Attachment I

Existing Environment & Impact of the Activity

CONTENTS

TABLES

I Existing Environment & Impact of the Activity

I.1 ASSESSMENT OF ATMOSPHERIC EMISSIONS

This section considers the potential air quality impacts arising from the proposed Gas-fired Power Plant.

The potential air quality impacts that may arise from the operation of the proposed development include emissions to atmosphere of typical gas-fired combustion emission gases from the stacks. Emissions to atmosphere could also arise from traffic generated by the proposed development.

The following Air Quality assessment methodology and Standards were used to assess the potential impact on air quality arising from the proposed development.

I.1.A Ambient Air Quality Standards:

The European Commission set down the principles of its approach to ambient air quality standards in 1996 with its Air Quality Framework Directive. This became Irish law through the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999 (SI 33 of 1999). Four "daughter" directives lay down limits for specific pollutants. The first two of these directives refer to sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter, lead, carbon monoxide and benzene. These two directives became Irish law as the Air Quality Standards Regulations 2002. Two further daughter directives deal with Ozone (in Irish law as the Ozone in Ambient Air Regulations 2004) and polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air (not yet transposed into Irish law). The Clean Air For Europe (CAFÉ) Directive (2008/50/EC) was published in May 2008. It has now entered into force and replaces the Framework Directive and the first, second and third Daughter Directives. The fourth Daughter Directive (2004/107EC) will be included in CAFÉ at a later stage. The limit values for the CAFE directive are outlined below. This has yet to be transposed into Irish law. Tables I.1.1 – I.1.7 below set out the limit values or target values specified by the three published daughter directives.

Table I.1.1 Limit Values of Directive 1999/30/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value µg/m3	Basis of Application of the Limit Value	Limit Value Attainment Date
SO_2	Protection of human health	1 hour	350	Not to be exceeded more than 24 times in a calendar year	1 Jan 2005
	Protection of human health	24 hours	125	Not to be exceeded more than 3 times in a calendar year	1 Jan 2005
	Protection of vegetation	calendar year	20	Annual mean	19 July 2001
	Protection of vegetation	1 Oct to 31 Mar	20	Winter mean	19 July 2001
NO_2	Protection of human health	1 hour	200	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010
	Protection of human health	calendar year	40	Annual mean	1 Jan 2010
NO_x	Protection of ecosystems	calendar year	30	Annual mean	19 July 2001
PM_{10} - Stage 1	Protection of human health	24 hours	50	Not to be exceeded more than 35 times in a calendar year	1 Jan 2005
	Protection of human health	calendar year	40	Annual mean	1 Jan 2005
PM_{10} - Stage 2	Protection of human health	24 hours	50	Not to be exceeded more than 7 times in a calendar year	1 Jan 2010
	Protection of human health	calendar year	20	Annual mean	1 Jan 2010
Lead	Protection of human health	calendar year	0.5	Annual mean	1 Jan 2005

Table I.1.2 Alert Thresholds for Sulphur Dioxide & Nitrogen Dioxide

Pollutant	Averaging Period	Limit Value
Sulphur Dioxide	1 hour	500 µg/m3
Nitrogen Dioxide	1 hour	400 µg/m3

The public must be informed if the above thresholds are exceeded for three consecutive hours.

Table I.1.3 Limit Values of Directive 2000/69/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value	Limit Value Attainment Date
Carbon Monoxide	Protection of human health	8 hours	10 mg/m^3	1 Jan 2005
Benzene	Protection of human health	Calendar year	5 µg/m3	1 Jan 2010

Target Values and Long Term Objectives of Directive 2002/3/EC

The ozone daughter directive is different from the previous two in that it sets target values and long term objectives for ozone levels rather than limit values. They are as follows:

Table I.1.4 Target Values for Ozone from 2010

Objective	Parameter	Value
Protection of human health	Maximum daily 8 hour mean	120 ug/m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years
Protection of vegetation	AOT40, calculated from 1 hour values from May to July	18000 µg/m3-h averaged over 5 years

Table I.1.5 Long Term Objectives for Ozone from 2020

Objective	Parameter	Value
Protection of human health	Maximum daily 8 hour mean	120 µg/m^3
Protection of vegetation	AOT40, calculated from 1 hour values from May to July	6000 µg/m^3-h

Table I.1.6 Information and Alert Thresholds for Ozone

Objective	Parameter	Threshold
Information Threshold	1 hour average	180 $\mu g/m^3$
Alert Threshold	1 hour average	240 $\mu g/m^3$

The public must be informed if ozone levels exceed the above thresholds:

Table I.1.7 Target Values of Directive 2004/107/EC

Pollutant	Limit Value Objective	Averaging Period	Target Value ng/m^3	Limit Value Attainment Date
Arsenic	Protection of human health	Calendar year	6 ng/m^3	31 Dec 2012
Cadmium	Protection of human health	Calendar year	5 ng/m^3	31 Dec 2012
Nickel	Protection of human health	Calendar year	20 ng/m^3	31 Dec 2012
Benzo(a)pyrene	Protection of human health	Calendar year	1 ng/m^3	31 Dec 2012

I.1.B Assessment Methodology

I.1.B.(a) NO_2 & SO_2 Diffusion Tube Baseline Monitoring

Background concentrations of NO_2 and SO_2 were determined using passive diffusion tube monitoring. The diffusion tubes were placed at four monitoring locations in the vicinity of the site. Following completion of the monitoring survey, the passive diffusion tubes were capped and placed in a protective container and sent to the Gradko International Ltd. laboratory for analysis. The sample locations, date and time were recorded for each sample. The results are expressed in $\mu g/m^3$ and compared to relevant annual average limit values.

I.1.B.(b) Relevant Available Ambient Air Quality Data

Baseline air quality monitoring data from the EPA monitoring database was analysed. The most recent annual report on air quality in Ireland was published in 2007 and details the range and scope of monitoring carried out throughout Ireland. EPA Air Quality Data was available for Ferbane, Co. Offaly from the 4th October 2006 to 29th March 2007.

As part of the EU Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined for Ireland, as follows;

- Zone A: Dublin Conurbation
- Zone B: Cork Conurbation
- Zone C: Other cities and large towns comprising Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Letterkenny, Celbridge, Newbridge, Mullingar and Balbriggan.
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C.

The area in the vicinity of the Lumcloon is in Zone D, one of the four air quality zones in Ireland. Zone D consists of small towns and rural areas of the country. The EPA continuous air quality monitoring locations that are representative of Zone D include Mountrath, Drogheda, Castlebar, Glashaboy and Kilkitt. EPA mobile monitoring units also monitor air quality at locations within Zone D.

Air quality data published in the EIS for the proposed power plant at Derrygreenagh, Co. Offaly. This site is approximately thirty eight kilometres from the proposed development site at Lumcloon, Co. Offaly.

I.1.B.(c) Dispersion Modelling Methodology

The potential ground level concentrations (GLC) of gaseous pollutants at receptors in the vicinity of the site have been predicted using the *AERMOD* atmospheric dispersion model. The transport and transformation of a pollutant in the atmosphere can be predicted with a degree of confidence using this model. *AERMOD* is a USEPA regulatory model for calculating pollutant concentrations from industrial sources and is widely accepted and used by the EPA. The model contains a meteorological data pre-processor (*AERMET*) and a terrain pre-processor (*AERMAP*) that allows for the influence of meteorological and local terrain data to be incorporated into the dispersion modelling predictions. The model predicts the ground level concentration or deposition value for each pollutant. Since most air quality standards are expressed as averages or percentiles, *AERMOD* allows further analysis of the results for comparison purposes. Percentile analysis for emissions is calculated for the maximum averages using the *AERMOD*-percent post-processing utility. This utility calculates the maximum concentration of a pollutant at all receptors at a specific percentile for a specific period.

The predicted emissions from the processes on site are based on emission data provided by Lumcloon Energy Ltd. The results of the dispersion modelling study have been assessed and compared to the relevant air quality standards.

The air dispersion modelling assessment was carried out in accordance with the Environmental Protection Agency, Office of Environmental Enforcement (OEE), Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (2010).

I.1.B.(d) Impact Assessment Significance Criteria:

The impact of the proposed development was assessed in accordance with the relevant ambient air quality standards as outlined above. At present, there is no legislative guidance in Ireland for the assessment of relative impact with regard to the increase / decrease in ambient air pollutant concentrations as a fraction of the relevant limit values. Ideally, the air quality impact assessment methodology should provide a description of the "nature of impact", "duration", "magnitude", "sensitivity", "significance" and "level of confidence". In the absence of appropriate guidelines to assess the relative impact, the National Roads Authority document "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*" details a methodology for determining air quality impact significance criteria for road schemes and this has been adopted in this case.

Nature of Impact

The significance of environmental effects is determined according to their magnitude and the sensitivity of receptors. Significant impacts may be of the following nature:

- Adverse or beneficial
- Temporary or permanent
- Short or long term
- Direct or indirect
- Reversible or irreversible
- Cumulative

Duration

The following terms are defined when quantifying duration (EPA Guidelines, 2002):

- Temporary: up to 1 year
- Short-term: from 1-7 years
- Medium-term: 7-15 years
- Long-term: 15-60 years
- Permanent; over 60 years.

Magnitude

The National Roads Authority document "Guidelines for the treatment of Air Quality during the Planning and Construction of National Road Schemes" details a methodology for determining air quality impact significance criteria for road schemes. The magnitude of the impacts due to the scheme, as they affect sensitive locations, may be described using the criteria set out in Table I.1.8, i.e. the impact can range from very large to extremely small. These impacts can represent an increase or decrease in exposure to air pollutants.

Table I.1.8 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2/PM_{10}	Days $PM_{10}>50\mu g/m^3$
Very Large	Increase/decrease >25%	Increase/decrease >25 days
Large	Increase/decrease 15-25%	Increase/decrease 15-25 days
Moderate	Increase/decrease 10-15%	Increase/decrease 10-15 days
Small	Increase/decrease 5-10%	Increase/decrease 5-10 days
Very Small	Increase/decrease 1-5%	Increase/decrease 1-5 days
Extremely Small	Increase/decrease <1%	Increase/decrease <1 days

Source: Guidelines for the treatment of Air Quality during the Planning and Construction of National Road Schemes – National Roads Authority (2006)

Significance

The interaction of magnitude and sensitivity results in the significance of an environmental effect. Significance should always be qualified as in certain cases an impact of minor significance could be considered to be of great importance by local residents and deserves further consideration. The significance of the impacts needs to take account of the magnitude of the change and the levels in relation to the standards. This may be achieved using the criteria set out in Table I.1.9, as quoted form the National Roads Authority document "Guidelines for the treatment of Air Quality during the Planning and Construction of National Road Schemes".

Table I.1.9 Air Quality Impact Significance Matrix

Absolute Concentration in relation to Standard Note 1	Change in Concentration					
	Extremely Small	Very Small	Small	Moderate	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 in 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 1: Well Below Standard = <75% of limit value

Source: Guidelines for the treatment of Air Quality during the Planning and Construction of National Road Schemes – National Roads Authority (2006)

Sensitivity

Sensitivity, or the importance of a receptor, is determined in terms of geographical extent and/or the importance of a receptor based on statutory designations. There are a number of proposed Natural Heritage Areas in the area of the proposed development. Lough Boora pNHA is located approximately 3km to the south east of the site. Grand Canal pNHA is located approximately 3km to the north of the site. Moyclare Bog and Ferbane Bog which are Special Areas of Conservation (SAC) and pNHAs are located approximately 7km to the north east of the proposed development site. Receptors such as individual properties and small watercourses are generally considered to be of local importance. The sensitivity of a receptor is determined according to the methodology shown Table I.1.10.

Table I.1.10 WYG Methodology for Determining Sensitivity

Sensitivity	Examples of Receptors
International	Special Area of Conservation, World Heritage Site
National	Site of Special Scientific Interest, Scheduled Ancient Monument, major aquifer used for potable water supply, national air quality resource
Regional or County	County Wildlife Site, Cyprinid fisheries, minor aquifer used for general water supply purposes, Sites and Monuments Record, regional transport network
Local or Borough	Single property or group of properties, ordinary watercourse, unclassified drainage ditch, footpath

Level of Confidence

WYG consider it very important to attribute a level of confidence by which the predicted impact has been assessed. For the purpose of this assessment, the criteria for these definitions are set out in Table 1.1.11.

Table I.1.11 Impact Prediction Confidence

Confidence Level	Description
High	The significance of an environmental effect is an informed estimate likely to be based on reliable data or subjective judgement with reference to similar schemes. Further information would not result in any change to assessment of significance.
Low	The significance of an environmental effect is a best estimate likely to be based on subjective judgement without reference to similar schemes. Further information would be needed to confirm assessment of significance.

I.1.C Receiving Environment

I.1.C.(a) NO_2 & SO_2 Baseline Monitoring Results

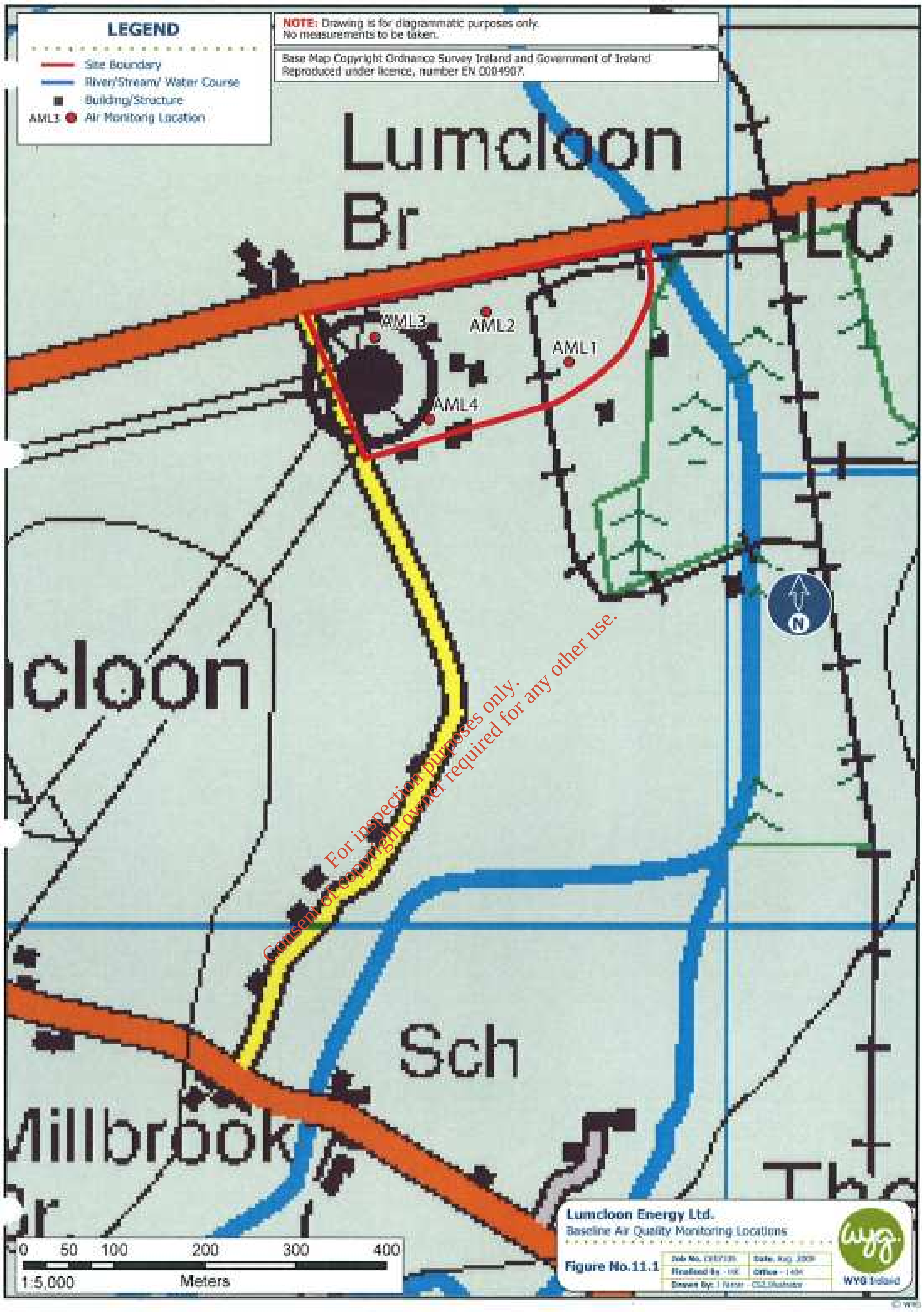
Background concentrations of NO_2 and SO_2 were determined using passive diffusion tube monitoring. The diffusion tubes were placed at four monitoring locations labelled AML-1 to AML-4 from 3rd February 2009 to 4th March 2009. Following completion of the monitoring survey, the passive diffusion tubes were capped and placed in a protective container and sent to the Gradko International Ltd. laboratory for analysis. The sample locations, date and time were recorded for each sample. The results are expressed in µg/m^3 and compared to relevant annual average limit values. The results of the baseline monitoring are presented in Table I.1.12 and the baseline diffusion tube monitoring locations are presented in Figure 11.1.

Table I.1.12 Nitrogen dioxide (NO_2) and Sulphur Dioxide (SO_2) Passive Diffusion Tube Sampling Results

Sample Location ID	NO_2 (µg/m^3)	SO_2 (µg/m^3)
AML-101	5.96	0.55
AML-102	5.57	L.O.D.
AML-103	3.96	L.O.D.
AML-104	3.87	0.6
Limit Value	**40**	**20 (V)**

L.O.D. Below limit of detection

(V) for the protection of vegetation.



The passive diffusion tube survey gives an indication of the existing baseline air quality levels at sensitive receptor locations in the vicinity of the proposed power plant. Average nitrogen dioxide levels of 4.84µg/m^3 were recorded over all the monitoring locations. At each location, the nitrogen dioxide and sulphur dioxide levels were well below the annual average EU limit values, i.e. approximately 10% of the limit value. The results confirm that the baseline pollutant concentrations in the area are less than the relevant ambient air quality limit values. These results are not bias corrected as it is only recommended to apply a bias adjustment factor to the annual mean, not to individual monthly values.

I.1.C.(b) Relevant PM_{10} Monitoring Results

PM_{10} monitoring was carried out from January to August 2008 for the air quality impact assessment of the proposed power plant at Derrygreenagh, Co. Offaly which is approximately 38 km from the proposed Lumcloon site. An average value of 18μg/m^3 was recorded which is less than 50% of the relevant annual mean PM_{10} limit value. This average value of 18μg/m^3 together with the EPA PM_{10} monitoring data for Ferbane, Co. Offaly of 21μg/m^3 suggests that the background PM_{10} concentration in the area is approximately 50% of the relevant annual mean PM_{10} limit value.

I.1.C.(c) EPA Air Quality Monitoring Reports

The closest Environmental Protection Agency air monitoring sample points to the proposed development is located at Ferbane mobile monitoring station. This mobile monitoring station was located approximately seven kilometres to the north east of the proposed development site.

Table I.1.13 Typical air quality monitoring data representative of EPA Zone D monitoring sites – 2007 - 2009

Pollutant	Zone D Monitoring Stations	EPA Baseline Monitoring Data			Relevant Limit Value
		Annual Mean 2007	Annual Mean 2008	Annual Mean 2009	
PM_{10}	Ferbane	21 μg/m^3			PM_{10} annual mean limit for the protection of human health = 40 μg/m^3
	Navan	23 μg/m^3			
	Drogheda	18 μg/m^3	17 μg/m^3		
	Castlebar	14 μg/m^3	16 μg/m^3		
	Cork Harbour	17 μg/m^3			
	Kilkitt	10 μg/m^3	10 μg/m^3	8 μg/m^3	
	Carnsore Point	27 μg/m^3	30 μg/m^3		
	Letterkenny		20 μg/m^3	13 μg/m^3	
SO_2	Ferbane	5 μg/m^3			SO_2 annual mean limit for the protection of vegetation= 20 μg/m^3
	Kilkitt	2 μg/m^3	4 μg/m^3	4 μg/m^3	
	Navan	4 μg/m^3	6 μg/m^3		
	Shannon Estuary	3 μg/m^3	5 μg/m^3	4 μg/m^3	
	Cork Harbour	3 μg/m^3	4 μg/m^3		
	Letterkenny		5 μg/m^3		
NO_2	Ferbane	6μg/m^3			NO_2 annual mean limit for the protection of human health = 40 μg/m^3
	Navan	16 μg/m^3	21 μg/m^3		
	Glashaboy	9 μg/m^3	9 μg/m^3	11 μg/m^3	
	Kilkitt	2 μg/m^3	3 μg/m^3	3 μg/m^3	
	Cork Harbour	11 μg/m^3	10 μg/m^3		
	Castlebar			8 μg/m^3	
	Letterkenny		14 μg/m^3		
NO_x	Ferbane	8 μg/m^3			NO_x annual mean limit for the protection of vegetation= 30 μg/m^3
	Navan	32 μg/m^3	43 μg/m^3		
	Glashaboy	13 μg/m^3	13 μg/m^3	15 μg/m^3	
	Kilkitt	3 μg/m^3	4 μg/m^3	3 μg/m^3	
	Cork Harbour	16 μg/m^3	15 μg/m^3		
	Castlebar			13 μg/m^3	
	Letterkenny		26 μg/m^3		

Pollutant	Zone D Monitoring Stations	EPA Baseline Monitoring Data			Relevant Limit Value
		Annual Mean 2007	Annual Mean 2008	Annual Mean 2009	
Lead	Ferbane Navan Cork Harbour Letterkenny	0.00 µg/m^3 0.00 µg/m^3 0.00 µg/m^3	 0.00 µg/m^3		Pb annual mean limit for the protection of human health = 0.5 µg/m^3
Ozone	Emo Court Glashaboy Kilkitt Mace Head Johnstown Castle Valentia Castlebar	47 µg/m^3 50 µg/m^3 59 µg/m^3 75 µg/m^3 56 µg/m^3 63 µg/m^3	51 µg/m^3 50 µg/m^3 60 µg/m^3 77 µg/m^3 59 µg/m^3 73 µg/m^3	49 µg/m^3 44 µg/m^3 58 µg/m^3 75 µg/m^3 55 µg/m^3 69 µg/m^3 55 µg/m^3	Maximum Ozone daily 8 – hour mean limit = No more than 25 days > 125 µg/m^3
Carbon Monoxide	Ferbane Navan Cork Harbour Castlebar	0.2 µg/m^3 0.5 µg/m^3 0.2µg/m^3	 0.4µg/m^3 0.4µg/m^3		CO maximum daily 8 – hour mean value = 10 mg/m^3
Benzene	Mountrath	Annual mean 2007 n/a Annual Mean 2005 = 0.3 µg/m^3			Benzene annual mean limit for the protection of human health = 5 µg/m^3

I.1.C.(d) EPA Air Quality Monitoring Data – Ferbane

Air quality monitoring data from the Ferbane, Co. Offaly Air Quality Monitoring Station was reviewed. This data is presented as daily or hourly means recorded throughout the monitoring period. Various percentile values were also calculated. Therefore, the recorded maximum daily and hourly means and the annual hourly mean values over the monitoring period have been averaged to allow for representative background concentrations in the vicinity of the proposed development location. This background air quality monitoring data (4th October 2006 – 29th March 2007) has been used to represent *Ambient Concentration (AC)* in the Air Quality Impact Assessment.

The monitoring station was originally sited at the town sewerage works on the western edge of the town on 4th October 2006 and remained at that location until 31st January 2007. This location was sited approximately 500m from the centre of Ferbane. The monitoring location was subsequently moved to the premises of Offaly County Council at the disused railway station on the southern edge of town on the 31st January 2007, as it was a more representative location of air quality in the town. The council premises are located beside the N62 which passes through Ferbane. Monitoring finished on 29th March 2007. Monitoring was undertaken using a mobile unit containing continuous monitors for sulphur dioxide, nitrogen oxides, carbon monoxide and PM_{10}.

Table I.1.14 EPA Air Quality Data Ferbane, Co. Offaly (4th October 2006 – 29th March 2007)

Parameter	Annual Mean (μg/m^3)	Limit Values (μg/m^3)	
		Stage 1	Stage 2
PM_{10}	18.7	40	20
NO_2	5.2	40	
NO_X	6.7	30	
CO	0.2	10	
SO_2	3.2	20	
Pb	0.002	0.5	

It is likely that the background air pollutant concentrations in the vicinity of the proposed development site are lower than those quoted in Table I.1.14 above, as it is in a more rural location than the EPA monitoring station.

I.1.D Dispersion Modelling Inputs

The operational impact of the proposed plant has been assessed under the following three modes. These modes encompass worst – case scenario in terms of emissions to atmosphere.

(i) combined cycle (turbine and HRSG) using natural gas (CCGT – Gas);
(ii) combined cycle using distillate oil (CCGT – Distillate oil);
(iii) open cycle (by-pass of HRSG) using natural gas (OCGT – Gas).

The details of the operation of the proposed plant are outlined in Chapter 2; Project Description.

In combined cycle mode, the HRSG integral exhaust stacks are the main emission points. Open cycle mode allows the plant to produce electricity from the gas turbine alone only. In open cycle mode, the by-pass stacks are the emission points.

Distillate oil will be used in the event that natural gas is unavailable. Operation on distillate oil is not expected to exceed 10 days per year. On-site storage is provided for up to five days operation on distillate oil (10,000m^3) and demineralised water. Demineralised water is required for injection into the gas turbine to control NO_x emissions when operating on distillate oil.

The assessment of the potential impact of the emissions from the power plant, when firing on natural gas or distillate oil, are in accordance with the relevant limit values outlined in the Draft BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector) Final Draft EPA February 2008, the IPPC reference document on BAT for Large Combustion Plants (July 2006) and the Industrial Emissions Directive (2010/75/EU) which has superseded the Large Combustion Plant (LCP) Directive (2001/80/EC).

AERMOD has been used to model the emissions from the stacks at the Lumcloon Power Plant. In order to model the emissions data is required in relation to the emission point stack height and diameter, exit velocity or volume flow rate, temperature and oxides of nitrogen (NO_x), sulphur dioxide (SO_2) and carbon monoxide (CO) emission rates in grams per second. Information related to stack diameters, emission velocities and temperatures as well as the proposed site layout have been provided by Lumcloon Energy Ltd. Emission concentration limit values for the relevant combustion gases and particulates have been taken from the Draft BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector) Final Draft EPA February 2008 and the Industrial Emissions Directive. Table I.1.15 outlines the emission data for the proposed Lumcloon Power Plant, which has been input into the model

The following data was used to accurately determine the likely impact of the emissions from the stack on nearby receptors locations:

Stack Height, Diameter, Gas Conditions and Location: The proposed CCGT and OCGT stack heights, internal stack diameter and emission rates have been input into the model as outlined in Table I.1.15. The following Emission Concentrations (mg/m^3) and Mass Emission Rates (g/s) of oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2) and PM_{10} emissions based on operating limit values for the proposed processes have been input into the dispersion model, as outlined in Table I.1.15.

The locations of the proposed stacks have been extracted from CAD drawings provided by the project team.

Table I.1.15 Emission data for the proposed Lumcloon Power Plant, which have been input into the model, based on emission limit values

Pollutant	Stack Reference	Stack Diameter (m)[1]	Stack Cross Sectional Area (m^2)	Temp. °C [1]	Stack Exit Velocity (m/s)[1]	Volume Flow (m^3/s)	Emission Conc. Limit Value (mg/Nm^3)	Mass Emission Rate (g/s)	Emission Concentration Reference
NOx	CCGT – Gas	3.2	8.0384	95	20	160.768	50	8.04	IED Directive / BAT
	CCGT – Distillate oil	3.2	8.0384	95	20	160.768	90	14.47	IED Directive / BAT
	OCGT – Gas	3.2	8.0384	550	32	257.2288	50	12.86	IED Directive / BAT
CO	CCGT – Gas	3.2	8.0384	95	20	160.768	100	16.08	BAT
	CCGT – Distillate oil	3.2	8.0384	95	20	160.768	100	16.08	BAT
	OCGT – Gas	3.2	8.0384	550	32	257.2288	100	25.72	BAT
SO_2	CCGT – Gas	3.2	8.0384	95	20	160.768	35	5.63	IED Directive / BAT
	CCGT – Distillate oil	3.2	8.0384	95	20	160.768	120	19.29	BAT
	OCGT – Gas	3.2	8.0384	550	32	257.2288	35	9.00	IED Directive / BAT
PM_{10}	CCGT – Gas	3.2	8.0384	95	20	160.768	5	0.80	IED Directive / BAT
	CCGT – Distillate oil	3.2	8.0384	95	20	160.768	30	4.82	N/A
	OCGT – Gas	3.2	8.0384	550	32	257.2288	5	1.29	IED Directive / BAT

1 Provided by Design Team.

IED Directive = Industrial Emissions Directive

BAT = Best Available Technique

CCGT – Gas = combined cycle (turbine and HRSG) using natural gas

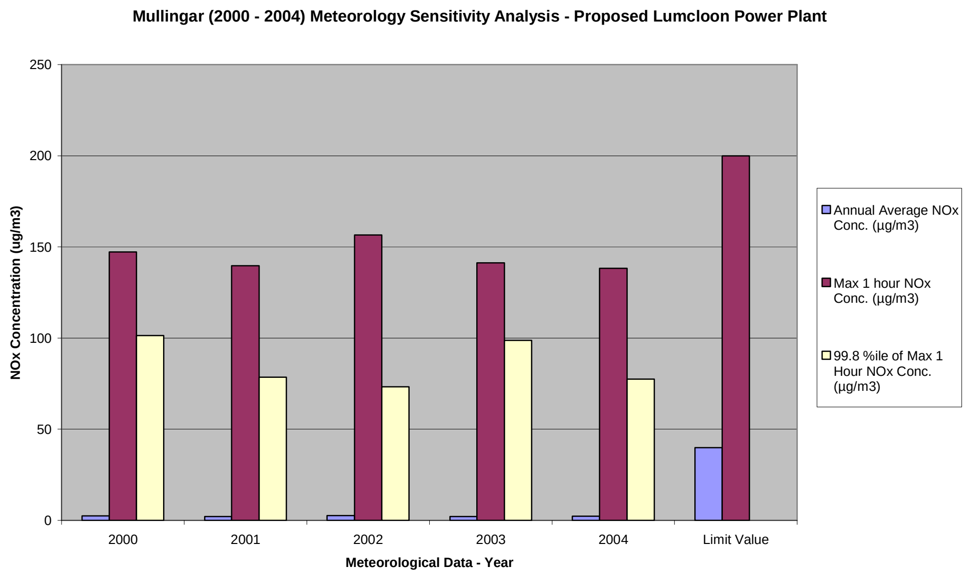
CCGT – Distillate oil = combined cycle using distillate oil

OCGT – Gas = open cycle (by-pass of HRSG) using natural gas

Meteorological Data: Five years of hourly sequential meteorological data (Mullingar – 2000 to 2004) was used in the air dispersion modelling assessment. The Mullingar meteorological station is located approximately 45km to the North East of the Lumcloon Power Plant site. This meteorological data is appropriate for use in the dispersion modelling assessment as it is representative of conditions in central Ireland and appropriate to assess the potential impact of the proposed Lumcloon Power Plant. A meteorological data sensitivity analysis of the meteorological data (Mullingar – 2000 to 2004) was carried out. This involved a preliminary run of the model using each year of Met. Data from 2000 to 2004 in order to determine the year of meteorological data, which gives rise to the worst-case ground level concentration predictions. In terms of worst-case ground level concentration predictions, meteorological data from 2002 was found to predict worst-case ground level concentrations. This allowed for the determination of the predicted worst-case long term (annual average) and short term (1-hour, 8-hour and 24-hour) impacts of emissions from the Lumcloon Power Plant.

Table I.1.16 Meteorology Sensitivity Analysis for the proposed Lumcloon Power Plant, based on maximum predicted ground level NOx concentrations and a 43m stack height based on CCGT only – Gas

Meteorology Data – Year	Annual Average NOx Conc. (µg/m3)	Max 1 hour NOx Conc. (µg/m3)	99.8 %ile of Max 1 Hour NOx Conc. (µg/m3)
2000	2.47	147.19	101.38
2001	2.21	139.71	78.47
2002	**2.67**	**156.55**	**73.32**
2003	2.09	141.26	98.86
2004	2.31	138.25	77.56
Limit Value	40	200	

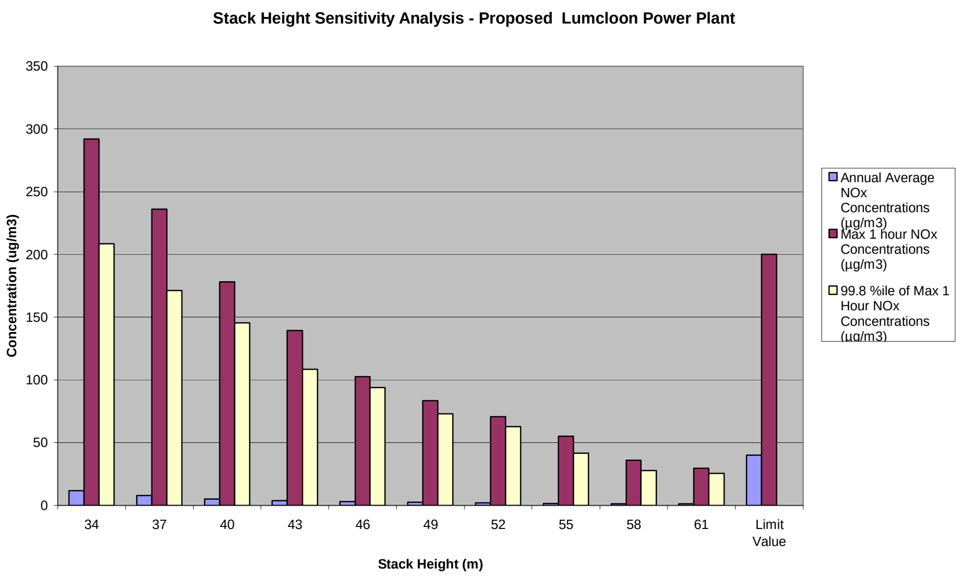


Stack Height Sensitivity Analysis

A stack height sensitivity analysis was determined for the proposed CCGT stacks. Stack heights in the range of 34m, 37m, 40m, 43m, 46m, 49m, 52m, 55m, 58m and 61m were modelled as part of this sensitivity analysis. This established that the stack height of a minimum stack height of 49 metres was sufficient to allow for appropriate dispersion of stack emissions from the site. This stack height was subsequently used to calculate the predicted worst-case long term (annual average) and short term (1-hour, 8-hour and 24-hour) impacts of emissions from the Lumcloon Power Plant.

Table I.1.17 Stack Height Sensitivity Analysis for the proposed Lumcloon Power Plant CCGT Stacks, based on maximum predicted ground level NOx concentrations – based on CCGT only – Gas

Height (metres)	Annual Average NOx Concentrations (µg/m3)	Max 1 hour NOx Concentrations (µg/m3)	99.8 %ile of Max 1 Hour NOx Concentrations (µg/m3)
34	11.82	292.05	208.53
37	8.01	235.90	171.17
40	5.04	178.06	145.34
43	3.71	139.2	108.51
46	3.13	102.68	93.84
49	**2.52**	**83.39**	**72.96**
52	1.96	70.70	62.86
55	1.54	55.16	41.55
58	1.27	35.85	27.71
61	1.11	29.63	25.56
Limit Value	40	200	



Building Downwash Effects: Buildings can affect the local mechanical turbulence around the point of release. Air moving over buildings increases in velocity and can cause downwash downwind of the source. Releases can be partly or wholly entrained into the building slip-stream leading to occasional elevated local ground level concentrations when wind direction increases the influence of nearby buildings on dispersion of the plume. Due to this fact, stack heights as well as building dimensions, shape and orientations have been incorporated into the model. These building dimensions have been extracted from drawings provided by the project architects.

Surface Roughness: The surface roughness conditions in the vicinity of the site have been adjusted for rural surroundings.

Receptors & Cartesian Grids: The *AERMOD* model calculates ground level pollutant concentrations at receptor points in the vicinity of the stack. Ground level pollutant concentrations were predicted at the nearest residential properties in proximity to the proposed development site. Ground level pollutant concentrations were predicted at every node on two Cartesian grids as follows;

- Large Cartesian grid – 12,800m x 13,000m area @ 200m intervals (SW Coordinates – 206850, 213250).
- Small Cartesian grid – 3,000m x 3,000m area @ 50m intervals (SW Coordinates – 212250, 218250).

NOx to NO_2 Chemistry: During the combustion processes, a mixture of both nitric oxide (NO) and nitrogen dioxide (NO_2) (termed NOx) is released and once released a series of complex chemical reactions takes place over time periods varying from seconds to days during which a portion of the nitrogen oxide is converted to nitrogen dioxide. Detailed modelling of NO_2/NOx chemistry has been carried out using the PVMRM method in AERMOD.

The volume fraction of NO_2 in the exhaust gas is typically assumed to be between 5 – 10%. In terms of atmospheric chemistry, NO reacts with ozone (O_3) to form NO_2 and O_2:

(1) $NO + O_3 \rightarrow NO_2 + O_2$

Additional reactions can occur to reform NO and O_3 from the reaction of NO_2 with sunlight:

(2) $NO_2 + h\nu \rightarrow NO + O$
(3) $O + O_2 \rightarrow O_3$

The Plume Volume Molar Ratio Method (PVMRM), assumes that the amount of NO converted to NO_2 via reaction (1) is proportional to the ambient ozone concentration. Where the ozone concentration is greater than NO, full conversion to NO_2 is assumed. Reactions (2) and (3) are ignored and it is assumed that initially 10% of the plume is NO_2. The PVMRM additionally uses both plume size and O_3 concentration to derive the amount of O_3 available for the reaction between NO and O_3.

NOx moles are determined by emission rate and travel time through the plume segment. The number of O_3 moles is determined by the size of the plume segment and the background ambient O_3 concentration. For a given NOx emission rate and ambient ozone concentration, the NO_2/NOx conversion ratio is primarily controlled by the volume of the plume. The current default options in AERMOD-PVMRM are:

- for background ozone, a single representative value or hour-by-hour data from a representative monitoring station can be used; in this case WYG has used a background O_3 concentration of 50 µg/m^3 based on ozone monitoring at Emo Court.
- NO_2/NOx equilibrium ratio = 0.90;
- NO_2/NOx in-stack ratio = 0.10.

Time Averaging and Percentiles: The time averaging and percentiles have been calculated in terms of the pollutant concentration limit values criteria detailed in the air quality standards. The averaging times for NO_2, SO_x and CO were selected in terms of the relevant air quality standards.

The predicted output concentrations from the AERMOD model have been reported below. Combustion of fossil fuels, such as natural gas, produces various forms of nitrogen oxides (NOx). The combustion of natural gas in a gas turbine results in approximately 90 – 95% of the NOx in the form of NO, with most of the remainder being NO_2. In relation to NO_2 emissions from the stacks it has been assumed that due to the limited availability of oxidants and sunlight, a 50%

conversion of NO to NO_2 has been considered for the maximum 1 hour averaging periods. Total conversion of all NOx to NO_2 has been used for the estimation of the annual mean NO_2 concentrations to determine the maximum NO_2 formation, based on the assumption that all NO emitted is converted to NO_2. NO_2 emissions were calculated as a 99.8th percentile of max 1-hour average and as an annual average as these represent the time averaged limit values specified for NO_2 in the relevant air quality standards. CO emissions were calculated as a running 8-hour average as this represents the averaged limit value specified for CO in the relevant air quality standards. SO_2 emissions were calculated as a 99.7th percentile of max 1-hour average, as a 99.2th percentile of max 24 hour averages and as an annual average as these represent the time averaged limit values specified for SO_2 in the relevant air quality standards. PM10 has been calculated as a 90.4th percentile of max 24-hour average. Where appropriate, the time averaging and percentiles have been calculated in terms of the pollutant concentration limit values criteria detailed in Tables I.1.1-7.

I.1.E Assessment of Impacts of Proposed Emissions

The approach to the assessment of the potential impact on ambient air quality of the emissions from the stacks has involved the following:

- Quantification of the local Ambient Concentration (AC) from consideration of EPA monitoring data and local air quality monitoring data, as outlined in Section 3 above. The background Ambient Concentration (AC) selected for presentation of the results is based on results of the EPA Air Quality Data Ferbane, Co. Offaly (4^{th} October 2006 – 29^{th} March 2007) – See Table I.1.14.
- Quantitative assessment of the operational emissions on local air quality from the stacks utilising the AERMOD dispersion model and a quantification of the Process Contributions (PC) from the proposed power plant.
- Assessment of the resultant Predicted Environmental Concentrations (PEC) taking into account cumulative effects through addition of the Ambient Concentration (AC) and the Process Contributions (PC) from the proposed power plant.

In order to obtain the predicted annual average Predicted Environmental Concentrations (PEC), annual average background concentration levels from the Ferbane, Co. Offaly Air Quality Monitoring Station were added directly to the process concentration.

As outlined by The UK Environment Agency, the short-term maximum Predicted Environmental Concentrations (PEC) due to emissions from elevated sources cannot be combined in the same way. An estimate of the maximum combined pollutant concentration can be obtained for NO_2, SO_2 and PM_{10} as follows:

NO_2 – The 99.8^{th} percentile of total NO_2 is equal to the minimum of either a) or b) below:

a) 99.8^{th} percentile hourly background total oxidant (O_3 & NO_2) + 0.05 x (99.8^{th}%ile process contribution NO_X)
b) The maximum of either:
- 99.8^{th} percentile process contribution NO_X + 2 x (annual mean background NO_2); or
- 99.8^{th} percentile hourly background NO_2 + 2 x (annual mean process contribution NO_x).

SO_2 – The 99.7^{th} percentile of total 1-hour SO_2 is equal to the maximum of either a) or b) below:
a) 99.7^{th} percentile hourly background SO_2 + (2 x annual mean process contribution SO_2)
b) 99.7^{th} percentile hourly process contribution SO_2 + (2 x annual mean background contribution SO_2)

The 99.2th percentile of total 24-hour SO_2 is equal to the maximum of either a) or b) below:

a) 99.2th percentile of 24-hour mean background SO_2 + (2 x annual mean process contribution SO_2)

b) 99.2th percentile 24-hour mean process contribution SO_2 + (2 x annual mean background contribution SO_2).

PM_{10} – The 90.4^{th} percentile of total 24-hour mean PM_{10} is equal to the maximum of either a) or b) below:

a) 90.4^{th} percentile of 24-hour mean background PM_{10} + annual mean process contribution PM_{10}

b) 90.4^{th} percentile 24-hour mean process contribution PM_{10} + annual mean background PM_{10}

I.1.E.(a) Summary of Pollutant Emissions:

The proposed power plant will release combustion gases through the burning of natural gas, which will give rise to emissions of nitrogen oxides (NOx), carbon monoxide (CO) and very low quantities of sulphur dioxide and particulates (PM_{10}) when run on natural gas, which will be the predominantly used fuel. As stated above, during periods of interrupted gas supply or during plant testing, the plant will be fired on back-up distillate oil. The combustion of distillate oil will give rise to emissions of nitrogen oxides (NOx), carbon monoxide (CO), sulphur dioxide and particulates (PM_{10}). The sulphur content of distillate oil (limited to 0.1% by mass) will lead to emissions of sulphur dioxide (SO_2) and there will also be higher emissions of particulates (PM_{10}) when run on distillate oil as compared to operation on natural gas. As stated above, distillate oil will be used in the event that natural gas is unavailable. Operation on distillate oil is not expected to exceed 10 days per year.

For the purposes of this air quality impact assessment, all of the emissions have been assessed based on the emission limit concentration values from each proposed stack as outlined in the Industrial Emissions Directive. Therefore, this is a worst case assessment as it unlikely that the emission stacks will emit pollutants at or above the emission limit concentration values.

The proposed power plant will also result in high levels of carbon dioxide (CO_2) emissions. However, CO_2 does not affect human health except in extremely high concentrations and therefore, emissions of CO_2 are not relevant for local air quality impact assessment and are not considered further through dispersion modelling. CO_2 emissions from the proposed plant are dealt with in further detail in Chapter 12.

The assessment of the potential impact of emissions on ambient air quality from the proposed power plant has been completed for the following scenarios:

Scenario 1 Combined cycle (turbine and HRSG) using natural gas (CCGT – Gas);
Most likely operating scenario. The average running time for the CCGT unit will be in excess of 6,000 hours per year. However, this unit will operate up to 24 hours a day for certain periods, as dispatched by the Transmission System Operator, depending on demand, wind generation and alternative generating capacity available on the grid.

Scenario 2 Combined cycle using distillate oil (CCGT – Distillate oil);
Very irregular operating scenario, not expected to exceed 10 days per year.

Scenario 3 Open cycle (by-pass of HRSG) using natural gas (OCGT – Gas).
It is expected that the OCGT unit will have a much lower load factor, with annual running of *c.* 500 hours per annum. It will typically operate during the morning peak (06:00 – 09:00) and during the evening peak (17:00 – 19:00).

The Predicted Maximum Ground Level Concentrations (µg/m^3) results of the air dispersion modelling assessment presented in Tables I.1.18 – I.1.20 and in Figures 1 – 11. These are the highest predicted concentrations in the vicinity of the proposed power plant. The actual predicted concentrations at all of the sensitive receptor locations, i.e. the nearby residential properties, are significantly lower than those concentrations reported in Tables I.1.18 – I.1.20 as can be seen by the concentration isopleths as presented in Figures 1 – 11.

Scenario 1 – Combined cycle (turbine and HRSG) using natural gas (CCGT – Gas)

Table I.1.18 Scenario 1: Combined cycle (turbine and HRSG) using natural gas (CCGT – Gas)

Combined cycle (turbine and HRSG) using natural gas (CCGT – Gas); Predicted Nitrogen Dioxide (NO2), Carbon Monoxide (CO), particulates (PM10) and Sulphur Dioxide (SO2) maximum ground level concentrations

Pollutant	Period Average	Ambient Concentration (AC) (µg/m^3) Note 1	Predicted Maximum Ground Level Concentration (µg/m^3) – Process Contributions (PC)	Predicted Environmental Concentrations (PEC) (µg/m^3)	Limit Value µg/m³	Legislation Type / Description	Figure Number
Nitrogen Dioxide (NO_2)	99.8th %ile of Maximum 1 Hour Conc.	10.4	19.81	30.21	200	- Not to be exceeded more than 18 times per year (31/12/05)	1
	Annual Mean Conc.	5.2	0.94	6.14	40	- Annual Mean Limit (31/12/04)	2
Nitrogen Oxides (NO_x)	Annual Mean Conc.	13.4	2.52	15.92	30	- Annual Mean Limit (19/07/01) – Protection of ecosystems	3
Carbon Monoxide (CO)	Running 8 – Hour Mean	2000	147.39	2147.39	10,000	- Running 8 – Hour Mean (31/12/03)	4
Sulphur Dioxide (SO_2)	99.7th %ile of Maximum 1 Hour Conc.	6.4	47.8	54.2	350	- Not to be exceeded more than 24 times per year (31/12/04)	5
	99.2th %ile of Maximum 24 Hour Conc.	6.4	17.92	24.32	125	- Not to be exceeded more than 3 times per year (31/12/04)	6
	Annual Mean Conc.	3.2	1.77	4.97	20	- Annual Mean Limit (31/12/00) – Protection of ecosystems	7
Particulates (PM_{10})	90.4th %ile of Maximum 24 Hour Conc.	18.7	0.82	19.52	50	- Not to be exceeded more than 35 times per year (31/12/04)	8
	Annual Mean Conc.	18.7	0.25	18.95	40	- Annual Mean Limit (31/12/04)	9

Note 1: Ambient Concentration (AC) based on the EPA Air Quality Data Ferbane, Co. Offaly (4th October 2006 – 29th March 2007)

I.1.E.(b) Scenario 1: Discussion of Results

Nitrogen Dioxide (NO_2)

The NO_2 modelling results indicate that the maximum short term and annual mean ambient ground level concentrations are below the relevant air quality standards assuming the use of natural gas for a full year. NO2 emissions equate to a process contribution of ambient NO2 concentrations which are approximately 10% of the maximum ambient 1-hour limit value, as a 99.8th %ile. The process contribution of ambient Annual Mean NO2 concentrations, of 0.94 µg/m3, is ~ 2.4% of the annual mean limit value. When background concentrations are included as appropriate, the Predicted Environmental Concentrations (PEC) values rise to ~15% of the maximum ambient 1-hour limit value and ~15% of the annual limit value. At the nearest residential receptor location, in terms of increased 1-Hour NO2 emissions, the proposed development will result in a moderate adverse impact and in terms of increased annual mean NO2 emissions, the proposed development will result in a slight adverse impact.

Nitrogen Oxides (NOx)

Maximum ground level ambient annual mean NOx concentrations directly due to process emissions are approximately 8.4% of the annual mean limit value for the protection of vegetation. At the nearest sensitive ecological receptors, i.e. Lough Boora pNHA located approximately 3km to the south east of the site and the Grand Canal pNHA located approximately 3km to the north of the site, the ambient annual mean NOx concentrations directly due to process emissions are <1% of the annual mean limit value. At the Moyclare Bog and Ferbane Bog Special Areas of Conservation (SAC) located approximately 7km to the north east of the proposed development site the ambient annual mean NOx concentrations directly due to process emissions will be insignificant. At the nearest sensitive ecological receptors, in terms of increased NO_x emissions, the proposed development will result in a negligible impact.

Carbon Monoxide (CO)

Maximum ground level ambient Running 8 – Hour Mean CO concentrations directly due to process emissions are predicted to be approximately 1.5% of the relevant limit value. At the nearest residential receptor location, in terms of increased CO emissions, the proposed development will result in a negligible impact.

Sulphur Dioxide (SO_2)

SO_2 emissions from the combustion of natural gas are insignificant. When modelled at the emission limit values as outlined in the Industrial Emissions Directive, SO_2 emissions equate to a process contribution of ambient SO_2 concentrations which are approximately 13.5% of the maximum ambient 1-hour limit value, as a 99.7th %ile and approximately 14% of the maximum ambient 24-hour limit value, as a 99.2th %ile. The process contribution of ambient Annual Mean SO_2 concentrations, of 1.77 µg/m^3, is approximately 9% of the annual mean limit value.

At the nearest sensitive ecological receptors, i.e. Lough Boora pNHA located approximately 3km to the south east of the site and the Grand Canal pNHA located approximately 3km to the north of the site, the ambient annual mean SO_2 concentrations directly due to process emissions are <1% of the annual mean limit value. At the Moyclare Bog and Ferbane Bog Special Areas of Conservation (SAC) located approximately 7km to the north east of the proposed development site the ambient annual mean SO_2 concentrations directly due to process emissions will be insignificant.

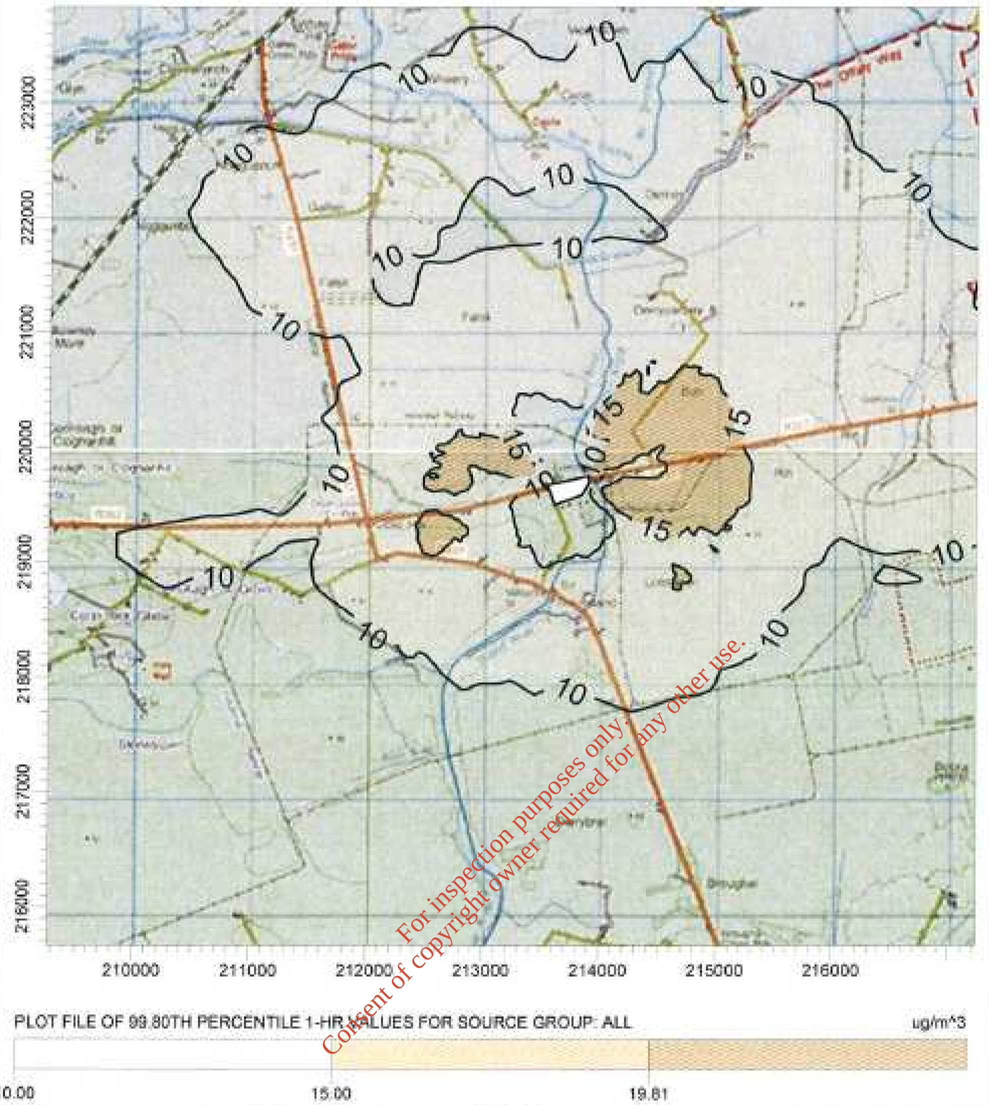
At the nearest residential receptor and sensitive ecological receptors, in terms of increased SO_2 emissions, the proposed development will result in a negligible impact.

Particulates (PM_{10})

The PM_{10} modelling results indicate that the maximum short term and annual mean ambient ground level concentrations are below the relevant air quality standards when using natural gas for a full year. PM_{10} emissions equate to a process contribution of ambient PM_{10} concentrations which are approximately 2% of the maximum ambient 24-hour limit value, as a 90.4th %ile. The process contribution of ambient Annual Mean PM_{10} concentrations, of 0.25 µg/m^3, is <1% of the annual mean limit value. When background concentrations are included as appropriate, the Predicted Environmental Concentrations (PEC) values rise to approximately 40% of the maximum ambient 1-hour limit value and 47.5% of the annual limit value. At the nearest residential receptor location, in terms of increased PM_{10} emissions, the proposed development will result in a negligible impact.

PROJECT TITLE:

Figure 1: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). 99.8th %ile of Maximum 1 Hour NO2 Concentrations. (Limit value = 200 µg/m3). Process Contributions Only.



COMMENTS:	SOURCES:	COMPANY NAME:	
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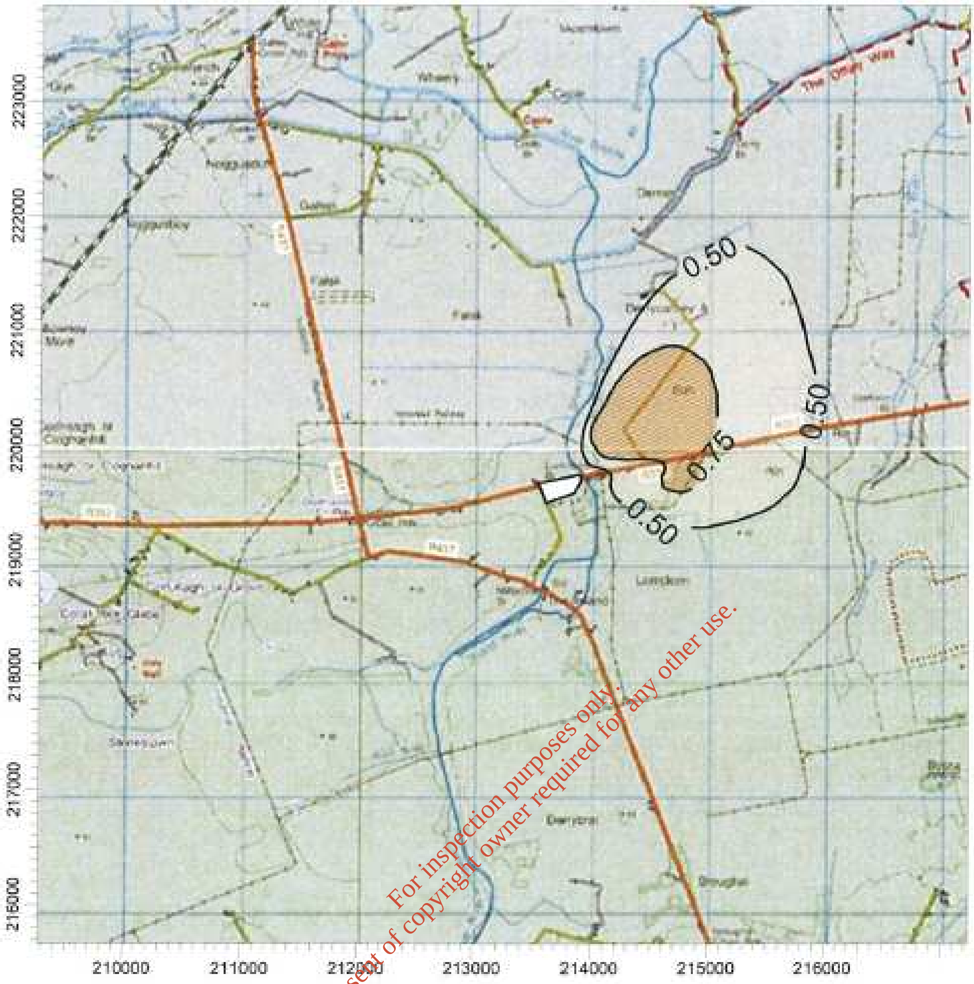
	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 (0 — 1 km)	
	MAX: 19.81362 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software

PROJECT TITLE:

Figure 2: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). Annual Mean NO2 Concentrations. (Limit value = 40 µg/m3). Process Contributions Only.



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL ug/m^3

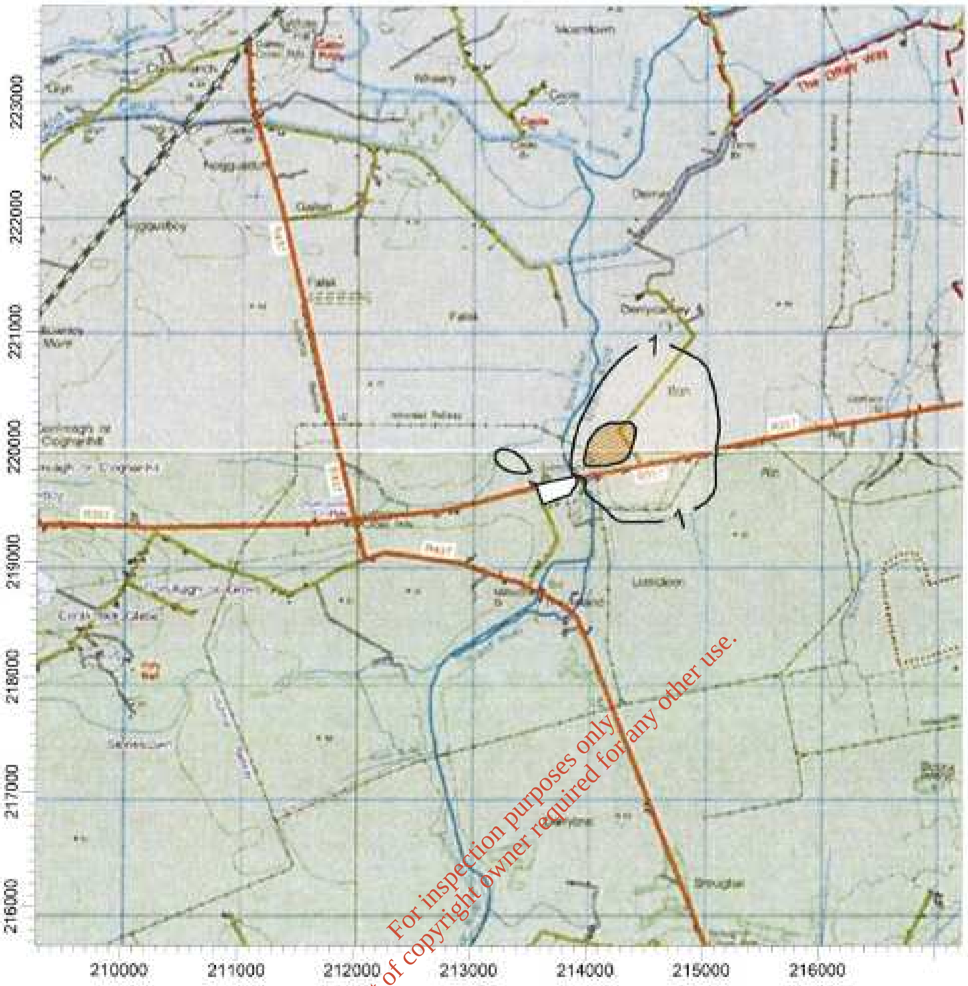
0.50 0.75 0.94

COMMENTS:	SOURCES: 8	COMPANY NAME: WYG (Ireland) Ltd.
	RECEPTORS: 8031	MODELER: M Keegan
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 (0 — 1 km)
	MAX: 0.94326 ug/m^3	PROJECT NO.:

AERMOD View - Lakes Environmental Software F:\Air Dispersion Modelling Files\Lumcloon\PPC\CCGT Only (G)\NO2.isc

PROJECT TITLE:

Figure 3: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). Annual Mean NOx Concentrations. (Limit value = 30 µg/m3). Process Contributions Only.



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL

ug/m^3

1.00 2.00 2.52

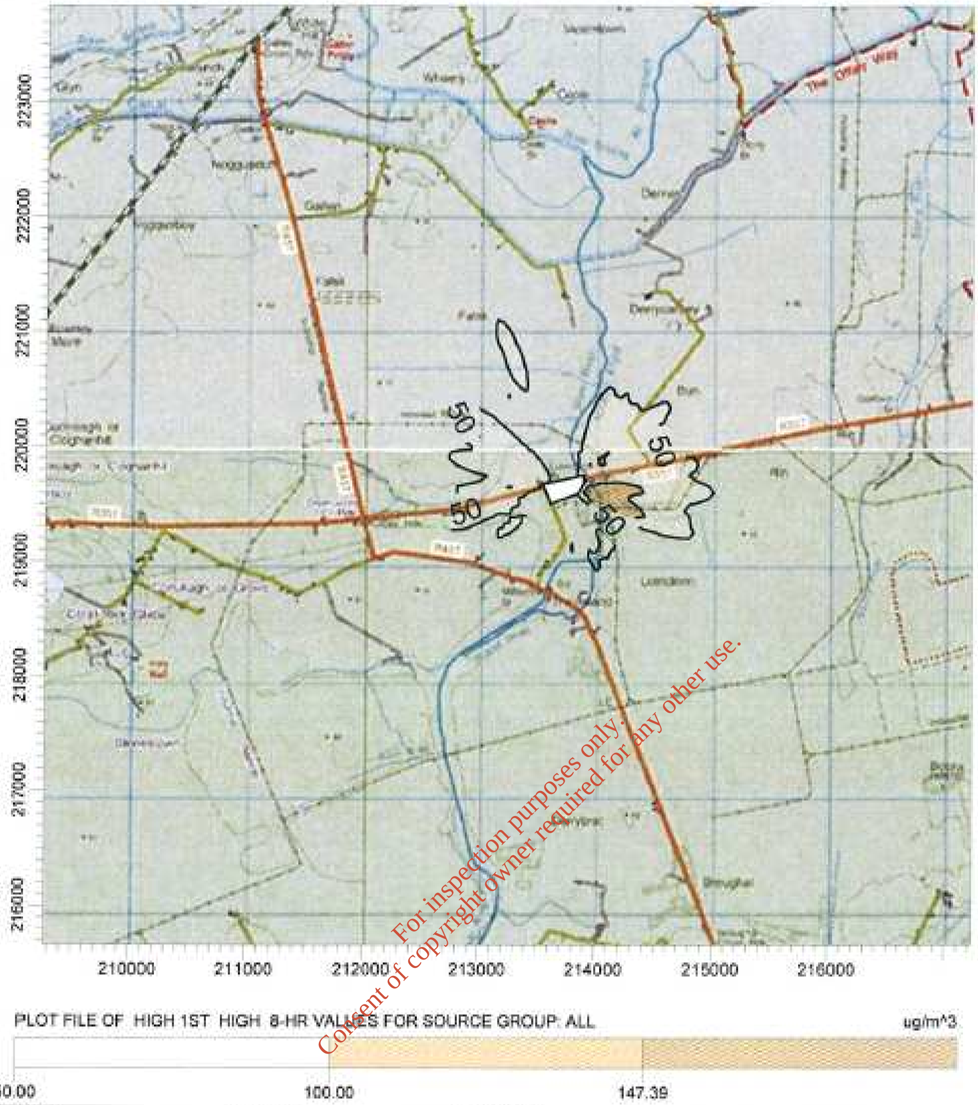
COMMENTS:	SOURCES:	COMPANY NAME:	
	8	WYG (Ireland) Ltd.	
	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:60,000 (0 — 1 km)	
	MAX: 2.52295 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software

F:\Air Dispersion Modelling Files\Lumcloon\IPPC\CCGT Only (G)\NOx.isc

PROJECT TITLE:

Figure 4: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). Running 8 - Hour Mean CO Concentrations. (Limit value = 10,000 µg/m3). Process Contributions Only.



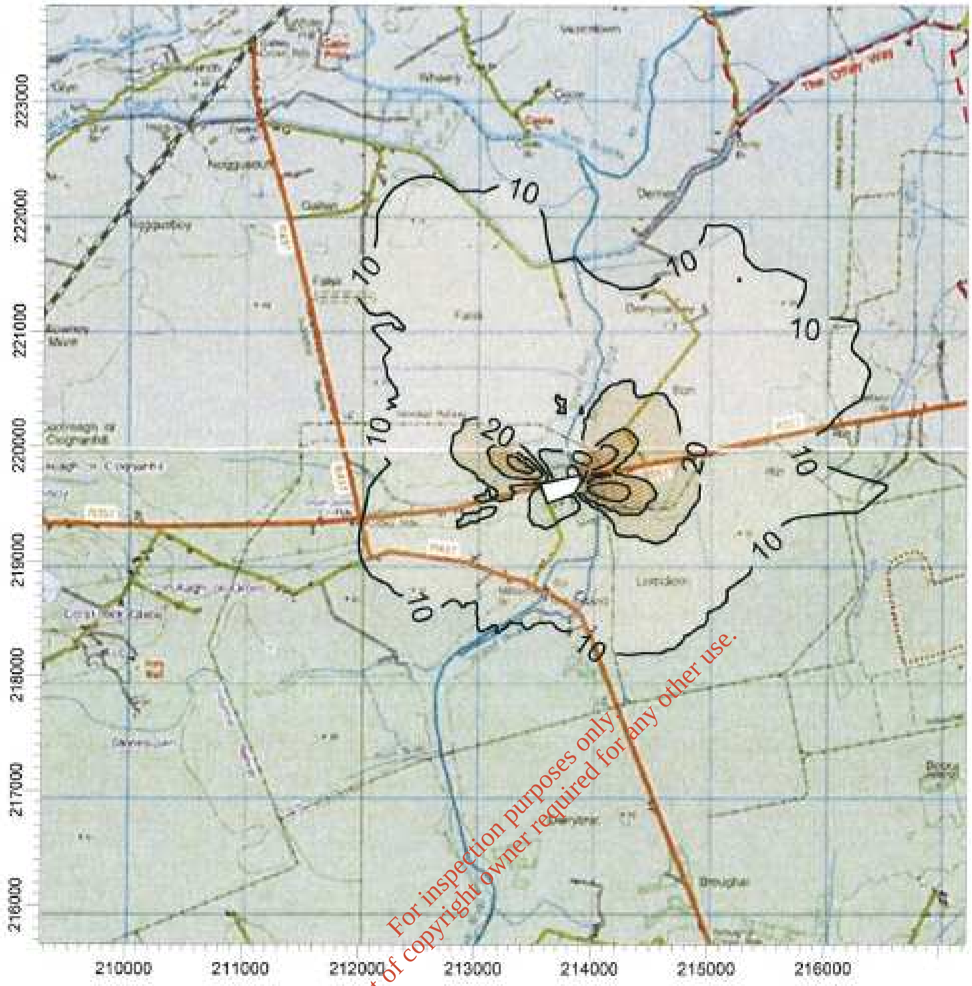
COMMENTS:	SOURCES: **8**	COMPANY NAME: **WYG (Ireland) Ltd.**	
	RECEPTORS: **8031**	MODELER: **M Keegan**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:50,000 0 — 1 km	
	MAX: **147.39089 ug/m^3**		PROJECT NO.:

AERMOD View - Lakes Environmental Software

F:\Air Dispersion Modelling Files\Lumcloon\PPD\CCGT Only (G)\CO.isc

PROJECT TITLE:

Figure 5: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). 99.7th %ile of Maximum 1 Hour SO2 Concentrations. (Limit value = 350 µg/m3). Process Contributions Only.



PLOT FILE OF 99.70TH PERCENTILE 1-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

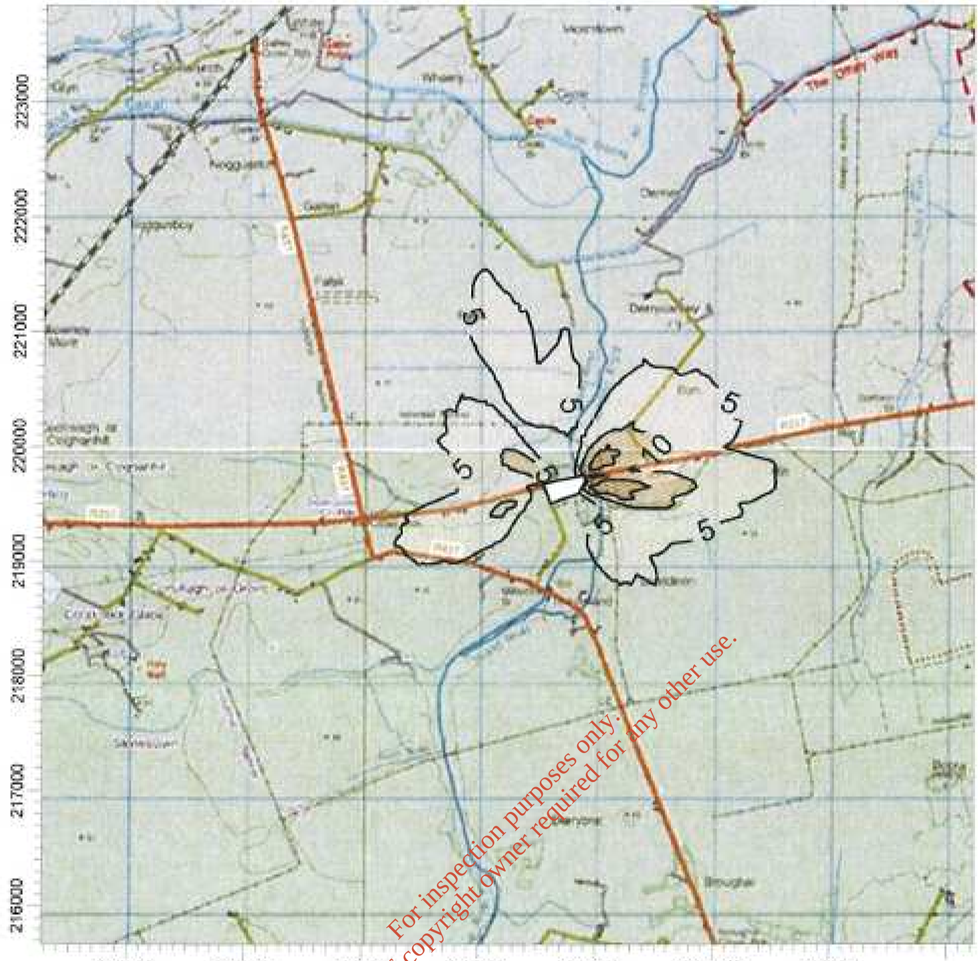
10.00 20.00 30.00 40.00 47.81

COMMENTS:	SOURCES: 8	COMPANY NAME: WYG (Ireland) Ltd.	
	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 (0 — 1 km)	
	MAX: 47.80688 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software F:\Air Dispersion Modelling Files\Lumcloon\PPC\CCGT Only (G)\SO.isc

PROJECT TITLE:

Figure 6: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). 99.2th %ile of Maximum 24 Hour SO2 Concentrations. (Limit value = 125 µg/m3). Process Contributions Only.



PLOT FILE OF 99.20TH PERCENTILE 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

5.00 10.00 15.00 17.92

COMMENTS:	SOURCES:	COMPANY NAME:	
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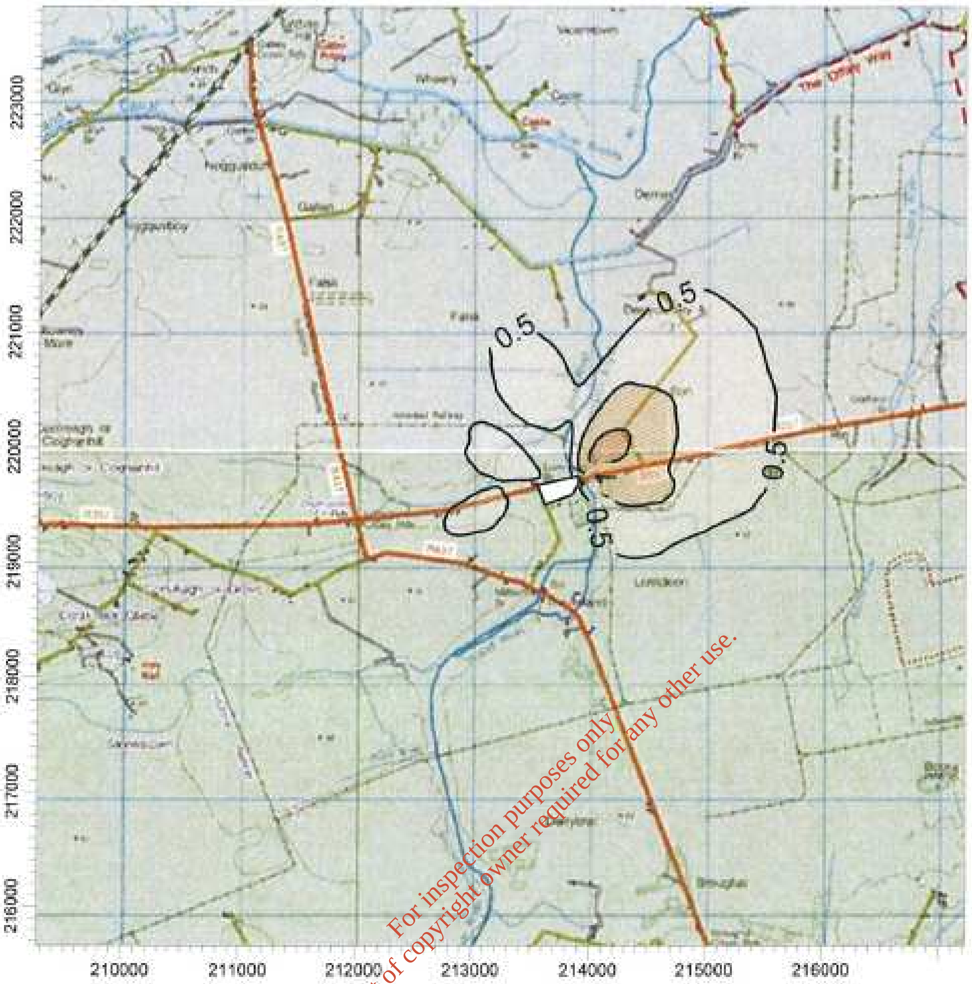
	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 (0 — 1 km)	
	MAX: 17.92256 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software

F:\Air Dispersion Modelling Files\Lumcloon\PPD\CCGT Only (S)\SO2.isc

PROJECT TITLE:

Figure 7: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). Annual Mean SO_2 Concentrations. (Limit value = 20 µg/m3). Process Contributions Only.



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL ug/m^3

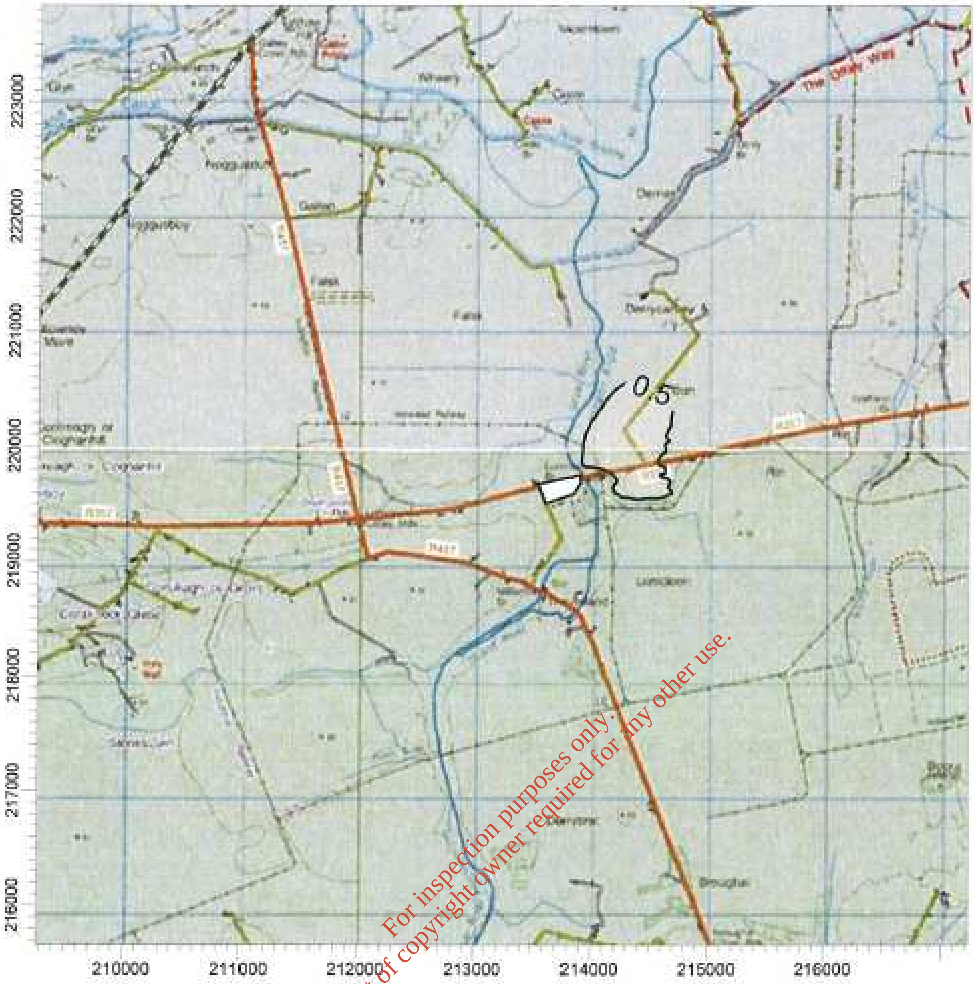
0.50 1.00 1.50 1.77

COMMENTS:	SOURCES: 8	COMPANY NAME: WYG (Ireland) Ltd.	
	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 0 — 1 km	
	MAX: 1.76669 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software F:\Air Dispersion Modelling Files\Lumcloon\IPPC\CCGT Only (G)\SO.isc

PROJECT TITLE

Figure 8: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). 90.4th %ile of Maximum 24 Hour PM10 Concentrations. (Limit value = 50 µg/m3). Process Contributions Only.



PLOT FILE OF 90.40TH PERCENTILE 24-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

0.50 0.82

COMMENTS:	SOURCES:	COMPANY NAME:	
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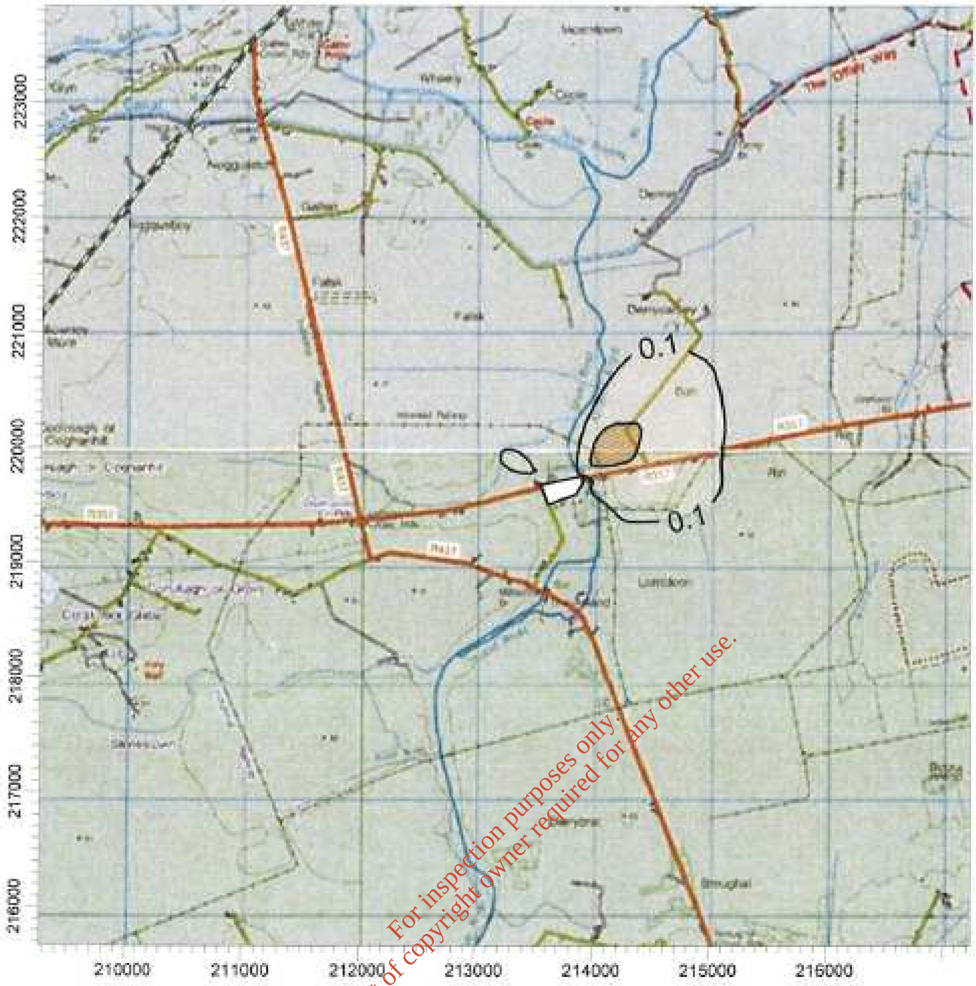
	MAX: 0.82023 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software F:\Air Dispersion Modelling Files\Lumcloon\PPC\CCGT Only (0)\PM10.isc

PROJECT TITLE:

Figure 9: Lumcloon Gas-fired Power Plant. Scenario 1 - Combined cycle (turbine and HRSG) - natural gas (CCGT). Annual Mean PM10 Concentrations. (Limit value = 40 µg/m3). Process Contributions Only.



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL ug/m^3

0.10 0.20 0.25

COMMENTS:	SOURCES:	COMPANY NAME:	
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	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 (0 — 1 km)	
	MAX: 0.25104 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software F:\Air Dispersion Modeling Files\Lumcloon\PPC\CCGT Only d\PM10.isc

Table I.1.19: Scenario 2: Combined cycle using distillate oil (CCGT – Distillate oil)

Predicted Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Particulates (PM_{10}) and Sulphur Dioxide (SO_2) maximum ground level concentrations.

Pollutant	Period Average	Ambient Concentration (AC) (μg/m^3) Note 1	Predicted Maximum Ground Level Concentration (μg/m^3) – Process Contributions (PC)	Predicted Environmental Concentrations (PEC) (μg/m^3)	Limit Value μg/m³	Legislation Type / Description
Nitrogen Dioxide (NO_2)	99.8th %ile of Maximum 1 Hour Conc.	10.4	35.09	45.49	200	- Not to be exceeded more than 18 times per year (31/12/05)
	Annual Mean Conc.	5.2	1.86	7.06	40	- Annual Mean Limit (31/12/04)
Nitrogen Oxides (NO_x)	Annual Mean Conc.	13.4	4.54	17.94	30	- Annual Mean Limit (19/07/01) – Protection of ecosystems
Carbon Monoxide (CO)	Running 8 – Hour Mean	2000	147.39	2147.39	10,000	- Running 8 – Hour Mean (31/12/03)
Sulphur Dioxide (SO_2)	99.7th %ile of Maximum 1 Hour Conc.	6.4	163.8	170.2	350	- Not to be exceeded more than 24 times per year (31/12/04)
	99.2th %ile of Maximum 24 Hour Conc.	6.4	61.4	67.8	125	- Not to be exceeded more than 3 times per year (31/12/04)
	Annual Mean Conc.	3.2	6.05	9.25	20	- Annual Mean Limit (31/12/00) – Protection of ecosystems
Particulates (PM_{10})	90.4th %ile of Maximum 24 Hour Conc.	18.7	4.94	23.64	50	- Not to be exceeded more than 35 times per year (31/12/04)
	Annual Mean Conc.	18.7	1.51	20.21	40	- Annual Mean Limit (31/12/04)

Note 1: Ambient Concentration (AC) based on the EPA Air Quality Data Ferbane, Co. Offaly (4th October 2006 – 29th March 2007)

I.1.E.(c) Scenario 2: Discussion of Results

As stated above, Scenario 2 – Combined cycle using distillate oil (CCGT – Distillate oil) will be a very irregular operating scenario, not expected to exceed 10 days per year. Therefore, while a comment has been made on the predicted ambient annual mean concentrations due to this scenario it is only the short – term maximum ground level concentrations which are likely to be of significance.

Nitrogen Dioxide (NO_2)

The NO_2 modelling results indicate that the maximum short term and annual mean ambient ground level concentrations are below the relevant air quality standards assuming the use of distillate oil for a full year. NO_2 emissions equate to a process contribution of ambient NO_2 concentrations which are approximately 17.5% of the maximum ambient 1-hour limit value, as a 99.8th %ile. The process contribution of ambient Annual Mean NO_2 concentrations, of 1.86 $\mu g/m^3$, is ~4.65% of the annual mean limit value. When background concentrations are included as appropriate, the Predicted Environmental Concentrations (PEC) values rise to ~23% of the maximum ambient 1-hour limit value and ~17.5% of the annual limit value. At the nearest residential receptor location, in terms of increased 1-Hour NO_2 emissions, the proposed development will result in a moderate adverse impact and in terms of increased annual mean NO_2 emissions, the proposed development will result in a slight adverse impact.

Nitrogen Oxides (NOx)

Maximum ground level ambient annual mean NOx concentrations directly due to process emissions are approximately 15% of the annual mean limit value for the protection of vegetation. At the nearest sensitive ecological receptors, i.e. Lough Boora pNHA located approximately 3km to the south east of the site and the Grand Canal pNHA located approximately 3km to the north of the site, the ambient annual mean NOx concentrations directly due to process emissions are <1% of the annual mean limit value. At the Moyclare Bog and Ferbane Bog Special Areas of Conservation (SAC) located approximately 7km to the north east of the proposed development site the ambient annual mean NOx concentrations directly due to process emissions will be insignificant. At the nearest sensitive ecological receptors, in terms of increased NO_x emissions, the proposed development will result in a negligible impact.

Carbon Monoxide (CO)

Maximum ground level ambient Running 8 – Hour Mean CO concentrations directly due to process emissions are predicted to be approximately 1.5% of the relevant limit value. At the nearest residential receptor location, in terms of increased CO emissions, the proposed development will result in a negligible impact.

Sulphur Dioxide (SO_2)

SO_2 emissions from the combustion of distillate oil are more significant than natural gas. When modelled at the emission limit values as outlined in the Industrial Emissions Directive, SO_2 emissions equate to a process contribution of ambient SO_2 concentrations which are approximately 47% of the maximum ambient 1-hour limit value, as a 99.7th %ile and approximately 49% of the maximum ambient 24-hour limit value, as a 99.2th %ile. The process contribution of ambient Annual Mean SO_2 concentrations of 6.05 μg/m^3, is approximately 30% of the annual mean limit value. At the nearest residential receptor location, in terms of increased SO_2 emissions, the proposed development will result in a slight adverse impact.

Particulates (PM_{10})

The PM_{10} modelling results indicate that the maximum short term ambient ground level concentrations are below the relevant air quality standards when using distillate oil. PM_{10} emissions equate to a process contribution of ambient PM_{10} concentrations which are approximately 10% of the maximum ambient 24-hour limit value, as a 90.4th %ile. The process contribution of ambient Annual Mean PM_{10} concentrations, of 1.51 μg/m^3, is approximately 3.75% of the annual mean limit value. When background concentrations are included as appropriate, the Predicted Environmental Concentrations (PEC) values rise to approximately 47% of the maximum ambient 1-hour limit value and 50% of the annual limit value. In terms of increased PM_{10} emissions, the proposed development will result in a negligible impact.

Table I.1.20 Scenario 3 – Open cycle (by-pass of HRSG) using natural gas (OCGT – Gas)

Predicted Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), particulates (PM_{10}) and Sulphur Dioxide (SO_2) maximum ground level concentrations.

Pollutant	Period Average	Ambient Concentration (AC) (μg/m^3) Note 1	Predicted Maximum Ground Level Concentration (μg/m^3) – Process Contributions (PC)	Predicted Environmental Concentrations (PEC) (μg/m^3)	Limit Value μg/m^3	Legislation Type / Description	Figure Number
Nitrogen Dioxide (NO_2) Note 2	99.8th %ile of Maximum 1 Hour Conc.	10.4	59.58	69.98	200	- Not to be exceeded more than 18 times per year (31/12/05)	10
	Annual Mean Conc.	5.2	2.65	7.85	40	- Annual Mean Limit (31/12/04)	-
Nitrogen Oxides (NO_x)	Annual Mean Conc.	13.4	17.27	30.67	30	- Annual Mean Limit (19/07/01) – Protection of ecosystems	-
Carbon Monoxide (CO)	Running 8 – Hour Mean	2000	776	2776	10,000	- Running 8 – Hour Mean (31/12/03)	-
Sulphur Dioxide (SO_2)	99.7th %ile of Maximum 1 Hour Conc.	6.4	247.39	253.79	350	- Not to be exceeded more than 24 times per year (31/12/04)	11
	99.2th %ile of Maximum 24 Hour Conc.	6.4	121.9	128.3	125	- Not to be exceeded more than 3 times per year (31/12/04)	-
	Annual Mean Conc.	3.2	12.09	15.29	20	- Annual Mean Limit (31/12/00) – Protection of ecosystems	-
Particulates (PM_{10})	90.4th %ile of Maximum 24 Hour Conc.	18.7	5.52	24.22	50	- Not to be exceeded more than 35 times per year (31/12/04)	-
	Annual Mean Conc.	18.7	1.73	20.43	40	- Annual Mean Limit (31/12/04)	-

Note 1: Ambient Concentration (AC) based on the EPA Air Quality Data Ferbane, Co. Offaly (4th October 2006 – 29th March 2007)

I.1.E.(d) Scenario 3:Discussion of Results:

As stated above, Scenario 3 – Open cycle (by-pass of HRSG) using natural gas (OCGT – Gas) will have a much lower load factor, with annual running of *c.* 500 hours per annum and will typically operate during the morning peak (06:00 – 09:00) and during the evening peak (17:00 – 19:00). In open cycle mode, the by-pass stacks are the emission points. It is not relevant to comment on the predicted ambient annual mean concentrations due to this scenario. Only short – term maximum ground level concentrations have been discussed below.

Nitrogen Dioxide (NO_2)

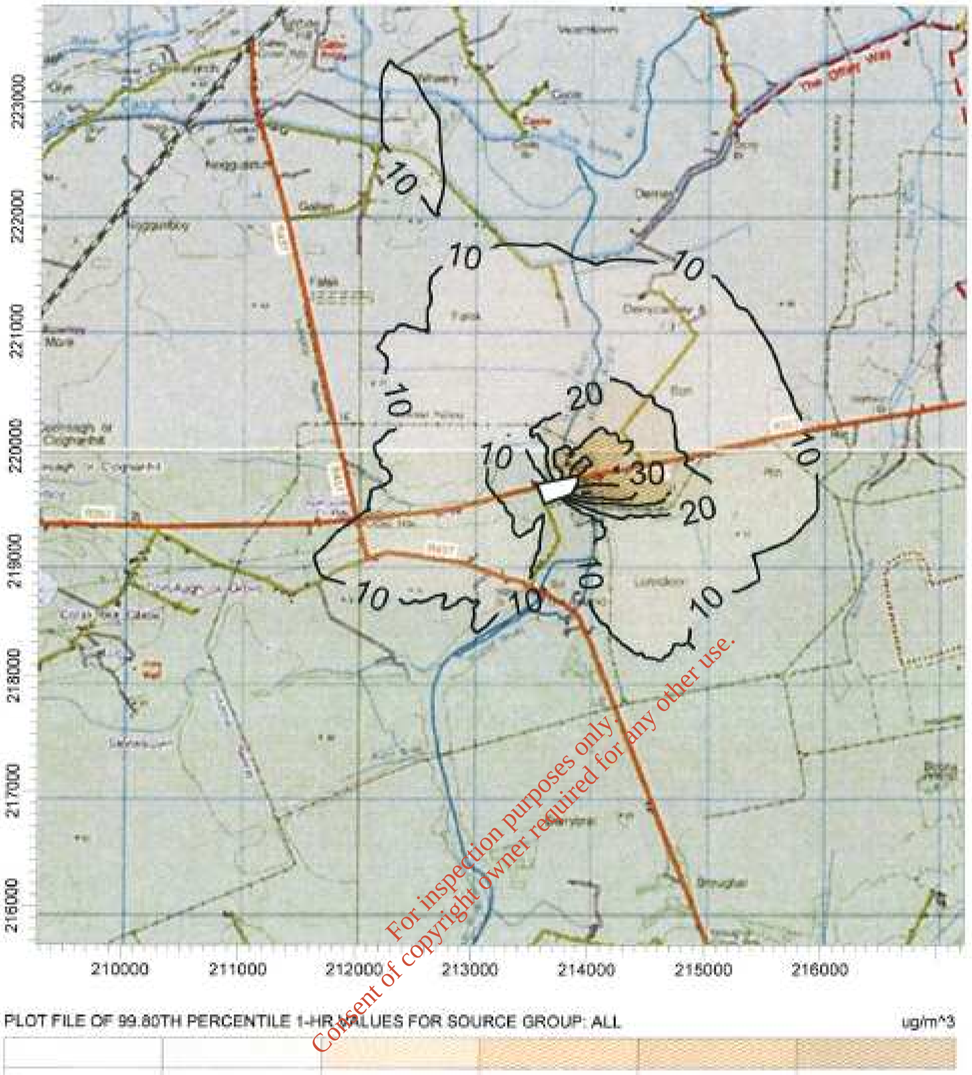
The NO_2 modelling results indicate that the maximum short term ambient ground level concentrations are below the relevant air quality standards assuming the use of the open cycle (by-pass of HRSG) using natural gas. NO_2 emissions equate to a process contribution of ambient NO_2 concentrations which are approximately 30% of the maximum ambient 1-hour limit value, as a 99.8th %ile. When background concentrations are included as appropriate, the Predicted Environmental Concentrations (PEC) values rise to ~35% of the maximum ambient 1-hour limit value. At the nearest residential receptor location, in terms of increased 1-Hour NO_2 emissions, the proposed development will result in a moderate adverse impact.

Sulphur Dioxide (SO_2)

SO_2 emissions from the open cycle (by-pass of HRSG) using natural gas, when modelled at the emission limit values as outlined in the Industrial Emissions Directive, equate to a process contribution of ambient SO_2 concentrations which are approximately 70% of the maximum ambient 1-hour limit value, as a 99.7th %ile. However, the maximum SO_2 short term ambient ground level concentrations in the vicinity of the nearest residential properties are well within the relevant air quality standards. At the nearest residential receptor location, in terms of increased SO_2 emissions, the proposed development will result in a moderate adverse impact.

PROJECT TITLE:

Figure 10: Lumcloon Gas-fired Power Plant. Scenario 3 - Open cycle (by-pass of HRSG) - natural gas (OCGT) 99.8th %ile of Maximum NO2 Concentrations. (Limit value = 200 µg/m3). Process Contributions Only.

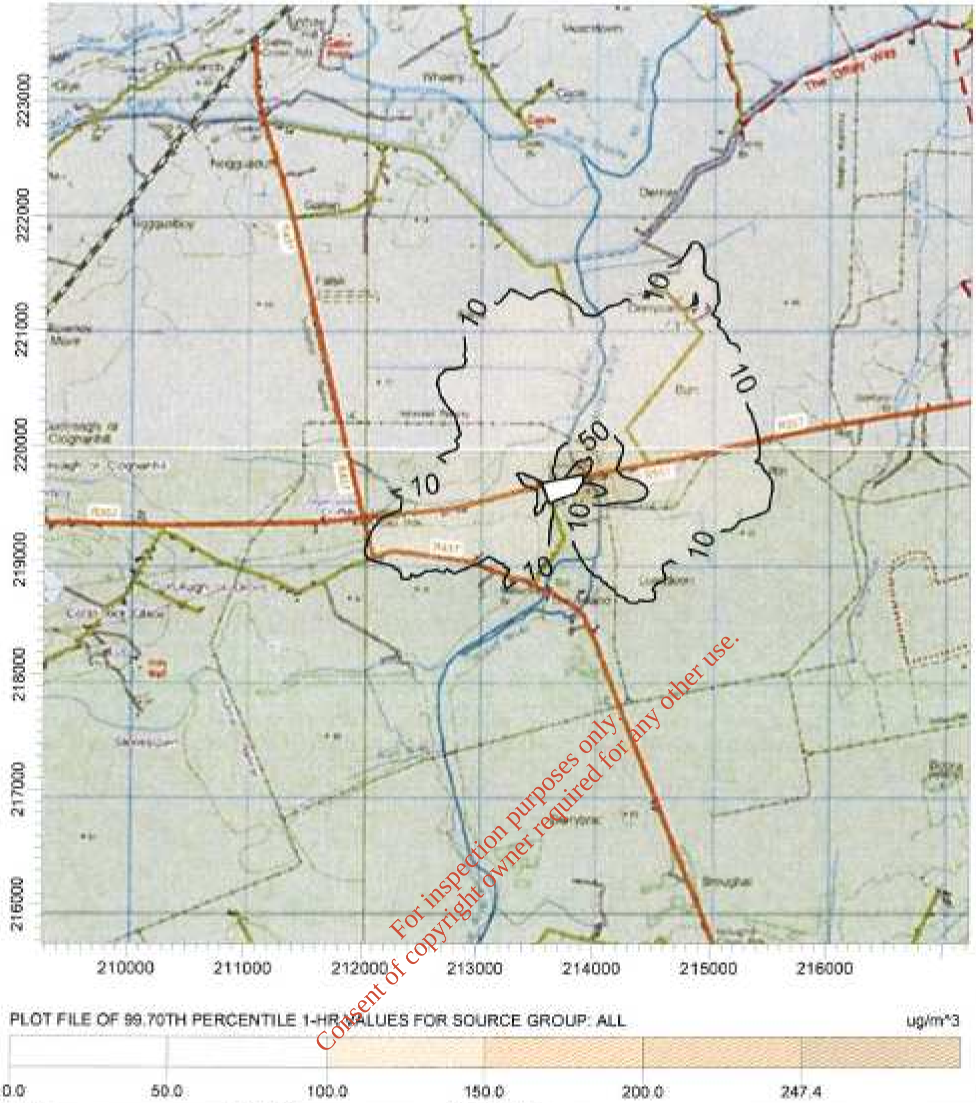


COMMENTS:	SOURCES:	COMPANY NAME:	
	8	WYG (Ireland) Ltd.	
	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 (0 — 1 km)	
	MAX: 59.58216 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software F:\Air Dispersion Modelling Files\Lumcloon\IPPC\OCGT (S)\NO2.isc

PROJECT TITLE:

Figure 11: Lumcloon Gas-fired Power Plant. Scenario 3 - Open cycle (by-pass of HRSG) - natural gas (OCGT) 99.7th %ile of Maximum 1 Hour SO2 Concentrations. (Limit value = 350 µg/m3). Process Contributions Only.



COMMENTS:	SOURCES: 8	COMPANY NAME: WYG (Ireland) Ltd.	
	RECEPTORS: 8031	MODELER: M Keegan	
	OUTPUT TYPE: Concentration	SCALE: 1:50,000 0 1 km	
	MAX: 247.3903 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software

F:\Air Dispersion Modelling Files\Lumcloon\PP\OCGT (S)\SO.isc

I.1.E.(e) Emissions from Operational Traffic

It is estimated that the proposed power plant when operational will generate approximately sixty vehicles (based on shift workers and day workers) per day with on average one HGV delivery vehicle to and from the site per week. This level of traffic volume will not generate a significant local air quality impact and greenhouse gas emissions from vehicular traffic will be negligible. The impact on background concentrations due to the additional staff and site traffic during the operation phase will lead to levels which are significantly below the ambient air quality limit values. Due to these very low projected traffic volumes the air quality impact has not been further assessed in further detail using the UK Dept. of Transport, *Design Manual for Roads and Bridges* (2007), Volume 11, Section 3, Part 1, Air Quality.

I.1.F Mitigation Measures

Lumcloon Energy Ltd. propose to fit a dry low NOx burner to the gas turbine to optimise the air / fuel ratio producing a uniform low temperature flame in the combustion chamber to minimise the production of NOx. Dry low NOx burners are recommended as Best Available Technique (BAT) for new gas turbines. The Industrial Emissions Directive provided for NOx emissions of up to 75 mg/m^3, where the overall efficiency is greater than 55%. It is proposed that this combined cycle Power Plant will have an efficiency in a range of 54% to 57%.

The Stack Height Sensitivity analysis has indicated that CCGT HRSG integral exhaust stack and OCGT bypass stack heights of 49m and 36m respectively have been proposed to ensure effective dispersion of combustion gas emissions from the proposed plant.

These emission controls will be adopted into the design of the plant to ensure that the air quality objectives set out in The Air Quality Standards are achieved in the vicinity of the proposed development and at the nearby residential receptors. The design of the plant and the incorporation of the emission controls have been considered according to the principle of Best Available Technique (BAT) and the emission limit criteria outlined in the Industrial Emissions Directive (2010/75/EU).

I.1.G Statement of Impacts of Emissions to Atmosphere

The long term impact of the proposed development on local air quality will not be significant in the future years of operation assuming that the proposed abatement equipment is maintained to a high standard.

The results of the air dispersion modelling exercise indicate that the maximum ground level concentrations (including background concentrations), for each scenario, on the basis of emission limit concentrations, do not result in an exceedence of the relevant Air Quality Standards at the nearby residential receptor locations. Operation on combined cycle (turbine and HRSG) using natural gas – results in the lowest predicted ground level concentrations in the vicinity of the plant. As detailed in Chapter two of this EIS, the plant will primarily operate in this mode. The emission limit concentration values as assessed in the air dispersion modelling assessment are based on the requirements of the Industrial Emissions Directive and Best Available Techniques (BAT).

No significant impacts on local air quality have been identified during the construction phase.

As it is predicted that emissions from the proposed plant will result in ambient concentrations at the nearby sensitive receptors within the relevant air quality limit values, there are no predicted health impacts associated with emissions from the proposed development.

I.2 ASSESSMENT OF IMPACTS OF ON RECEIVING WATERS

I.2.A Description of Existing Surface Water Quality

There are two drainage ditches on site, one of which runs along the northern site boundary and a second smaller ditch runs along the south east boundary. The ditch along the northern boundary currently takes surface run-off waters from the adjacent R357 and the ditch discharges to the Silver River via and existing settlement chamber.

The Silver River rises in the Slieve Bloom Mountains and flows in a northerly direction through Kilcormac towards Lumcloon and joins the River Brosna approximately 3km north and downstream of the Lumcloon Bridge. The Silver river is located within the Shannon International River Basin District (SIRBD). The annual discharge of the River at the site is estimated to be 2.4m³/sec. The Silver River is approximately 35km long with an average slope of 5m/km and a catchment area of 157km².

The Silver River is a nutrient rich river with elevated BOD, Suspended Solids and total ammonia as the majority of the catchment is peatland. The Silver River and the Brosna River are both "at risk of not achieving Good Status" (EPA, 2005). The main tributaries of the Silver River are classified as "possibly at risk of not achieving Good Status" (EPA, 2005).

A macroinvertebrate survey was completed on the stretch of the Silver River near the proposed development site and could be compared with a Q3-Q4 stream (Class B – slightly polluted).

The gauging station at Millbrook (25014) provides annual maximum data for flow and water level data for a period of 56 years, from 1951 to 2005. The EPA undertook a dry weather flow assessment of 250 l/s (98%-ile flow) and 500 l/s for the 95%-ile flow. Peak flows range from 11 to 27m3/s and maximum water levels at Millbrook range from 45.88 to 46.91mOD (Malin).

Offaly County Council supplied detailed water quality information and this was available in monthly intervals from 1998 up to 2007 for Monitoring Point 25S02 Silver Kilcormac, Lumcloon Bridge 0700.

Table I.2.1 SURFACE WATER QUALITY

(Sheet 1 of 2) Monitoring Point/ Grid Reference: River Code 25S02, Station Code 0100

Parameter	Results (mg/l)				Sampling method[2] (grab, drift etc.)	Normal Analytical Range[2]	Analysis method / technique
	Mean 2004	Mean 2005	Mean 2006	Mean 2007			
pH	7.65	8.05	7.924	7.65	Offaly Co. Co. Results	6.49 – 8.33	Offaly Co. Co. Results
Temperature	11.37	10.94	11.53	7.56	As Above	3.9 – 17.9	As Above
Electrical conductivity EC	561.5	583.9	608.8	539.33	As Above	209 - 698	As Above
Ammoniacal nitrogen NH_4-N	0.0802	0.09	0.0635	0.0996	As Above	0.005 – 0.261	As Above
Chemical oxygen demand	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Biochemical oxygen demand	1.659	1.676	1.411	1.633	Offaly Co. Co. Results	1 – 4.4	Offaly Co. Co. Results
Dissolved oxygen DO	91.95	90.45	91.33	87.56	As Above	82.1 – 99.9	As Above
Calcium Ca	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Cadmium Cd	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Chromium Cr	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Chloride Cl	NA	NA	NA	19.93	Not Applicable	Not Applicable	Not Applicable
Copper Cu	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Iron Fe	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Lead Pb	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Magnesium Mg	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Manganese Mn	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Mercury Hg	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable

Surface Water Quality (Sheet 2 of 2)

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range *	Analysis method / technique
	Mean 2004	Mean 2005	Mean 2006	Mean 2007			
Nickel Ni	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Potassium K	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Sodium Na	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Sulphate SO_4	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Zinc Zn	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Total alkalinity (as $CaCO_3$)	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Total organic carbon TOC	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Total oxidised nitrogen TON	3.0419	3.786	3.897	4.033	Offaly Co. Co. Results	0.9 – 5.956	Offaly Co. Co. Results
Nitrite NO_2	0.0177	0.017	0.0208	0.0253	As Above	0.006 – 0.034	As Above
Nitrate NO_3	NA	NA	NA	4.007	As Above	2.731 – 5.934	As Above
Faecal coliforms (/100mls)	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Total coliforms (/100mls)	NA	NA	NA	NA	Not Applicable	Not Applicable	Not Applicable
Phosphate PO_4	0.0112	0.009	0.0124	0.0206	Offaly Co. Co. Results	0.001 – 0.034	Offaly Co. Co. Results

* Minimum and Maximum values from 2004 – 2007
NA = Not Analysed

I.2.B Assessment of Impacts

Data from the local hydrometric station combined with physicochemical data, from Offaly County Council, was used in conjunction with indicative waste water loading figures to determine the potential impact on the Silver River in assessing its assimilative capacity discharge.

I.2.B.(a) Assimilative Capacity

An assimilative capacity assessment (ACA) was undertaken to provide precise quantifiable impacts in terms of water quality. This assessment takes account of the proposed foul water discharge, process water discharge and discharges from the adjoining site to the south and typical discharge concentrations from similar plants and the proposed plant.

Tables I.2 (ii) and I.2 (iii) present the results of the ACA. As can be identified from the table below the proposed discharge (using the maximum discharge concentrations and at a maximum discharge of 96m^3/day) will result in a low quantity of the assimilative capacity being taken up by the proposed discharge.

Table I.2.2 Assimilative Capacity Assessment of Site Discharge using 50% of 95%ile Limits, High Status SI272/2009)

	BOD	Ammonia	Phosphate
Background Concentration (mg/l)*	1.100	0.045	0.023
Propose Discharge Concentration (mg/l)	19.861	5.000	0.108
Resultant Concentration (mg/l)	1.142	0.067	0.023
% Increase over Background	4%	33%	0%
Limit (mg/l)	1.500	0.065	0.035
*1/2 of the 95% limits of High Status as advised by EPA			

Although the resultant concentration of ammonia just exceeds the limit of 0.065mg/l by 0.002mg/l (0.067mg/l), the review of treatment process shows that it is feasible to reduce the ammonia discharge to 3 mg/l. This would result in the limit not being exceeded.

Table I.2.3 Assimilative Capacity Assessment of Site Discharge using 50% of 95%ile Limits, High Status SI272/2009) – Ammonia concentration reduced to 3mg/l

	BOD	Ammonia	Phosphate
Background Concentration (mg/l)*	1.100	0.045	0.023
Propose Discharge Concentration (mg/l)	19.861	3.019	0.108
Resultant Concentration (mg/l)	1.142	0.058	0.023
% Increase over Background	4%	23%	0%
Limit (mg/l)	1.500	0.065	0.035
*1/2 of the 95% limits of High Status as advised by EPA			

Findings show that the proposed discharges are compliant in meeting the relevant water quality objectives as set out in the New Surface Water Regulations SI No 272 of 2009.

I.2.B.(b) Impact on River Water Temperature

The discharge of the process water has the potential to increase water temperature of the River. The Salmonid Regulations (S.I. No. 293 of 1988) specify that water temperature at the edge of the mixing zone is not to be increased by more than 1.5°C and that the overall water temperature should not be increase to more than 21.5°C. The potential impact of the proposed process water discharge in terms of water temperature impact has been assessed using the Dilution Model for Effluent Discharges (USEPA, 1994-2003).

The assessment was undertaken with various discharge rates and temperatures to provide an indication of the potential impact. No modelling results were retrieved for the discharge rates of 100m3/day or less and the results presented are based on 200m3/day, providing a worst case scenario. The assessment was undertaken for low flow conditions of the Silver River.

Results show that the acute zone ranges from 1 to 1.6m downstream from the discharge point and temperatures have completely assimilated at 160m downstream from the discharge point for all of the scenarios and that the affected area is generally less than $10m^2$.

I.2.C Flood Risk Impact

The OPW also supplied information on the Silver River from the District Drainage Scheme. The two river crossings and a typical cross section were surveyed and a simple hydraulic model was developed in order to estimate the 100 year design flood level. In order to provide a conservative design a district drainage factor, 95% confidence interval and climate change factor were also applied. Results from our hydraulic modelling showed that for the 100 year design flows, the Lumcloon Bridge and the local access bridge are surcharge. However, no flooding of the site occurs for any of the design flows investigated.

I.2.D Statement of Impact on the Silver River

The assimilative capacity assessment provides quantifiable results showing that the cumulative impact of the site would not cause a significant impact in terms of the water chemistry and that future concentrations would achieve good status. The results show that the water temperature has completely assimilated at 160m downstream from the discharge point for all scenarios and the affected area is generally less than $10m^2$.

Surface water run off from the hardstanding areas contain mild contamination and untreated waste wasters have the potential for significant organic pollution and nutrient enrichment of the River but with the implementation of oil/water interceptors these can be considered to have a negligible impact.

I.3 ASSESSMENT OF IMPACT OF SEWAGE DISCHARGE

I.3.A Details of Emissions to Sewers

There will be no emissions to sewer from the operations of the facility.

I.4 ASSESSMENT OF IMPACT OF GROUND /GROUNDWATER EMISSIONS

I.4.A Existing Groundwater Quality

The underlying aquifer of the site is a locally important aquifer and the bedrock is classified as Dinantian Pure Unbedded Limestones (DPUL) of the Waulsortian Limestone Formation. The site is situated within the Clara Groundwater Body and the current Water Framework Directive Status of the Clara is described as Good. There are no Karst features within 1km radius of the site and the nearest springs are 6.2km and 6.9km to the south of the site. The groundwater vulnerability of the site is classified as high to moderate and the groundwater flow direction is assumed to be east/northeast towards the Silver River.

Shallow groundwater has been encountered at the site <5.0metres below ground level and as such the groundwater and surface water are closely linked. Streams and rivers crossing the aquifer are generally gaining.

There is an existing groundwater abstraction well on site which was used for the previous site use. This abstraction well will be used for process water purposes for the gas fired plant. The well is greater than 50m deep. Several well owners in the area have reported elevated Iron Levels in groundwater in the area.

There are approximately 23 wells within a 1km radius. The Kilcormac Public Water Supplies and Ballyboy Group Water Scheme are located approximately 7km to the southeast. Holmshill and Agall Spring Protection areas are located approximately 13km to east and Tully source is located approximately 15km to the Southeast.

A groundwater sample was obtained from the on-site well and the concentrations of total ammonia and manganese exceeded the Drinking Water Standards and EPA IGV Limits.

A groundwater assessment was completed outside of the site boundary and found that ammoniacal nitrogen, nitrite, manganese exceeded the EPA IGV and the Drinking Water Standard. The arsenic and nickel concentrations were slightly elevated and elevated hydrocarbons were encountered at one location close to the site of the former station dump.

Table I.4(i) GROUNDWATER QUALITY

(Sheet 1 of 2) Monitoring Point/ Grid Reference: GW1

Parameter	Results (mg/l) 12/06/2009	Sampling method (composite etc.)	Normal Analytical Range	Analysis method / technique
pH	7.46	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Temperature	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Electrical conductivity EC	652 µS/cm	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Ammoniacal nitrogen NH_4-N	2.8mg/l	As Above	As Above	As Above
Dissolved oxygen DO	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Residue on evaporation (180°C)	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Calcium Ca	81.88mg/l	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Cadmium Cd	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Chromium Cr	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Chloride Cl	20.9mg/l	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Copper Cu	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Cyanide Cn, total	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Iron Fe	<20µg/l	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Lead Pb	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Magnesium Mg	17.09mg/l	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Manganese Mn	<2µg/l	As Above	As Above	As Above
Mercury Hg	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Nickel Ni	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Potassium K	3.6mg/l	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Sodium Na	24.96mg/l	As Above	As Above	As Above

Groundwater Quality (sheet 2 of 2)

Parameter	Results (mg/l) 12/06/2009	Sampling method (composite, dipper etc.)	Normal Analytical Range	Analysis method / technique
Phosphate PO_4	<0.06mg/l	As per WYG sampling Protocol	Only 1 sample taken	Standard Method
Sulphate SO_4	98.96mg/l	As Above	As Above	As Above
Zinc Zn	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Total alkalinity (as $CaCO_3$)	232mg/l	As Above	As Above	As Above
Total organic carbon TOC	3mg/l	As Above	As Above	As Above
Total oxidised nitrogen TON	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Arsenic As	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Barium Ba	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Boron B	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Fluoride F	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Phenol	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Phosphorus P	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Selenium Se	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Silver Ag	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Nitrite NO_2	0.03mg/l			
Nitrate NO_3	0.4mg/l			
Faecal coliforms (/100mls)	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Total coliforms (/100mls)	Not Analysed	Not Applicable	Not Applicable	Not Applicable
Water level (m OD)	Not available	Not Applicable	Not Applicable	Not Applicable

TABLE I.4(ii): LIST OF OWNERS/FARMERS OF LAND

Land Owner	Townlands where landspreading	Map Reference	Fertiliser P requirement for each farm
			*NMP must take account of on-farm slurry

Total P requirement of the client List **NOT APPLICABLE**

TABLE I.4(ii): LANDSPREADING

Land Owner/Farmer Not Applicable

Map Reference________________________

Field ID	Total Area (ha)	(a) Usable Area (ha)	Soil P Test Mg/l	DATE OF P TEST	Crop	P Required (kg P/ha)	Volume of On-Farm Slurry Returned (m^3/ha)	Estimated P in On-Farm Slurry (kg P/ha)	(b) Volume to be Applied (m^3/ha)	P Applied (kg P/ha)	Total Volume of imported slurry per plot (m^3)

Total volume that can be imported on to the farm: Not Applicable

Concentration of P in landspread material	- kg P/m^3
Concentration of N in landspread material	- kg N/m^3

I.4.B Details of Emissions to Ground / Groundwater

There will be no emissions to ground or groundwater from the facility.

I.4.C Impact on Groundwater

There will be no direct discharge of the process water to ground. The surface water drainage will collect runoff from roofed and paved areas and will be discharged to the stream in the north eastern corner of the site. The large external areas/compounds at the site are surfaced with stone to allow the rainwater to percolate to the underlying soils.

Although there will be no direct emissions to the groundwater from the operation of the facility there will be groundwater abstracted on site and the impact on the groundwater was assessed. The water from the well will be used for the process water in the facility and the water for domestic purposes at the facility will be taken from Leabeg-Leamore Group Scheme supplied by the Agall Spring, Holmshill and Tully sources.

The water requirement from the well will be $96m^3$/day and the abstracted water will be demineralised. Following a pumping test on the well, the groundwater well can sustain the proposed abstraction rate and indicates a transmissivity of $130m^2$. The cone of draw down from pumping the well is unlikely to impact the Silver River.

The dry weather flow (DWF) and 95%ile flow for Millbrook gauging station (approximately 1.5km upstream the Silver River at the proposed development site) is 250l/s (216,000m3/d) and is 500l/s (432,000m3/d) respectively. These figures are used for the dry weather flows for the Silver River at the proposed development site. These figures are, therefore, conservative for the Silver River at the proposed development site. The proposed abstraction rate from the on-site borehole is $96m^3$/day. This equates to 0.04% and 0.02% of the DWF and 95%ile flow respectively.

In addition process water will be discharge to the Silver River at a down stream location. Therefore any minor impacts on flow in the river will be very localised. It is anticipated that the impact of the groundwater abstraction on the flow in the River Silver will be negligible.

There is the potential for ground water contamination in the event of accidential spillage as there are lubricants, oils and greases that will require storage on site. Approximately $5,200m^3$ of diesel will require storage and therefore the site is classified as lower tier COMAH (Control of Major Accident Hazards Involving Dangerous Substances). With the implementation of the mitigation measures the impact to the groundwater is considered a slight negative.

The chemical feed area drainage consists of spillage, tank overflows, maintenance operations and area wash downs. Waste water will be contained and collected in a bund area and drainage will be manually emptied by mobile drainage pump. The effluents produced will be collected in a system of floor drains, sumps and condensate pit and goes to the WWTP via an interceptor. Therefore, nothing will be discharged to ground to cause contamination. Possibly oil contaminated surface drains will be discharged to a separate system, collected separately and routed through an oil/water separator and delivered to the plants effluent sump. Any surface water indirectly discharging to the ground will therefore be uncontaminated.

The underlying clay subsoils will reduce the potential for migration of the any contaminants to groundwater.

I.4.D Statement of Impact on the Silver River

There will be a negligible impact of groundwater abstraction on River Silver and a negligible impact on the neighbouring wells.

I.4.E Details of Landspreading of Agricultural / Non- Agricultural Waste

There will be no landspreading of agricultural / non agricultural waste associated with any waste generated at the facility.

I.5 GROUND AND /OR GROUNDWATER CONTAMINATION

I.5.A Historical Ground and Groundwater Contamination

Environmental exit audits were undertaken by the ESB between 2003 and 2008 for the former ESB owned peat powered station at Lumcloon, Ferbane, Co. Offaly. The assessments were undertaken on all lands within the boundary of the former ESB owned power site. Lumcloon Energy Ltd. only acquired part (i.e. 11 acres) of the former ESB owned power site and the gas fired powered station is to be developed on these lands.

A report on Phase 1 of the exit audit process reported that asbestos containing materials (ACM) had been detected in the station dump area (ash field) which is located 450m south east of the proposed development site. Remediation work was undertaken and the ACM removed. The Phase 1 report also indicated that the soils at the site had potentially been impacted by oil or chemical spills in the vicinity of the station site.

The Phase 2 investigations within the proposed development site found frequent low level contamination by arsenic and vanadium and less frequent low level contamination by cadmium, molybdenum and nickel. The source of the metals is thought to be a result of the presence or influence of peat ash. Localised low level lead, copper, zinc and phenol contamination was also reported which might relate to demolition waste or past station activities. Low level lead contamination was found in the vicinity of the former main station buildings in the north and central areas of the proposed development site. Low level copper and zinc contamination was found in the north and central areas of the site (former main station buildings) and in the southwest of the site (former transformer bays). Low level phenol contamination was found in the north and central areas of the site (former main station buildings) and in a few samples elsewhere on the site.

Low-level hydrocarbon contamination was found in near-surface soils in the location of the former transformer bays. These areas are located in the southwest of the proposed development site. An area of more elevated hydrocarbon contamination was identified in the electrical compound which borders the south west boundary of the proposed site. It was concluded that the hydrocarbon contamination encountered was unlikely to have an impact upon the local environment.

It was determined as part of the contamination assessment that no remedial action was required for the proposed development.

There is the potential for leaching of historic hydrocarbons to groundwater however the percolation is ongoing under natural conditions and there will be no additional impact.

I.6 ASSESSMENT OF THE ENVIRONMENTAL IMPACT OF ON-SITE WASTE DISPOSAL

There will be no on-site waste recovery or disposal.

I.7 NOISE IMPACT

This noise and vibration impact assessment evaluates and discusses the potential noise and vibration impact arising from the operation of the proposed gas-fired power plant at Lumcloon, Co. Offaly. The assessment considered the existing noise environment, the predicted noise impact, possible noise mitigation and the residual impact of the proposed power plant.

I.7.A Methodology

The methodology for the assessment and evaluation of the noise impact arising from the proposed power plant involved the following:

- Baseline Noise Survey – day and night time noise monitoring at three residential receivers in the vicinity of the proposed power plant. The purpose of the baseline noise monitoring survey was to evaluate the existing noise environment. Current noise sources and the background noise level have been evaluated during the noise survey.
- Development of a computational noise model to represent the proposed power plant and subsequently predict the noise impact at nearby residential receivers. Noise data for equipment and machinery to be used in the proposed power plant were input to the model to predict the noise levels at nearby residential receivers.
- Comparison of the predicted noise impact on residential receivers with the existing noise climate, the relevant EPA IPPC noise limits and the World Health Organisation (WHO) *Guidelines for Community Noise*. BS4142 *Method for Rating Industrial Noise affecting mixed residential and industrial areas (1997)* was also referenced.
- Recommendations for mitigation measures to minimise the noise impact on nearby sensitive receivers.
- Discussion of the residual noise impact on residential receivers after mitigation measures have been taken into account.

I.7.A.(a) Noise Monitoring Methodology

All noise measurements were conducted according to the British Standard *BS 7445 Description and Measurement of Environmental Noise* and the EPA *Environmental Noise Survey Guidance Document.* The measurements were made using a Norsonic Nor140 Sound Level Meter which is a Type 1 meter according to IEC 651. The sound level meter was orientated towards the dominant noise source during all measurements at a height of 1.5m above ground level. A wind shield was used on the microphone throughout the survey and the sound level meter was calibrated before and after the noise survey. The Time Weighting used was Fast and the Frequency Weighting was A-weighted.

The primary measurement parameter recorded was the equivalent continuous A-Weighted sound pressure level, $L_{Aeq, T}$, during the daytime and nighttime monitoring periods. A statistical analysis of the measurement results was also completed so that the percentile levels $L_{A90, T}$ was also recorded. The percentile levels recorded represent the noise level in dB(A) exceeded for 90% of the measurement time, i.e. the background noise level.

Sound pressure levels were measured and recorded in 1/3rd octave bands from 6.3Hz to 20 KHz to establish the presence of tonal noise if any at each of the three monitoring locations. All noise sources were noted, recorded and where possible, identified during the course of the survey.

I.7.A.(b) Noise Modelling Methodology

Noise predictions were made for the operational phase of the proposed power plant using Cadna_A Version 3.72 noise modelling software by DataKustik GmbH. The Cadna_A noise modelling software generates predicted noise levels for noise sensitive receivers in the vicinity of the proposed development. This noise prediction model incorporates appropriate noise calculation methodologies. The Cadna_A computational model develops a visual and mathematical representation of the predicted noise environment in the vicinity of the proposed development.

The proposed power plant was represented in the noise model and the resulting noise level at residential receivers was predicted. The most significant noise sources at the proposed power plant were input to the noise model and an appropriate sound insulation value for the proposed building elements was included. All buildings and natural screens were implemented to the model to maintain an accurate representation. The noise level was predicted at each of the three nearest residential receivers and the model was also used to identify the particular element at the plant site contributing most to the noise level at receivers.

In relation to the calibration and validation of the noise model, where a monitored and modelled noise level is within approximately +/- 3dB, the location can be deemed to be well validated in relation to monitored and modelled noise levels (i.e. a "Good" level of validation). WYG has validated the local noise climate in the noise model in terms of existing traffic noise levels versus the measured noise levels to a "Good" level of validation.

I.7.A.(c) Noise Impact Assessment Criteria

An IPPC license as issued by the Environmental Protection Agency (EPA) will be required given the power generation capacity of the proposed power plant. According to the EPA document *Guidance Note for Noise in Relation to Scheduled Activities*, 2nd Edition 2006, the following noise limits are recommended:

- Daytime (8am to 10pm) – 55dB $L_{Ar,T}$ free field
- Night time (10pm to 8am) – 45 dB $L_{Aeq,T}$ free field

These noise limits are related to the recommended noise levels as outlined in the WHO *Guidelines for Community Noise*.

To assess the noise impact from the proposed power plant, guidance from BS4142 *Method for Rating Industrial Noise affecting mixed residential and industrial areas (1997)* is taken into account. According to BS4142:

> *Apply a 5dB correction if one or more of the following features occur, or are expected to be present for new or modified noise sources:*
>
> *- the noise contains a distinguishable, discrete, continuous note (whine, hiss, screech, hum, etc.);*

The proposed power plant will produce a "hum" noise. Noise that can be described as a hum or constitute a definable note can be defined as "tonal" in character. Noise which is tonal in character is defined in ISO 1996 *Description and measurement of environmental noise (1987)* as noise where the sound pressure level in any one 1/3rd octave band is 5dB above the sound pressure levels in each adjacent 1/3rd octave band. Therefore, the noise impact from the power plant has been rated according to the guidelines set out in BS4142 and as such, a 5dB correction has been added to the predicted noise level due to the power plant at each of the three residential receivers. This level is deemed the Rated Noise Level, $L_{Ar,T}$ and has been compared directly to the EPA defined limits as outlined above.

The likely future perceived impact of change in noise level at the noise sensitive properties adjacent to the proposed Lumcloon energy Ltd. development site has also been determined. In addition to the assessment of noise impact in accordance with the EPA document *Guidance Note for Noise in Relation to Scheduled Activities*, the perceived impact of change in noise level has also been reported for the noise sensitive properties. The perceived impact rating and the subjective response to changes in noise levels have been determined based on the subjective assessment of changes in noise levels, in terms of perceived change and loudness outlined in Table I.7.1. The prediction of the perceived impact of change in traffic noise level may result in a noise sensitive property being classified as potentially suffering from a "no change", "negligible", "noticeable", "clearly noticeable", "substantial" or "very substantial" subjective change in noise level.

Table I.7.1 Subjective assessment of changes in noise levels, in terms of perceived change and loudness

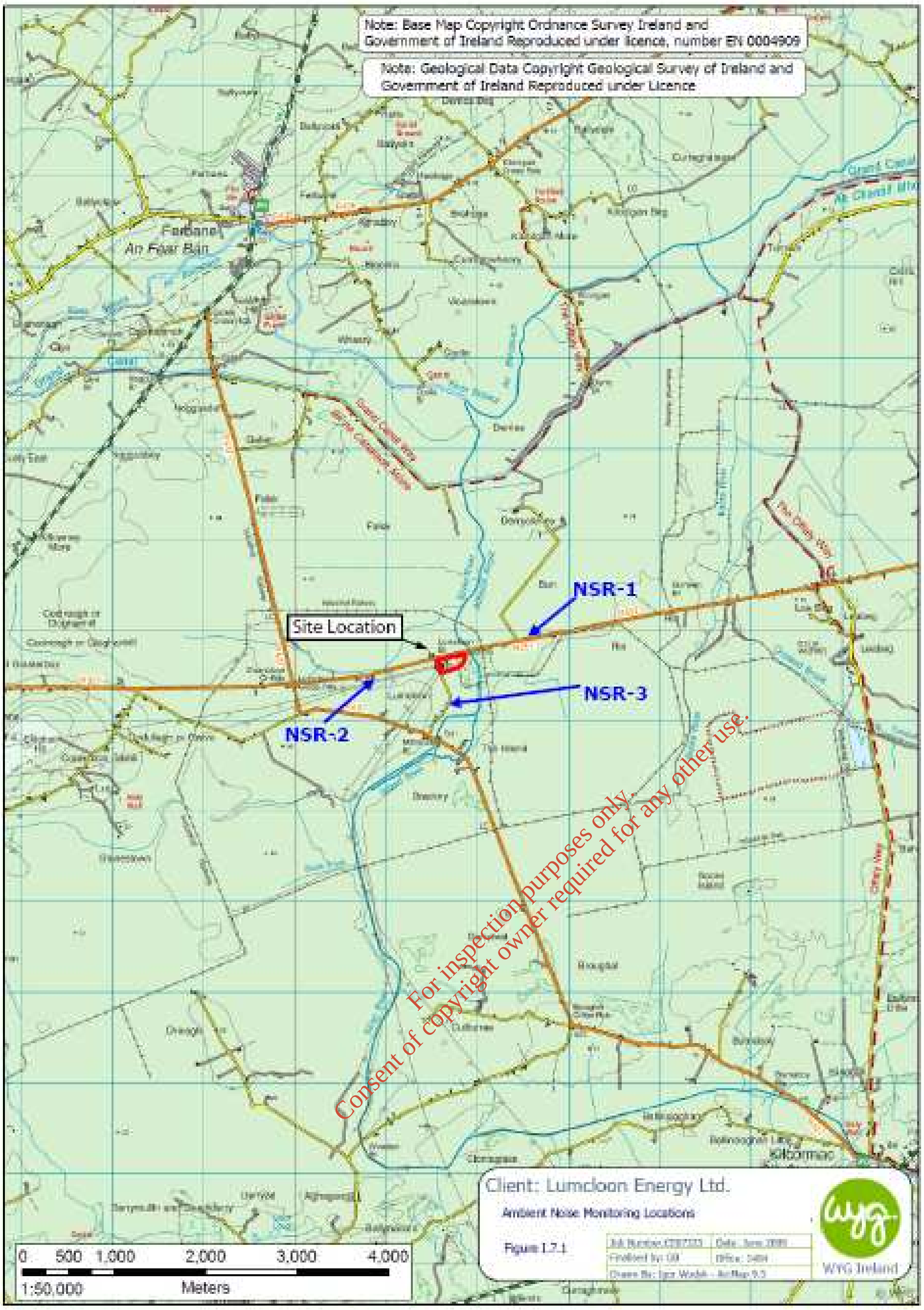
Change in Noise Level	Impact Rating	EPA Glossary of Impacts	Subjective Reaction	Subjective Change
0	No change	n/a	n/a	No change
<3 dB(A)	Not Significant	Neutral, Imperceptible or Slight Impact	Barely perceptible	Negligible
3 – 5 dB(A)	Minor	Significant Impact: Positive or Negative	Perceptible	Noticeable
6 – 10 dB(A)	Moderate		Up to a doubling of loudness	Clearly Noticeable
11 – 15 dB(A)	Major		Over a doubling of loudness	Substantial
>15 dB(A)	Severe	Profound Significant Impact: Negative only	---	Very Substantial

Note: Based on an extract from Morris, Peter and Therivel, Riki, Methods of Environmental Impact Assessment 2nd Edition, 2001.

I.7.B Receiving Environment

I.7.B.(a) Noise Monitoring Survey Results

An attended noise monitoring survey was carried out at the three closest residential receivers to the proposed development on the 4th and 5th of March 2009 during daytime and night time hours. Daytime noise monitoring was carried out over a period of 1 hour at each location. Nighttime noise monitoring was carried out over a period of 15 minutes at each location. The noise monitoring locations are shown on Figure I.7.1. The noise levels recorded at each monitoring location during daytime and nighttime are displayed in Tables I.1.2 & I.7.3. The L_{A90} is representative of the background noise level at each monitoring location. Weather conditions were clear, dry and cold when noise measurements were taken during daytime hours and night time hours. Measurements were taken between 6.3 Hz and 20 KHz. The normal maximum audible range is from 20 Hz to 20 KHz.



Note: Base Map Copyright Ordnance Survey Ireland and Government of Ireland Reproduced under licence, number EN 0004909
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Ferbane
An Fear Bán
Site Location
NSR-1
NSR-2
NSR-3
Client: Lumcloon Energy Ltd.
Ambient Noise Monitoring Locations
WYG Ireland
0 500 1,000 2,000 3,000 4,000
1:50,000
Meters

Table I.7.2: Daytime noise monitoring survey results

Noise Sensitive Receiver	Measured Noise Level		Description of Noise Environment	Description of Location
	L_{Aeq} dB	L_{A90} dB		
NSR2	72.6	38.8	Predominant noise sources comprised approximately 60 cars, 3 vans, 2 tractors. No other significant noise sources.	Beside gateway to residence 3m off R357
NSR3	47.6	28.9	Predominant noise sources comprised dogs barking, bird song and 4 cars passed during measurement.	In garden of residence off R437 within 5m of front façade of house

Note: Daytime noise levels at NSR1 not recorded due to technical fault. The daytime noise levels recorded at NSR 2 are representative of the daytime noise levels at NSR1 as the noise levels at both locations are dominated by road traffic on the R357.

Table I.7.3 Night time noise monitoring survey results

Noise Sensitive Receiver	Measured Noise Level		Description of Noise Environment	Description of Location
	L_{Aeq} dB	L_{A90} dB		
NSR1	63.4	18.8	The only significant noise source included 8 cars passing during the measurement.	Within 3m of front façade of house off R357
NSR2	60.8	21.0	The only significant noise source included 8 cars and 1 van passing during the measurement.	Beside gateway to residence 3m off R357
NSR3	37.2	25.2	Audible noise comprised very distant cars travelling on R357, no noise in immediate area.	In garden of residence off R437 within 5m of front façade of house

I.7.B.(b) Description of the Noise Environment

The existing noise environment in the vicinity of the proposed site was observed to be typical to that of a rural area. The predominant noise sources noted were road traffic along the R357 and R437. Other noted noise sources included birdsong and agricultural activity. Previously, there was an ESB power plant on the site of the proposed development. Typically this would have resulted in an audible hum at each of the three receivers. As with any power plant, this audible hum would contribute to the background noise environment in an area.

I.7.C Noise Modelling & Assessment

The noise impact on the nearby residential receivers from the proposed development was determined and where noise mitigation is required this has been recommended and input into the noise model. All major noise sources proposed for use at the power station are included in the noise model to determine the noise level at nearby residential receivers. The most significant noise source types only were taken into account as any noise source of less significance will result in a negligible difference in the overall noise level at any of the nearest residential receivers. The noise generated by a power station is perceived as a constant "hum" due to the cyclic nature of the machinery used.

There will be no expected vibration sources from the operation of the proposed development.

All sound power levels shown above were provided to WYG by Lumcloon Energy Ltd. There was no available sound power data for the Air Cooled Condenser Fans (ACC Fans) when the noise impact assessment was carried out. Therefore a realistic sound power level of 100dB L_w per ACC Fan was input into the noise model.

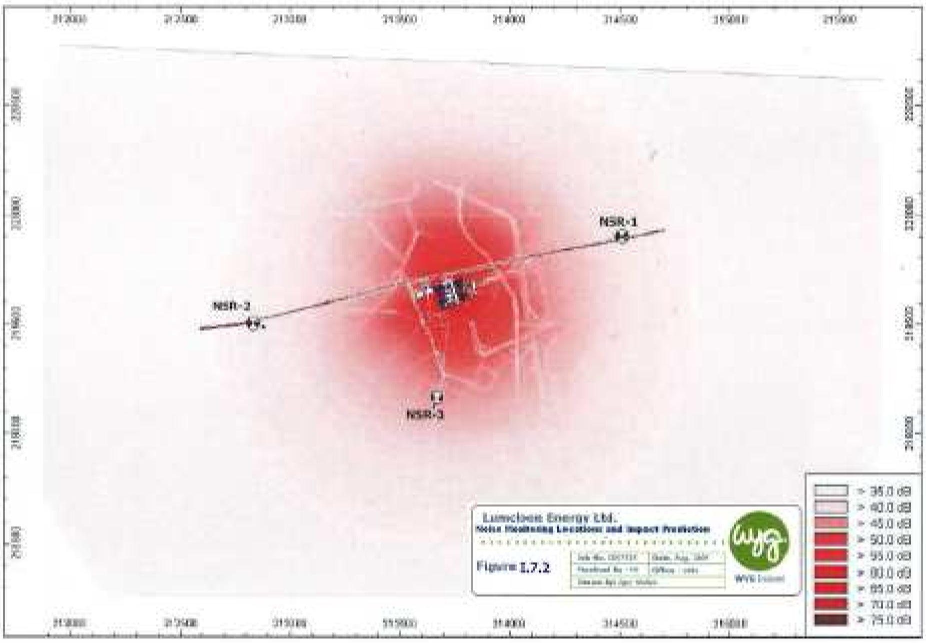
Table I.7.4 Sound power levels of the most significant noise sources on site

Plant Item	Source Type	Source Location	Sound Power Lw dB	Number	Height
Bypass	Point	Inside CCGT Building	115	4	4.0
Closed Cooling	Point	Inside CCGT Building	99	2	4.0
Enclosed Ventilation Inlet GT	Point	On OCGT Building Roof	90	4	19.6
Enclosed Ventilation Outlet GT	Point	On OCGT Building Roof	89	4	14.0
GT Air Intake	Point	On OCGT Building Roof	94	4	26.4
HRSG Stack	Point	On CCGT Building Roof	99	4	43.0
Transformer	Point	Outside, at side of OCGT Building	86	6	4.0
ACC Fans	Point	Outside, between CCGT Buildings and Diesel Tanks	100	18	15.0
Gas & Steam Turbine	Point	Inside CCGT Building	98	2	8

The sound pressure levels predicted to arise due to the operation of the proposed Lumcloon Energy Ltd. power plant are as outlined in Table I.7.5. The propogation of noise from the proposed development towards the nearest noise sensitive receivers is shown in Figure I.7.2.

Table I.7.5 Predicted noise levels at residential receivers due to operation of plant

Receiver	Predicted Noise Level L_{Aeq} dB	Rated Noise Level (+5dB) $L_{Ar,T}$ dB
NSR1	38.6	43.6
NSR2	37.3	42.3
NSR3	38.9	43.9



The highest noise level as a result of the operation of the proposed power station has been predicted to be 39dB L_{Aeq} at NSR 1 and NSR 3. When expressed as a rated noise level, this equates to approximately 44dB L_{AR} at NSR 1 and NSR 3. The operation of the proposed power plant will result in higher background noise levels at the nearest residential receivers as the power plant will operate on a 24 / 7 basis.

As stated above, an IPPC license will need to be issued by the Environmental Protection Agency (EPA) for the proposed development to operate. On the basis of the predicted noise levels at the surrounding receiver locations, the EPA noise limits of 55dB $L_{Ar,T}$ during daytime (8am to 10pm) and 45 dB $L_{Aeq,\,T}$ during night time (10pm to 8am) will be achieved.

Although the predicted noise levels are not in excess of the specified guideline values at the nearest noise sensitive receiver locations, the perceived impact of the proposed development on the nearby noise sensitive receivers has also been assessed in accordance with the criteria outlined in Table I.7.1. For the assessment of perceived impact on the nearest residential receivers the predicted noise levels due to the proposed power plant have been compared with the existing background noise levels in the area, i.e. the measured L_{A90} noise levels. Therefore, the modelling results indicate negligible subjective change in perceived noise levels during daytime at NSR1 and NSR2, i.e. along the R357. At NSR3 during the daytime, there will be an increase of approximately 10dB which constitutes a clearly noticeable subjective change in perceived noise levels. In comparison to the measured background nighttime noise levels, the increase in predicted noise levels during nighttime will result in a substantial to very substantial increase in perceived noise level at the nearest noise sensitive receiver locations. However, as stated above, the EPA IPPC noise limits will not be exceeded which are based on the World Heath Organisation (WHO) *Guidelines on Community Noise*.

The WHO *Guidelines on Community Noise* state that "To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}. These values are based on annoyance studies, but most countries in Europe have adopted 40 dB L_{Aeq} as the maximum allowable level for new developments (Gottlob 1995). Indeed, the lower value should be considered the maximum allowable sound pressure level for all new developments whenever feasible. At night, sound pressure levels at the outside façades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax}, so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB". The proposed development will achieve the WHO recommended noise levels.

Site traffic due to employees entering and leaving the site will give rise to a less than 20% increase in traffic flows and therefore, an insignificant traffic noise impact in the vicinity of the proposed development site. Table I.7.6 outlines the proposed traffic flows that the development will generate. The increase in traffic flow along local routes can be considered negligible in terms of a road traffic noise impact on nearby sensitive receivers.

Table I.7.6 Generated Traffic for the Operational Phase of the proposed development

Location	Existing AM Peak	Existing PM Peak	Total Vehicle Movements – Operational Phase
R357 and R437 staggered crossroads	227	235	21
Local Road T-junction onto R357	190	208	21
R357 at Proposed Junction	189	203	30

I.7.D Noise Mitigation Measures

I.7.D.(a) Building Envelope

The predicted noise levels at the three residential receivers as detailed above are based on a specific transmission loss performance for the cladding and roof elements of buildings housing high noise generating power plant equipment. In order to achieve the predicted values set out above and meet the previously discussed EPA noise limits for this facility, the sound insulation values for building elements outlined in Table I.7.7 are required of the cladding and roof systems used in the power plant building envelopes. The sound transmission loss coefficients assumed for the CCGT and OCGT areas of the power plant building assume an average absorption coefficient of 0.25 at 500Hz.

Table I.7.7: Assumed transmission loss octave band values for power plant buildings

Building Element	Octave Spectrum (dB)									
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	Rw
CCGT Building	7	13	19	25	31	38	38	38	38	35
OCGT Building	10	16	22	28	34	41	41	41	41	38

I.7.D.(b) Power Plant Equipment Isolation

Due to the noise levels generated by the gas and steam turbine / generator in particular, it is recommended that all major plant items are sufficiently isolation mounted to minimise noise transmission through to the building structure and the concrete floor. The vibration isolation employed must be specifically selected to suit the weight, frequency of oscillation and isolation efficiency of the plant item being considered. Otherwise, if noise is transmitted to the structure, the building envelop itself will become vibration excited and as a result emit excessive noise into the surrounding environment.

I.7.E Statement of Impacts of Noise Emissions

The closest residential receiver to the power station is approximately 400m away with two residential receivers located approximately 600m away. The distance of the proposed power plant from the nearest residential receivers allows for significant noise attenuation due to distance. When all major noise sources on the proposed site were modelled, it was found that the noise impact at the three residential receivers is predicted to be below the EPA noise limits of 55dB $L_{Ar,T}$ during daytime (8am to 10pm) and 45 dB $L_{Aeq,T}$ during night time (10pm to 8am). As the power station will be operation on a 24 hour basis, the night time scenario defines the actual noise limit on the power station. It is concluded that the noise impact due to the power station will not result in an exceedance of the relevant EPA limit values and the recommended daytime and nighttime noise levels in the World Health Organisation (WHO) *Guidelines for Community Noise*.

Table I.7(i): AMBIENT NOISE ASSESSMENT

Third Octave analysis for noise emissions should be used to determine tonal noise.

	National Grid Reference	Sound Pressure Levels		
	(6N, 6E)	$L(A)_{eq}$	$L(A)_{10}$	$L(A)_{90}$
1. SITE BOUNDARY (Note 1)	N/A			
Location 1:	-	-	-	-
Location 2:	-	-	-	-
Location 3:	-	-	-	-
Location 4:	-	-	-	-
2. NOISE SENSITIVE LOCATIONS	DAYTIME			
Location 1:	-	-	-	-
Location 2:		72.6	72.6	38.8
Location 3:		47.6	45.2	28.9
3. NOISE SENSITIVE LOCATIONS	NIGHTTIME			
Location 1:		63.4	41.3	18.8
Location 2:		60.8	41.4	21.0
Location 3:		37.2	40.2	25.2

NOTE 1: No monitoring was undertaken at the site boundary as the site is presently unoccupied and there are no existing sources in operation. Noise survey locations were selected at the nearest residential receptor locations.

I.8 CLIMATE IMPACT

The potential impacts of the proposed gas fired power plant at Lumcloon on climate are addressed in this section with specific reference to the generation of greenhouse gases from operational activities and from traffic associated with the construction and operational phases of the proposed development.

I.8.A Receiving Environment

I.8.A.(a) Microclimate

The climate of the area is best described by meteorological measurements collected by the National Meteorological Service from the meteorological stations at Birr, Co. Offaly and Mullingar, Co. Westmeath; the nearest met stations to the proposed development. To characterise the prevailing conditions at the site, historical meteorological data compiled by Met Eireann (www.meteireann.ie) is presented for Birr and Mullingar for the period 1981-1990. The most important meteorological parameters in relation to the proposed development are wind speed, rainfall and temperature.

Birr Station is located 1.5 Km ESE of Birr Town, Co. Offaly (53°5'25" N, 7°53'25"W) at 73M above mean sea level. Birr station is located approximately 15 km from the proposed site. Mullingar Synoptic Station is situated approximately 1.7 Km northwest of Mullingar, Co. Westmeath (53° 32' 14" N 07° 21' 44" W) at 104M above mean sea level. Mullingar station is located approximately 45 km from the proposed site.

The prevailing weather conditions at the site of the proposed development and that at Birr and Mullingar meteorological station is not expected to be significantly different.

I.8.A.(b) Mullingar Wind Data

Outlined below is a windrose and tabulated data for wind direction and wind speeds in the area of the proposed development site. This data has been used for the purposes of the air dispersion modeling exercise carried out as part of the local air quality impact assessment. Figure 1 indicates the predominant wind direction is south-westerly. The wind speed is greater than 10 knots for approximately 3% of the measured met data from 2000 to 2004 (See Figure 2).

Figure I.8.1 Mullingar Windrose Diagram detailing wind speed and direction (Blowing to) from 2000 to 2004

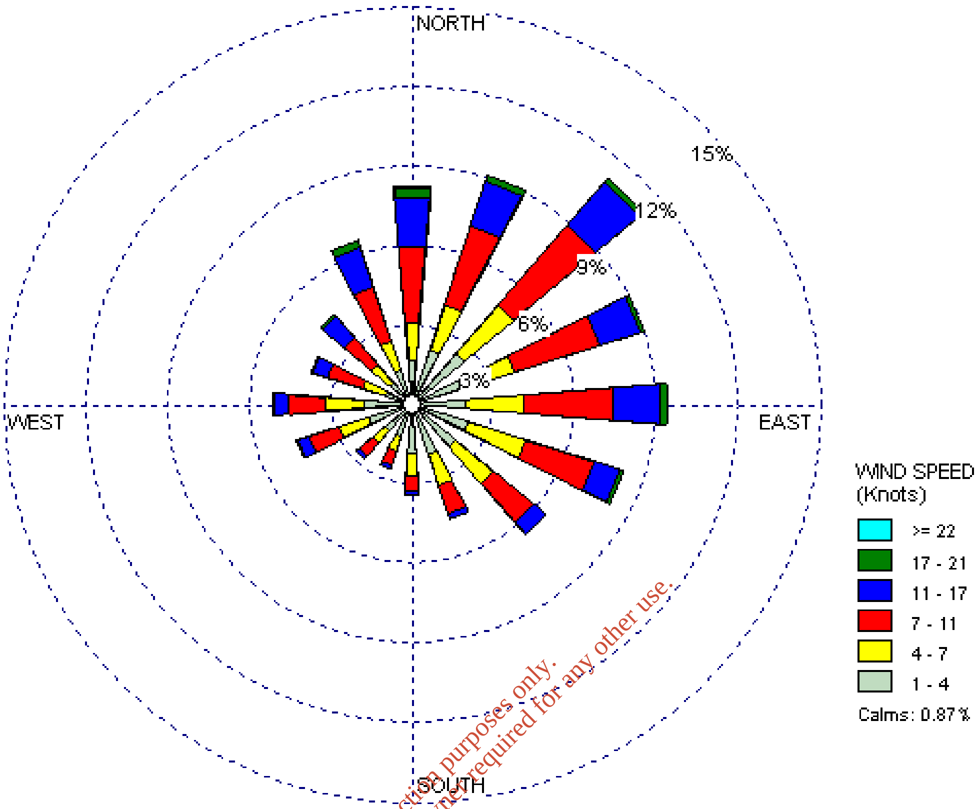
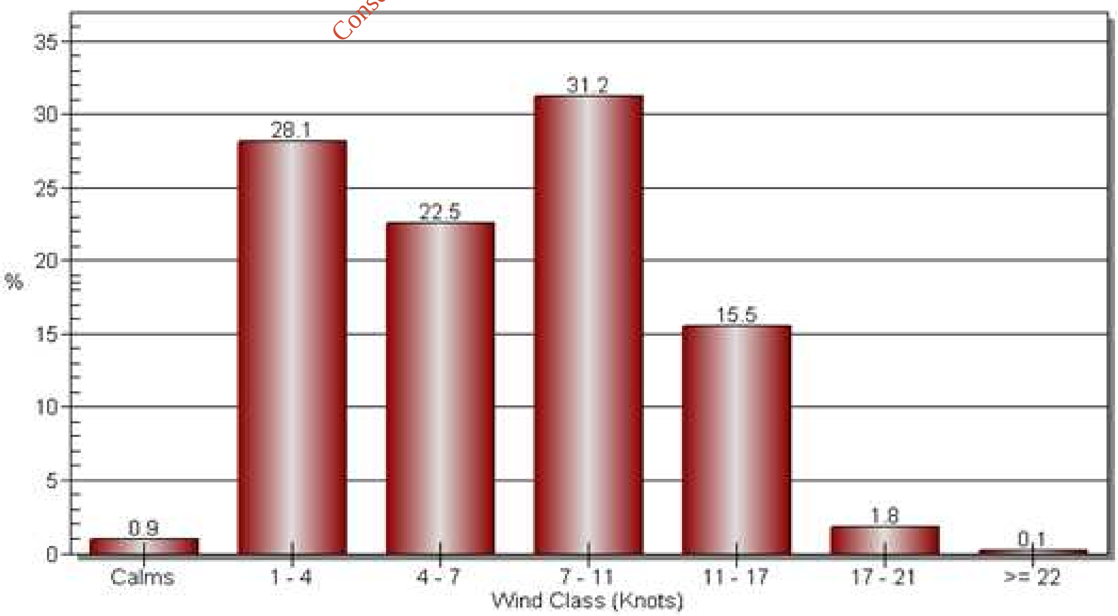


Figure I.8.2 Mullingar wind speed frequency distribution (2000 – 2004)



Solar Radiation

Mean monthly Solar Radiation data from Birr for 2009, 2008 and mean value from 1981-1990 is presented in Table I.8.1. No solar radiation data is available for Mullingar Met station.

Table I.8.1 Solar Radiation Data for Birr Meteorological Station

Global Solar Radiation in Joules/cm^2 for Birr													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2009	7745	12237	27780	36039	51710	-	-	-	-	-	-	-	187463
2008	6849	13904	26502	41033	54000	48593	45087	33549	29031	17961	8511	5643	330663
Mean	7205	12563	24060	38647	50261	48440	49530	39060	29348	17288	9201	5522	331127

Note: Data for the most recent months are provisional. Solar radiation means are presented for 1981-1990.

Precipitation

Rainfall data for 2008 and 2009 to date along with average monthly and annual precipitation rates over the period 1961 – 1990 for Birr and Mullingar are presented in Table I.8.2 (a) and Table I.8.2 (b). The results show that the annual average rate of precipitation for 2008 in Birr and Mullingar is 1,017 mm and 1,065, respectively. The average monthly rainfall values in 2008 at Birr range from 30.7 mm in April to 181.5 mm in August. In the summer months, high rainfall amounts tend to be associated with intense thunder showers which may be localised in rainfall intensity.

Table I.8.2 (a) Mean Monthly Rainfall Data for Birr Meteorological Station

Total rainfall in millimetres for Birr													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2009	124.8	15.6	49.3	106.1	69.8	-	-	-	-	-	-	-	381.4
2008	134.9	31.5	95.2	30.7	19.1	86.8	91.8	181.5	84.1	121.1	77	63.7	1017.4
Mean	76	53.9	60.7	52.8	61.2	55.6	58.7	78	70.6	84.1	74.2	78.3	804.2

Note: Data for the most recent months are provisional. All means are for the period 1961-1990.

Table I.8.2 (b) Mean Monthly Rainfall Data for Mullingar Meteorological Station

Total rainfall in millimetres for Mullingar													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2009	104.6	-	40.6	102.9	75	-	-	-	-	-	-	-	-
2008	138.5	54.6	91.6	59.1	19.4	84.7	98.6	154.5	104.7	124	78.2	57.1	1065
mean	92.4	66.3	72.6	59	70.9	67	61.2	82.9	85.1	94.1	87.9	92.2	931.5

Note: Data for the most recent months are provisional. All means are for the period 1961-1990.

Air Temperature

Air temperature for 2008 and 2009 to date, along with average daily air temperatures over the period 1961 - 1990 for Birr and Mullingar are presented in Table I.8.3 (a) and Table I.8.3 (b). The 2008 average daily temperatures for Birr and Mullingar ranged from 4.5°C in December to 15.4°C in August and 4.1°C in December to 14.9°C in August, respectively.

Table I.8.3 (a) Mean Air Temperatures at Birr Meteorological Station

Mean temperature in degrees C. for Birr													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2009	4.3	5.2	7.2	9	11.2	-	-	-	-	-	-	-	7.8
2008	6.4	5.9	5.9	7.7	13.3	13	15.2	15.4	12.3	8.9	7.2	4.5	9.6
mean	4.6	4.8	6.1	7.9	10.4	13.2	14.9	14.6	12.6	10.1	6.4	5.4	9.3

Note: Data for the most recent months are provisional. All means are for the period 1961-1990.

Table I.8.3 (b) Mean Air Temperatures at Mullingar Meteorological Station

Mean temperature in degrees C. for Mullingar													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2009	3.5	4.9	6.5	8.7	10.8	-	-	-	-	-	-	-	7.5
2008	5.6	5.4	5.5	7.5	12.5	12.5	14.5	14.9	12	8.1	6.7	4.1	9.1
mean	4	4.2	5.7	7.6	10.1	13	14.7	14.2	12.3	9.7	5.9	4.8	8.8

Note: Data for the most recent months are provisional. All means are for the period 1961-1990.

I.8.B Climate Change & Existing Energy Usage in Ireland

The potential effects of climate change on a global scale have been investigated by the Intergovernmental Panel on Climate Change (IPPC). The predicted impacts in Ireland are outlined in the National Climate Change Strategy including the following:

- Significant increases in winter rainfall;
- Lower summer rainfall (10% reduction in the southern half of the country);

- Prolonged water shortages and CO_2 losses from peat land due to water deficit;
- Benefits will include increased temperatures and related increases in agricultural production.

In relation to Ireland's Kyoto Limit, the baseline emissions total for Ireland is calculated as the sum of CO_2, CH_4 and N_2O emissions in 1990 and the contribution from fluorinated gases in 1995. The baseline value was established at 55.607 Mt CO_2eq following in-depth review of Ireland's 2007 submission to the UNFCCC and results in total allowable emissions of 314.18 Mt million tonnes carbon dioxide equivalent (Mt CO_2eq) in the commitment period 2008-2012 under the Kyoto Protocol. This equates to an average of 62.84 Mt CO_2eq per annum (i.e. 13% above the baseline estimate). Compliance with the Kyoto Protocol limit is achieved by ensuring that Ireland's total greenhouse gas emissions in the period 2008-2012, less any offsets from approved forest sinks as well as any surrender of purchased Kyoto Protocol credits, are below the Kyoto limit at the end of the five year period.

According to the latest release in relation to Greenhouse Gas emissions from the EPA dated 22nd October, 2010, for 2009, total national greenhouse gas emissions are estimated to be 62.32 Mt CO_2eq which is significantly lower (7.9% lower or 5.36 Mt CO_2eq) than emissions in 2008. This further closes the gap to our Kyoto Protocol limit and results in an overall exceedance of the limit, based on the first two years of the Kyoto Period (i.e. 2008 and 2009), of 6.21 Mt CO_2eq when the impact of forest sinks and of the EU-Emissions Trading Scheme are included. Agriculture remains the single largest contributor to the overall emissions, at 29.1% of the total, followed by Transport and Energy (primarily power generation) both at 21.1%. The remainder is made up by the Industry and Commercial at 14.8%, Residential sector at 12.0% and Waste at 1.9%. The 2009 estimates of greenhouse gas emissions show a considerable annual reduction compared with 2008 emissions which primarily reflects the downturn in economic activity during 2009.

In relation to Energy Emissions in 2009, total emissions were 1.57 Mt CO_2eq lower than in 2008 which represents a 10.7% decrease. This reflects a reduced demand for electricity from end-users in Ireland. In addition, the share of renewables in gross electricity consumption increased to 14.1% in 2009 from 11.7% in 2008 whilst carbon-intensive fuels in power generation decreased in 2009 relative to 2008. However, energy has shown a substantial increase on 1990 levels by 15.4% which reflect an overall increase in demand for electricity.

Figure I.8.3Greenhouse Gas Emission by Sector 2009

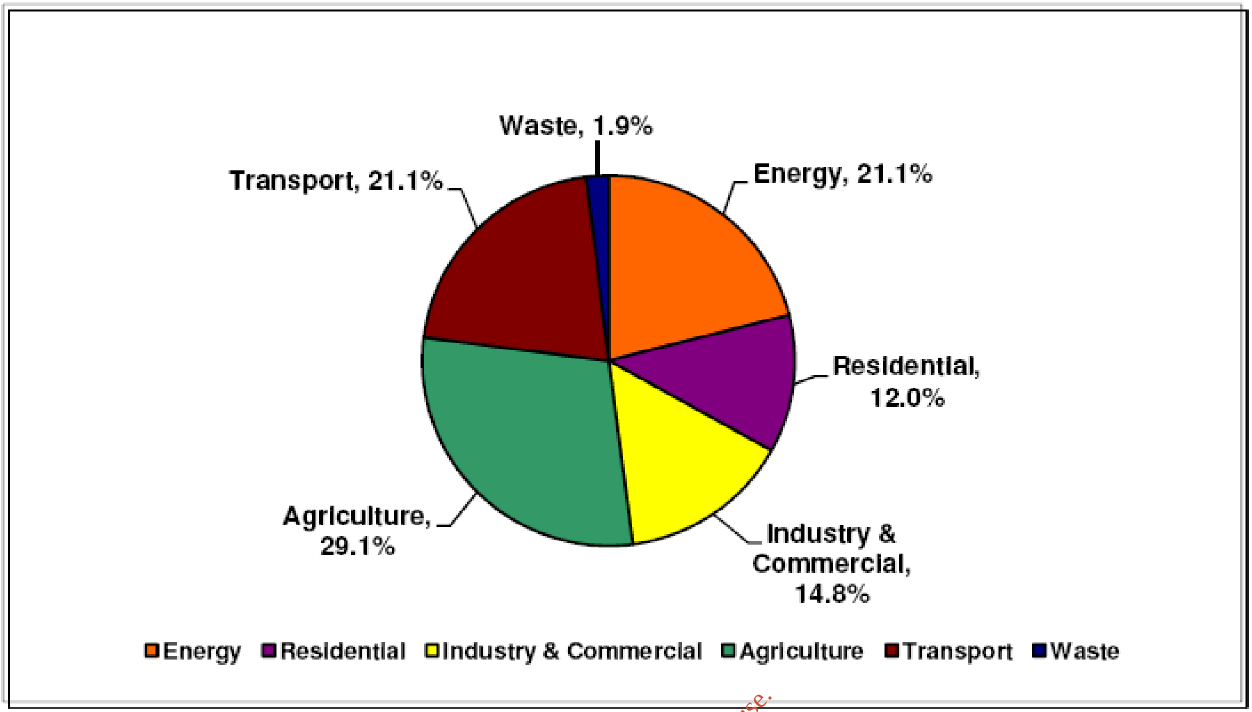
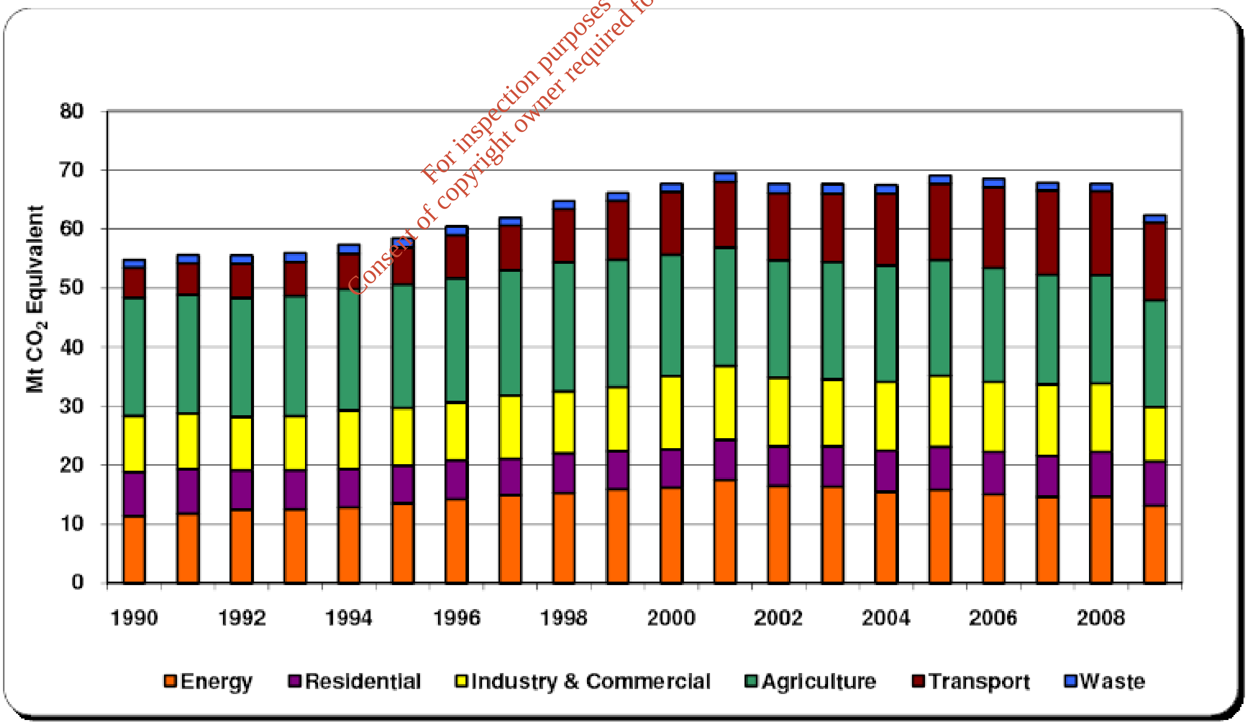


Figure I.84 Trends in Greenhouse Gas Emissions 1990 - 2009



I.8.C Climate Impact Assessment

The proposed plant will have the capability of producing up to 350MW of power. The proposed development will operate as essentially one power block and will be capable of running in either open cycle or combined cycle modes. The proposed power block will comprises four small scale (<50MW) gas turbines, four heat recovery steam generators (HRSGs) and two steam turbine generators producing a further 75MW. Each HRSG will be fitted with supplementary gas burners and capable of producing around 32.5MWs of power at the alternator terminals. The principal design feature of the Lumcloon plant design is its flexibility and the fact that it will be capable of accommodating a wind power loss in the range from 47 to 185 MWs in open cycle mode and up to 70MW in supplementary firing mode.

In the combined cycle mode, a conditioned gas is combusted in the gas turbine generator producing electricity and the waste heat from the gas turbine is used to make steam to generate additional electricity via a Heat Recovery Steam Generator (HRSG) and a steam turbine. Combined Cycle Power Plants far exceed conventional Thermal Power Plants with efficiencies in a range of 54% to 57%. Open cycle gas turbines (OCGTs) are less efficient than combined cycle gas turbines (CCGTs) with typical efficiencies of approximately 37.5%. However, the advantage of operation in open cycle mode is that the plant can supply electricity in a much shorter timeframe than in combined cycle. In open cycle mode, the plant will be capable of producing 188MW of power.

I.8.C.(a) CCGT & OCGT CO_2 Emissions

A document by the Oxford Institute for Energy Studies (20:20 vision to reducing CO_2 emissions in the UK electricity market) states that a modern CCGT plant only produces 40% of the CO_2 that a conventional coal-fired power station produces, and 75% of that produced by a conventional oil-fired power station, for the same amount of electricity output. Within the constraints of existing technologies it therefore appears that the only way to achieve a 20% reduction in emissions from electricity generation nationally would be to replace all conventional fossil fuel generation with low GHG emission CCGT plants and supported by renewable energy, and constrain demand growth to 1% per annum. At present, Ireland emits 13.12 Mt CO_2eq from the Energy Sector, with emissions projected to increase over the period 2007 – 2020 to 15.0 Mtonnes of CO_2eq.

Gas Turbines, as proposed in the Lumcloon plant, in both the Open cycle and Combined Cycle modes have relatively low emissions of CO_2, CO and NO_x. From information provided by the project engineers, CO_2 emissions for the Lumcloon plant will be 200 kgs/ MWhr minimum to 350kgs/MWhr maximum for the OCGT and 145 kgs/ MWhr minimum to 280 kgs/MWhr maximum for the CCGT as opposed to coal and oil-fired thermal power plants with a CO_2 emission of 300 kgs/MWhr minimum to 1,000kgs/MWhr maximum.

At a maximum proposed output of 350MW, the Combined Cycle Unit operating at full capacity for a year (circa 6,000 hours) at an average output of 212.5 kgs/MWhr CO_2 emissions would amount to 446,250 tonnes CO_2 /annum. If the 188 MW Open Cycle Unit (Reserve Peaking Plant) operated at an expected circa 500 hours/year, at an average output of 275 kgs/MWhr CO_2 emissions would amount to 25,850 tonnes CO_2 /annum. Therefore, this would amount to an approximate annual CO_2 output of 472,100 tonnes CO_2 /annum, which is approximately 0.75% of Ireland's total GHG emissions in 2009 of 62.32 million tonnes carbon dioxide equivalent (Mt CO_2eq), , of which energy accounted for 21.05%.

When compared to a 350MW coal fired plant with an average CO_2 emission output of 341 kgs/MWhr running at the same operating capacity and producing 774,865 tonnes CO_2 /annum, the proposed Lumcloon CCGT and OCGT plant will result in a CO_2 emissions reduction of approximately 302,765 tonnes CO_2/annum. When compared to a sample 350MW oil fired plant with an average CO_2 emission output of 265 kgs/MWhr running at the same operating capacity and producing 602,875 tonnes CO_2 /annum, the proposed Lumcloon CCGT and OCGT plant will result in a CO_2 emissions reduction of approximately 130,775 tonnes CO_2/annum (Ref.: http://www.sei.ie/Publications/Statistics_Publications/Emission_Factors). Therefore, this surmises that the proposed Lumcloon Power Plant only produces 60% of the CO_2 that a conventional coal-fired power station produces, and 78% of that produced by a conventional oil-fired power station, for the same amount of electricity output.

The principal feature of the Lumcloon plant design is that it can accommodate a wind power loss in the range from 47 to 185 MWs in open cycle mode and up to 70MW in supplementary firing mode. There are currently a number of wind farms in very close proximity to Lumcloon in Offaly and North Tipperary including the 2.55 MW Carrig wind farm, the 4.25 MW Skehanagh wind farm, the 2.55 MW Ballinleugh wind farm and the 2.55 MW Ballinveny wind farm. In their strategy document (*Grid 25)* for the Development of Ireland's Electricity Grid for a Sustainable and Competitive Future, Eirgrid predicts that the demand for electricity in the Midlands region will grow by over 40% by 2025 and the region is expected to have up to 160MW of wind energy capacity. As such, Eirgrid propose to invest an additional €310m in the midlands region upgrading the transmission network and new circuit build. Eirgrid state that this *'reinforcement is necessary to cater for the continued demand growth in the gateway towns of Athlone, Mullingar and Tullamore'.* Upgrading the network will also facilitate power flows from both conventional and renewable sources. The proposed plant at Lumcloon will provide a secure and reliable source of electricity

I.8.C.(b) Traffic

Based on the very low traffic volumes which the proposal will generate, there will be an insignificant increase in greenhouse gases related to traffic on a local, regional or national scale.

I.8.D Statement of Climate Impact

There will be no ozone depleting substances produced or emitted during the operational phase of the proposed development. Emissions of acidifying gases, such as Nitrogen Oxides and Sulphur Dioxide from the development will not have any significant adverse impact on the receiving environment as outlined in the Air Quality Impact Assessment.

The EU is committed to an average reduction of greenhouse gas emissions by 8% below 1990 levels. The EU Emissions Trading Scheme (EU ETS) through Directive 2003/87/EC is being implemented to achieve this. As this plant will replace traditional coal, oil and peat power plants and support wind energy, it will therefore help Ireland to achieve the EU GHG emission targets. The EPA has been given the responsibility for implementing the Emissions Trading Directive in Ireland by Government under the European Communities (Greenhouse Gas Emissions Trading) Regulations 2004 (S.I. 437 of 2004). The Lumcloon plant will operate under the EU ETS and will require a Greenhouse Gas Emissions Permit from the EPA.

Minimal residual impact is expected from the operation of the proposed development due to the comparatively low GHG emissions associated with CCGT & OCGT gas power generation in conjunction with supply support from local wind energy.

The first phase of the Kyoto Protocol is from January 2008 until December 2012 and during this 5 year period Ireland has legally committed to limit it's emissions to a combined total of 314.18 Mt CO_2eq or 62.84 Mt CO_2eq per year. In 2007, Ireland emitted 69.28 Mt CO_2eq. In 2008, Ireland emitted 67.68 Mt CO_2eq and in 2009, Ireland emitted 62.32 Mt CO_2eq. Emissions from Energy (principally electricity generation) decreased by 10.7% from 14.69 Mt CO_2eq in 2008 to 13.12 Mt CO_2eq in 2009. This reflects a reduced demand for electricity from end-users in Ireland. In addition, the share of renewables in gross electricity consumption increased to 14.1% in 2009 from 11.7% in 2008 whilst carbon-intensive fuels in power generation decreased in 2009 relative to 2008.

CO_2 emissions from the country as a whole can be significantly reduced by converting our conventional fossil fuel power plants to state of the art CCGT gas power plants and supplementing this with renewable energy supplies such as local wind farms. The proposed Lumcloon CCGT and OCGT plant will result in significant CO_2 emission reductions when compared to conventional coal fired or oil fired power plants.