed landfill and the full 15,126 tCO_2eq will be the resultant carbon losses.

Changes in Carbon Stored in Peat Lands – Drained Peat

The areas of peat around the proposed pipeline construction temporary working area may suffer carbon losses from loss of moisture through drainage (either planned or unplanned drainage). These losses ($L_{indirect}$) will be temporary in nature as the trench will be reinstated following pipe-laying and are calculated as follows:

$$L_{indirect} = L_{drained} - L_{undrained}$$

The drained losses are calculated as follows:

$$L_{drained} = (E_{CH4} + E_{CO2}) \times A_{indirect} \times t$$

E_{CH4} + E_{CO2} are default annual emission factors for methane and carbon dioxide in drained acid bogs (tCO_2/ha/yr) and equate to 0 and 45.709 respectively.

$A_{indirect}$ (in hectares) is the total area of peat that may be temporarily affected by alterations to drainage in the area around the excavations. The total area of peat affected by drainage is calculated as approximately 70.542 hectares as outlined above.

t is the time to restoration (years) which is assumed to be 2 years.

Based on the above data the $L_{drained}$ equates to 6,449 tCO_2eq.

The undrained losses are calculated as follows:

$$L_{undrained} = (E_{CH4} + E_{CO2}) \times A_{indirect} \times t$$

E_{CH4} + E_{CO2} are default annual emission factors for methane and carbon dioxide (tCO_2/ha/yr) and equate to 0.600 and 23.418 respectively.

$A_{indirect}$ (in hectares) is the total area of peat that will be affected by alterations to drainage in the area around the excavations. The total area of peat affected by drainage is calculated as 70.542 hectares as outlined above.

t is the time to restoration (years) which is assumed to be 1 year.

Based on the above data the $L_{undrained}$ equates to 3,388 tCO_2eq resulting in a net loss of carbon from indirect drainage ($L_{indirect}$) of 3,061 tCO_2eq.

Loss of Carbon Dioxide due to Leaching of Dissolved and Particulate Organic Carbon

The losses due to leaching of dissolved and particulate organic carbon (L_{DOC}) are calculated using the procedures applicable to this project as follows:

$$L_{DOC} = 3.667 \times (P_{DOC \rightarrow CO2} \times P_{DOC}/100) \times L_{gas}$$

$P_{DOC \rightarrow CO2}$ (%) is the percentage of leached dissolved organic carbon that is emitted as carbon dioxide. This is set as a default value of 100%.

P_{DOC} (%) is the percentage of total gaseous loss or carbon that is leached as dissolved organic carbon. This is set as a default value of 10%.

L_{gas} (tC) is the sum of gaseous losses of carbon from the different sources in the soil. This includes total CO_2 losses from removed peat and drained peat (3,061 tCO_2 equivalent to 834 tC)

The losses due to leaching of dissolved organic carbon (L_{DOC}) are calculated as 305 tCO_2eq and the losses due to leaching of particulate organic carbon (L_{DOC}) are calculated as 459 tCO_2eq. This totals 764 tCO_2eq due to losses of leaching organic carbon.

Loss of Carbon due to Peatslide

The reference document lists peatslide as a potential source of carbon losses but states that management should carry out all practical measures to ensure that peatslide is considered low risk so a quantification of carbon losses is not included.

The Corrib Onshore Pipeline has been designed to ensure that it will not be at risk from landslides. This has been achieved through route selection and in the case of peat land, by specifying an appropriate construction method which has been modelled and assessed to verify the design. The construction methodology has been set out in Chapter 5 the EIS and stability is discussed in Chapter 15 of the EIS.

Loss of Carbon due to Forestry Clearance

The losses due to forestry clearance (L_{forest}) are calculated using the following calculation:

$$L_{forest} = A_{forest} \times G_{forest} \times t$$

A_{forest} is the area of forest (hectares) to be removed during construction. Approximately 3.5 hectares of forestry will be felled during construction. All of this forestry is coniferous.

G_{forest} is the average carbon sequestered by this tree type per year (tCO_2/ha/yr). Given the coniferous nature of the forestry the sequestration rate of Sitka Spruce is applied (13.2 tCO_2/ha/yr).

t is the lifetime of the period where trees cannot be grown on the site. This is assumed to be 2 years to allow for construction as trees may be replanted on the site on all but the 14m permanent wayleave following construction.

Based on the above data the Loss of Carbon from Forestry Clearance (L_{forest}) from the project equates to 92 tCO_2eq.

The area to be felled is part of a commercial coniferous forest of non native lodgepole pine, owned and managed by Coillte. It is not unreasonable to consider that Coillte's plans for this plantation will more than likely include harvesting of the entire plantation over a period of time.

Carbon Dioxide Saving due to Improvement of Peat Land Habitat

There are no predicted savings in carbon dioxide as a result of works included in this assessment.

REFERENCES

1 - “Air Quality Standards Regulations 2002” Statutory Instrument 271 of 2002

2 - “European Communities (National Emission Ceilings) Regulations 2004” Statutory Instrument 10 of 2004

3 - “Update and Revision of the National Programme for Ireland under Article 6(3) of Directive 2001/81/EC for the progressive reduction of national emissions of transboundary pollutants by 2010”, Department of Environment, Heritage and Local Government, July 2007

4 - “Technical Instructions on Air Quality Control” (TA Luft), German Government, 2002

5 – “Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)” Environmental Protection Agency 2009 (Draft)

6 - EMEP/EEA “Emission Inventory Guidebook” 2009

7 – “Calculating Carbon Savings from Wind Farms on Scottish Peatlands – a new approach”, Scottish Government 2008