10. AIR EMISSIONS

10.1 Introduction

This section considers the potential impacts of emissions to the atmosphere arising as a result of drilling, construction, installation, operation and decommissioning activities.

Drilling activities and construction plant and vehicles/vessels will generate combustion gases (carbon dioxide (CO_2), nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM), sulphur dioxide (SO_2), methane (CH_4) and volatile organic compounds (VOC)). Landfall construction may also result in fugitive dust emissions. A description of all of the emissions which could result from the subsea aspects of the Corrib development is provided in **Appendix 10.1**.

Fugitive emissions of VOC/methane could arise from venting of storage vessels, bulk material transfer operations and mud handling equipment on board the drilling rig.

Emissions to atmosphere will arise as a result of drilling and construction activities and consequently will be of a temporary nature. Once the pipeline and subsea equipment are in place, operational releases to the atmosphere are not anticipated, except for small volumes of atmospheric emissions from marine vessels associated with occasional inspection surveys of the pipeline and field facilities. Vessels involved in the eventual decommissioning of the pipeline and field facilities will also contribute to air emissions at the end of field life.

10.2 Study Methodology

This section of the EIS identifies and assesses the sources of atmospheric releases from the proposed development. Historical emissions resulting from drilling activities have been included in **Appendix 2.1**.

Standard oil and gas industry factors from the United Kingdom Offshore Operators Association (UKOOA) have been used to calculate the air emissions from the project, from the tonnages/volumes of fuel used or estimated, or well test gas flared.

10.3 Receiving Environment

Specific ambient air quality data are not available for the offshore, nearshore and landfall environments associated with the Corrib development. The location of the Corrib Field suggests that offshore ambient air quality is of a high standard. The nearshore environment and the area within the vicinity of the landfall are considered to be rural, with very little industry and a low population density. This again suggests that

ambient air quality is of a high standard nearshore and surrounding the landfall area.

The nearest air quality monitoring station is at Mace Head, Co. Galway. This station, however, only records ozone concentrations. Sulphur dioxide is monitored at Burren, Co. Clare, approximately 150 km to the south and Lough Navar, Co. Fermanagh, approximately 130 km to the east. Both of these sites are located 20-25 km inland. This factor, combined with their distance from Broadhaven Bay, means that data from those sites could not be confidently taken as being representative of the Broadhaven Bay area.

Wetlands and mud flats are a known natural source of methane. No data to confirm whether this applies to the Sruwaddacon estuary are currently available from public sources.

Peat extraction is widely practised in Ireland to provide a source of fuel. The extraction process is known to release CO_2 into the atmosphere, as the peat oxidises once exposed to the air.

10.4 Characteristics of the Proposed Development

The proposed offshore development includes the following operations:

- the drilling of three additional development wells;
- the completion of upto eight wells;
- the construction of subsea facilities;
- the construction of a 20" gas pipeline and 6" umbilical from the Corrib Field to the Terminal and the construction of an 8" water discharge pipe in Broadhaven Bay from the Terminal;
- the construction of the landfall and crossings of Sruwaddacon Bay; and
- operation of the above facilities.

10.5 Potential Impacts of the Proposed Development

10.5.1 Description of Atmospheric Pollutants

A description of the atmospheric pollutants that would be generated by the subsea Corrib development work is provided in **Appendix 10.1**. Emissions associated with global impacts such as climate change are assessed in **Section 13**.

10.5.2 Impacts

The potential impact of atmospheric emissions is an increase in emission concentrations in the vicinity of construction and drilling activities. Sensitive receptors in the area could be affected by elevated levels of pollutants. No sensitive receptors have been identified in the Corrib Field.

The exposed nature and meteorological conditions of the area around the landfall and estuary crossings should ensure that no impacts occur as a result of atmospheric emissions during construction. Emissions from drilling and construction activities are of a temporary nature.

10.5.2.1 Drilling

Five appraisal wells have already been drilled and suspended for future use as producers. Three further wells are proposed for the Field. Well P6 is scheduled to be drilled and suspended in 2002, and wells P7 and P8 for drilling and completion before 2007, if required.

Wells P1-P6 will be re-entered, completed and cleaned before connection to the subsea manifold. P7 and P8 will be drilled, completed and tested prior to connection.

The equipment requirement for drilling is likely to comprise:

- one mobile offshore drilling unit (MODU);
- one standby vessel;
- three anchor handling vessels (for mooring and releasing the rig);
- one supply boat;
- one drill cuttings removal vessel; and
- helicopters for crew changes (to and from the air base in Donegal).

The routine emissions from drilling operations are combustion products from power generation. This includes diesel power generators on the MODU, and diesel engines on the various types of support vessel. In addition, combustion emissions will arise from burning reservoir gas and condensate during the well test programme.

The emissions from the well tests carried out to date are provided in **Appendix 2.1**, along with estimates of emissions from other historic offshore activities in the Corrib Field.

Table 10.1 provides an estimate of the emissions from the drilling of the future wells (P6, P7 and P8) based on previous data from Corrib wells. Although it is not expected that well testing will be carried out on all of these three wells, potential emissions have been included in order to present a worst-case scenario.

10.5.2.2 Well Completion

Completion of six suspended wells is scheduled for the summer of 2002 with a total estimated duration of 90 days. Completion of the suspended wells P1-P6 requires use of a MODU and a standby vessel. Supplies of equipment will be transported by supply boat, and crew changes will be made by helicopter. Estimates of the air emissions from the well completion programme are provided in **Table 10.2**.

Table 10.1: Estimated atmospheric emissions – drilling and testing

	Drill Rig	Support Vessels	Helicopter	Flaring	Total
	tonnes	tonnes	tonnes	tonnes	tonnes
Drilling-P6, P7 & P8					
CO_2	8064	13390	245	-	21699
NOx	150	247	1	-	398
CO	40	33	0	-	73
SO_2	10	17	0	-	27
VOC	5	10	0	-	15
CH_4	0.5	1	0	-	1.5
Testing–P6, P7 and P8					
CO_2	3360	2962	102	18420	24844
NOx	62	55	0	8	125
CO	16	7	0	44	67
SO_2	4	4	0	0	8
VOC	2	2	0	33	37
CH_4	0	0	0	296	296

Assumptions:

- drilling takes place over 60 days per well;
- testing takes place over 25 days, with an average of 107 MMscf flared during testing per well (see Appendix 2.1);
- emissions from bulk storage operations are negligible and have not been included;
- sulphur content of fuel is 0.2% (wt); and
- emissions have been calculated using emission factors from the 1999 UKOOA Environmental Emissions Management System (EEMS) Guidelines for the Compilation of an Atmospheric Emissions Inventory.

Table 10.2: Estimated emissions from the completion of suspended wells and the installation of subsea production equipment

Emissions	Completion	Field Installation	Total Emissions
	tonnes	tonnes	tonnes
CO_2	12849	12406	25255
NOx	235	228	463
CO	48	31	79
SO_2	16	16	32
VOC	9	9	18
CH_4	1	1	2

Assumptions:

- field installation takes place over 60 days;
- completion takes place over 25 days per well;
- sulphur content of fuel is 0.2% (wt);
- emissions have been calculated using emission factors from the 1999 UKOOA EEMS Guidelines for the Compilation of an Atmospheric Inventory; and
- fuel consumption: MSV/Lift Vessel 30 tonnes/day (mobilisation) 20 tonnes/day operational, anchor handlers 20 tonnes/day (mobilisation) 15 tonnes/day operational, survey vessel 6 tonnes/day and supply vessel 10 tonnes/day.

10.5.2.3 Infield Operations

Installation of field facilities is scheduled for July 2002. The vessels/aircraft required include one diving support vessel (DSV), two support vessels, two anchor handling vessels, one survey vessel and return helicopter flights.

Atmospheric emissions will be generated from the combustion of fuel on these vessels.

Potential emissions from the installation of the Field facilities are presented in **Table 10.2**.

10.5.2.4 Pipeline and Umbilical

Operations to lay the pipeline and the umbilical have been considered separately for the offshore work, the nearshore work, the landfall and the Sruwaddacon crossings.

Offshore Work

Offshore pipelaying is scheduled for summer 2002. The offshore pipeline will be 84 km in length. The work requires a large pipelaying vessel, the Solitaire, which will be dynamically positioned. The spread also requires a pipeline trencher, a rock placement vessel, four pipe haul vessels, a supply vessel and a survey vessel. Each of these vessels will emit engine exhaust, according to the size of the engine concerned.

Umbilical laying is scheduled for May 2003 and will most likely be carried out by a reel-lay vessel with an umbilical plough or jet.

Total estimated emissions as a result of offshore pipeline and umbilical installation are presented in **Table 10.3**.

Table 10.3: Estimated emissions from offshore pipelay and umbilical installation

Emissions	Offshore Pipelay and Umbilical Installations
	tonnes
CO_2	18119
Nox	334
CO	45
SO_2	23
VOC	14
CH_4	2

Assumptions:

- offshore pipeline installation takes place over 25 days;
- umbilical installation takes place over 7 days;
- sulphur content of fuel is 0.2% (wt); and
- emissions have been calculated using emission factors from the 1999 UKOOA EEMS Guidelines for the Compilation of an Atmospheric Emissions Inventory.

Nearshore Work

Survey work in Broadhaven Bay is scheduled for six weeks in July and August of 2001. This may require a self-elevating platform (manoeuvred by a tug) a tender and a rigid inflatable boat (RIB). The survey will also involve two crawler-type vehicles: one for excavation of trial pits and the other with rock coring equipment. Emissions from surveying will be negligible and consequently, have not been quantified.

Pipeline preparation in Broadhaven Bay is scheduled for February-May 2002. This will again require a self-elevating platform (and tug), operating as a drilling and blasting pontoon. The nearshore spread will comprise a hopper barge, a backhoe dredger capable of working in 12 m water depth, crew launches and RIBs.

The pipelay vessel, survey boat and supply boats will enter Broadhaven Bay in June 2002. It is estimated that it will take five days to pull the pipeline and umbilical conduit through the prepared trench.

Atmospheric emissions will arise from the operation of these vessels. Total estimated emissions as a result of nearshore pipeline installation are presented in **Table 10.4**.

Table 10.4: Estimated emissions from nearshore pipelaying

	Nearshore Pipelay
	tonnes
CO_2	1955
Nox	36
CO	5
SO_2	2
VOC	1
CH_4	0

Assumptions:

- nearshore pipeline installation takes place over a total period of 5 days;
- sulphur content of fuel is 0.2% (wt); and
- emissions have been calculated using emission factors from the 1999 UKOOA EEMS Guidelines for the Compilation of an Atmospheric Emissions Inventory.

Onshore Work

The onshore pipeline work is scheduled for summer 2002. At the time of writing, it is estimated that equipment required for the construction activities will include the following:

Excavators (2 x 15 tonne, 4 x 20 tonne, 4 x 25 tonne), JCB, dumptrucks (4 x 20 tonne, 6 x 7 tonne), bulldozers (3 x 15 tonne), sidebooms (4 x CAT 572), tracked crane, forklift, crawler loader, Hiab truck, compressor, umbilical cable reel transporter, pipe bending machine, pipe bevelling machine, weld rig, generator, lighting towers, rock borer and pile hammer.

The emissions associated with the construction of the onshore pipeline are described in **Section 19**.

Much of this equipment will also be used for the crossings of the Sruwaddacon estuary. The estimated emissions from the use of the above plant associated with the estuary crossings are included in **Table 10.5**.

Landfall

Preparation of the trench through the landfall is scheduled for April-May 2002, to allow for the pipeline to be pulled into place in June 2002. The

onshore equipment required for this operation is two winches, each with a 250 tonne pull capacity.

The umbilical landfall, scheduled for May 2003, involves pulling the umbilical through a conduit, which has been installed with the pipeline in the previous season. This would need a smaller (100 tonne capacity) winch.

The estimated emissions from the use of the above plant associated with the landfall are included in **Table 10.5**.

Sruwaddacon Crossings

The construction of the river crossings is scheduled for August-September 2002. This will involve a pontoon-mounted backhoe, one small vessel and a small survey vessel. The estimated emissions from these vessels are included in **Table 10.5**.

Table 10.5: Estimated emissions from the landfall and Sruwaddacon crossings

Emissions	Pipeline and umbilical landfall	Sruwaddacon crossings	Total Emissions
	tonnes	tonnes	tonnes
CO_2	123	210	**333**
NOx	2	4	**6**
CO	1	1	**2**
SO_2	0	0	**0**
VOC	0	0	**0**
CH_4	0	0	**0**

Assumptions:

- umbilical installation takes place over 2 days;
- Sruwaddacon crossings take place over 60 days;
- sulphur content of fuel is 0.2% (wt); and
- emissions have been calculated using emission factors from the 1999 UKOOA EEMS Guidelines for the Compilation of an Atmospheric Inventory.

10.5.2.5 Discharge Pipeline

There will be no additional emissions from the construction of the discharge pipeline, as it will be installed at the same time as the gas pipeline.

10.5.2.6 Pipeline Operation

Once the pipeline and subsea equipment are in place, scheduled releases to the atmosphere are not anticipated as a result of routine operation. Occasionally, there will be small atmospheric emissions from marine vessels used for inspection surveys of the pipeline and field facilities.

10.5.2.7 Decommissioning

Decommissioning is likely to involve a mobile offshore work-over rig and lift vessels. It is not possible to predict at this time what the capabilities of these vessels will be, nor their emissions. However, a detailed

decommissioning study will be undertaken approximately five years prior to the anticipated last gas date, and this study will consider the potential air emissions from the different decommissioning options.

10.6 Do-Nothing Scenario

In the absence of the project, there would be no emissions to air over and above those already existing.

10.7 Mitigation Measures

10.7.1 Construction

Combustion emissions associated with transportation will be minimised through appropriate vessel selection and vehicle management plans.

Combustion emissions from power generation and construction equipment will be minimised where possible. A programme of regular maintenance will be put in place to ensure that fuel use is as efficient as possible and emissions are within acceptable limits.

Vented gas associated with drilling activities will be flared where possible. Flaring during well testing will be kept to a minimum.

Landfall construction activities and vehicle movements will cause agitation of dust. This will be minimised, where possible, through careful traffic management. For example, vehicles will use only designated rights of way and will keep to speeds that are as low as reasonably practicable.

10.7.2 Operations

Regular pipeline inspections and examinations using pipeline integrity gauges (PIGs), surface gas detectors (onshore) and inspections of the offshore route using survey vessels, will ensure that the integrity of the pipeline is maintained. These measures can be expected to be completely effective in eliminating any potential for release of gas from the pipeline and are used routinely worldwide.

10.8 Predicted Impact of the Proposed Development

Estimated emissions from the project are summarised in **Table 10.6** (total of **Tables 10.1–10.5**).

Table 10.6: Summary of emissions

	Drilling	Completion	Testing	Field Installation	Offshore Pipelay	Nearshore Pipelay	Landfall & Crossings	Total
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
CO_2	21698	12849	24844	12406	18119	1955	333	**92204**
NO_x	398	235	125	228	334	36	6	**1362**
CO	73	48	68	31	45	5	2	**272**
SO_2	27	16	8	16	23	2	0	**92**
NMVOC	15	9	37	9	14	1	0	**85**
CH_4	2	1	296	1	2	0	0	**302**

The predicted impact of the air emissions on the local environment depends largely on their dispersion in the atmosphere and the resulting concentrations of emissions at ground level. Dispersion is controlled by a number of factors including: meteorology, release rates, release height, exhaust gas temperature and topography (onshore). Although it is not possible to predict accurately dispersion and ground level pollutant concentrations without undertaking a detailed modelling study, it is predicted that the local meteorological conditions and topography will cause adequate dispersion of atmospheric emissions.

To put atmospheric emissions into context, **Table 10.7** compares emissions from the Corrib construction and drilling activities to the annual emissions from various onshore sources. Carbon dioxide and methane emissions are discussed in **Section 13**.

Table 10.7: Comparison of emissions with other industrial sources

Emission source	NOx as NO_2	SO_2	CO	NMVOC	Time span of emissions data
	tonnes	tonnes	tonnes	tonnes	
Corrib offshore activities	1362	92	272	85	Predicted total over approx 5-6 years
Operations					
Corrib Terminal activities	77	0.025	112	25	Predicted total over 1 year
Large gas terminal, UK	1241	70	140	109	1 year (1999)
240 MW oil-fired power station, Ireland	320	3720	No data	No data	1 year (1996)
915 MW coal-fired power station, Ireland	23920	41470	No data	No data	1 year (1996)
350 MW CCGT[1] power station, UK	2083	19	89	Below reporting threshold	1 year (1999)

[1] CCGT=Combined-cycle gas turbine

In view of the short duration or periodic nature of most of the activities, the impacts are predicted to have little significance. In general, there are no resident sensitive receptors offshore and impacts will be negligible. The distances from the landfall and Sruwaddacon crossings are such that there will be no impacts from emissions to air upon local residents.

Global impacts relating to climate change are discussed in **Section 13**.

10.9 Monitoring

No monitoring of air quality during the construction or operation of the offshore pipeline and facilities is proposed.

10.10 Reinstatement and Residual Impacts

There are no residual impacts to air quality anticipated as a result of the project.