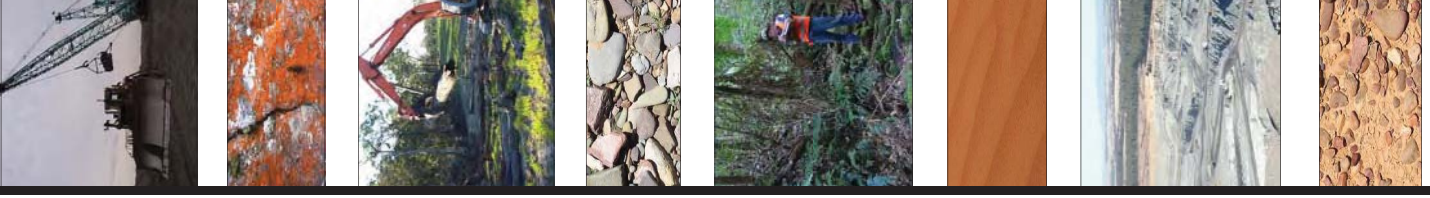

APPENDIX 10

Centennial Coal

Newstan Colliery s75W Modification

Greenhouse Gas Assessment

November 2010

FUTURE POWER | Centennial Coal

CONTENTS

FIGURES

TABLES

1.0 Introduction

Newstan Colliery is an underground coal mine owned and operated since 2002 by Centennial Newstan Pty Limited (Centennial Newstan). Underground mining at the Newstan Colliery has been undertaken in the Young Wallsend, Great Northern, Fassifern, Borehole and West Borehole coal seams and produces semi soft coking coal and/or thermal coal for both the domestic and export markets. The Newstan Colliery ceased underground mining production in 2009 however continues to operate the Newstan Colliery Surface Facilities Area for the handling and processing of coal from other Centennial Coal operations.

Newstan Colliery is seeking a modification to its existing Development Consent (DA 73-11-98) subject to s75W of the Environmental Planning and Assessment Act 1979 (EP&A Act) to allow for the recommencement of first workings bord and pillar mining in an area referred to as Main West located beyond the existing Development Consent boundary.

A greenhouse gas (GHG) assessment is required to support the Environmental Assessment. The GHG assessment is required to be developed in accordance with the new Centennial standard for GHG reporting and includes Scope 1, Scope 2 and Scope 3 GHG emissions. The report will compare the impact of the proposed Project on the base case of Centennial Newstan's NGERS reporting for 08/09 and 09/10.

1.1 Scope of Works

The purpose of this assessment was to estimate the change in annual GHG emissions associated with the proposed Project. A quantitative assessment of the potential scope 1, 2 and 3 GHG emissions from the project were made in relation to the following sources:

- Emissions from combustion of fuel by on-site vehicles used to transport men and materials associated with operations (Scope 1);
- Emissions from combustion of fuel by on-site vehicles used to handle and manage the mine's ROM coal reject and washed coal products (Scope 1);
- Emissions from the use of Liquefied Petroleum Gas (LPG), sulphur hexafluoride (SF_6), and oils and greases (Scope 1);
- Fugitive emissions from the extraction of coal (Scope 1);
- Fugitive emissions from post mining activities (stockpiled coal) (Scope 1);
- Electricity use (Scope 2 and 3); and
- Indirect emissions from the combustion of the coal produced (Scope 3).

Scope 1 and Scope 2 emissions were estimated using data provided by Centennial Newstan and emission factors and methods specified in the National Greenhouse and Energy Reporting System (NGERS) (to which Centennial Newstan is a mandatory respondent). Indirect emissions (Scope 3) associated with the operation of the facility, namely those associated with use of the product coal by Power Generation, were estimated using National Greenhouse Account (NGA) Factors (DCC; June, 2009), as NGERS has no Scope 3 requirement.

Emissions were assessed for two scenarios:

- Last year of production (2008/09 data); and
- Proposed revised operation (production up to 1.0 Mtpa).

Results were compared to historical Australian emission levels.

2.0 Project Description

The proposed Project will allow bord and pillar (first working) mining at Newstan Colliery in an area, reffered to a Main West located beyond the existing development consent boundary. The Project's mining operations will be carried out using continuous miner methods in the West Borehole seam, generally consistent with the processes that are used at other Centennial Coal operations. Further, existing infrastructure at the Surface Facilities Area will be utilised to service the proposed Project.

2.1 Mining Area

The Project will allow bord and pillar (first working) mining at Newstan Colliery in an area reffered to a Main West located beyond the existing Development Consent boundary. Access to the new area will be from the existing workings.

2.2 Mining Methods

In the proposed Main West mining area the Project will require:

- The use of up to 2 continuous miners carrying out first workings; and
- The employment of 50 personnel for the Project (note this is within the current consent limit of 320 personnel.

Note: No longwall mining will be utilised for mining within the Main West mining area.

Note: The Project will not require any additional infrastructure beyond what has previously been approved for the site however minor upgrades to existing infrastructure at the site will be required.

Mining in the Main West area will:

- Experience the same levels of gas content as previously experienced at Newstan;
- Require 3 shifts per day (24 hours 7 days a week);
- Increase in the ventilation fan throughput by approximately 20% from 150 m^3/second to 180 m^3/second; and
- Produce up to 1 Million tonnes per annum (Mtpa) of coal from a total resource of approximately 8.4 million tonnes.

2.3 ROM Coal Production Limits

This project will provide for up to 1 Mtpa of coal from a total resource of approximately 8.4 Mt.

2.4 Coal Transport

No changes are proposed to the current coal transport methods. Coal produced by Newstan Colliery will continue to be supplied directly to Eraring Power Station via the dedicated private haul road or exported through the port of Newcastle via the Newstan rail loop.

2.5 Coal Handling

No changes are proposed to the current coal handling, preparation, or stockpiling procedures of the existing operations.

2.6 Mine Access and Surface Facilities

Existing mining areas (including existing underground workings for ventilation) will continue to be utilised for the Project including (but not limited to) mine access, emergency management and underground services and infrastructure. As such, no changes are proposed to the current mine access, infrastructure or facilities.

Newstan Colliery has two existing electric submersible pumps that can pump water from the underground storages to the surface at up to 6.5 ML/day. The site currently only operates one pump which is pumping at the rate of 110 L/second. Previously 2 pumps were sometimes operated however were only operated on a ‘part time’ basis as to not exceed the discharge limits.

Vehicles operated on site use diesel fuel, while the coal handling plant, mine fan, compressors and surface conveyors are electrically powered.

3.0 Greenhouse Gases

GHGs are gases found in the atmosphere that absorb outgoing heat that is reflected from the sun. This absorption of the heat energy warms the air, enabling life to survive, and is known as the Greenhouse Effect.

The primary greenhouse gases in the Earth's atmosphere are water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3). These are all naturally occurring, while others like sulphur hexafluoride (SF_6), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs) are anthropogenic.

Human activities, such as:

- Burning fossil fuels, such as coal, oil or gas
- Using energy generated by burning fossil fuels
- Aspects of farming, such as raising cattle and sheep, using fertilisers and growing some crops
- Clearing land, including logging
- Breakdown of food and plant wastes and sewerage
- Industrial processes, such as making cement and aluminum.

can make GHG's as well and cause increased amounts of GHGs in the atmosphere leading to greater absorption of heat and increases in atmospheric temperature, this is known as the Enhanced Greenhouse Effect.

These temperature increases can result in changes in ocean levels (due to melting of glaciers and polar ice caps) and water temperatures and greater humidity. Changes in weather patterns are also associated with increased atmospheric temperatures, resulting in effects such as increased droughts in some areas and increased flooding in others.

The NSW Government has committed to a long term GHG reduction target of 60% reduction in GHG emissions by 2050 and a return to year 2000 GHG emission levels in NSW by 2025. There are, however, no legislative limits for emissions of CO_2, methane (CH_4) or nitrous oxide (N_2O).

3.1 Global Warming Potential

Different GHGs have different heat absorbing capacities. In order to achieve a basic unit of measurement, each GHG is compared to the absorptive capacity of CO_2, and measurements and estimates of GHG levels are reported in terms of CO_2 equivalent emissions (CO_2-e). Global warming potentials (GWPs) are used to compare the abilities of GHGs to trap heat in the atmosphere. A GWP is based on the radiative efficiency of a gas (i.e. its heat-absorbing ability), relative to that of CO_2, and its decay rate (i.e. atmospheric lifetime), also relative to CO_2. The GWP provides a means to convert emissions of GHGs into CO_2-e units. The global warming potentials of the primary greenhouse gases are shown in **Table 1**.

Table 1: Greenhouse Warming Potentials - Select Greenhouse Gases

Greenhouse Gas	Global Warming Potential*
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous oxide (N_2O)	310
Sulphur hexafluoride (SF_6)	23,900
*GWP factors specified for calculating emissions under Kyoto accounting provisions Source: NGA Factors, June 2009	

3.2 National Response to Climate Change

3.2.1 Kyoto Protocol

The Kyoto Protocol is an international agreement created under the United Nations Framework Convention on Climate Change in Kyoto, Japan in 1997. The Kyoto Protocol aims to reduce the collective GHG emissions of

developed countries by at least 5% below 1990 levels during the period 2008 to 2012, which is known as the first commitment period.

Australia ratified the Kyoto Protocol in December, 2007, with the action taking effect in March 2008. Australia has committed to ensuring its GHG emissions over 2008 to 2012 are no more than 8% above 1990 levels.

3.2.2 National Greenhouse Gas Inventory

Australia's National Greenhouse Gas Inventories are designed to provide estimates of Australia's net GHG emissions and track Australia's progress towards its Kyoto target. Australia has updated and published annual national GHG inventories for each year from 1990 to 2008 inclusive. The inventories are prepared according to international guidelines. Details of the most recent inventory (2008) are shown in **Table 2**.

Table 2: Australian National Greenhouse Gas Emissions, 2008

Sector	Mt CO_2-e
Agriculture, forestry, fishing	120.1
Mining	57.8
Coal Mining	***32.1***
Manufacturing	72.7
Electricity, gas, water	210.8
Construction	1.8
Commercial services	17.6
Transport & storage	41.0
Residential	54.3
Total of all economic (ANZSIC) sectors	576.2
Source: Australian Greenhouse Emissions Information System, Department of Climate Change and Energy Efficiency. (Wed Jun 30 09:44:41 2010)	

In 2008, Australia's net GHG emissions were 576.2 Mt CO_2-e. Of the total Australian emissions, 32.1 Mt CO_2-e (5.5 %) were emitted by the coal mining industry. The change in emissions from coal mining in Australia between 1990 and 2008 are shown in **Figure 1**. Emission levels steadily increased between 2002 and 2007.

Figure 1: Greenhouse Gas Emissions from Coal Mining - Australia, 1990 - 2007

Source: http://ageis.climatechange.gov.au/ANZSIC.aspx; accessed 30 June 2010

3.2.3 Greenhouse Gas Reporting

The National Greenhouse and Energy Reporting Act 2007 (the NGER Act) was passed in September 2007, establishing a mandatory reporting system for corporate GHG emissions and energy production and consumption in Australia. The first reporting period under the Act commenced on 1 July 2008. The NGER Act requires controlling corporations to register and report if they emit GHGs, produce energy, or consume energy at or above specified quantities per financial year (1 July to 30 June). The reporting timeline is shown in **Figure 2**. Corporations emitting the greatest amount of GHG or consuming the most energy were initially targeted for the first phase, while corporations with lower emission and energy consumption levels are now being incorporated. The final threshold is 50 kilotonnes of CO_2 equivalent or 200 terajoules of energy.

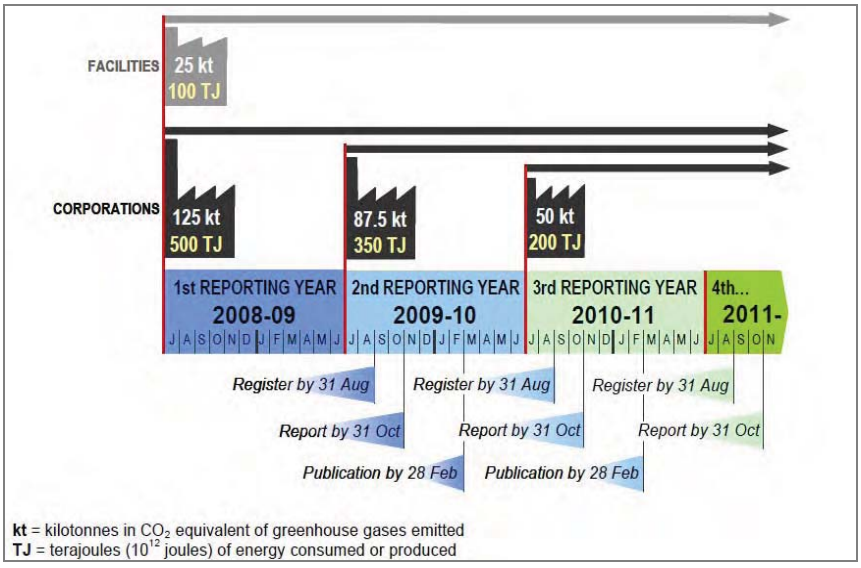

Figure 2: NGER Reporting Timeline

Corporations, such as Centennial Newstan, that meet the NGER thresholds must report on:

- GHG emissions;
- Energy production; and
- Energy consumption.

The NGER (Measurement) Determination 2008 outlines calculation methods and criteria for GHG emissions, energy production and consumption. The Determination provides for four methods of calculation:

- Method 1 (default method) is derived from the National Greenhouse Accounts methods, and is based on national average estimates;
- Method 2 is a facility-specific method that uses industry practices for sampling and Australian or equivalent standards for analysis;
- Method 3, which is the same as Method 2 but is based on Australian or equivalent standards for both sampling and analysis; and
- Method 4, which relates to direct measurement of emissions by continuous or periodic emissions monitoring.

The specific methods used by Centennial Newstan for all emission sources, energy produced, and energy consumed is as detailed in appendix 1.

4.0 Emissions Estimates

4.1 Methodology

Estimation of the GHG emissions associated with the existing approved operations and proposed Project was undertaken using the emission factors and methods outlined in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 and complementary to the National Greenhouse Accounts (NGA) Factors (June, 2009). The NGA Factors provide three types of assessment categories:

- **Scope 1**, which covers direct emissions from sources within the boundary of an organisation, such as fuel combustion and manufacturing processes;
- **Scope 2**, which covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation; and
- **Scope 3**, which includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation; that is, emissions associated with the production of fuels and emissions from the generation of purchased electricity (external emissions).

Annual emissions from the following sources were assessed, based on information provided by Centennial Newstan:

- Emissions from combustion of fuel by on-site vehicles used to transport staff and materials associated with operations and to handle and manage the mine's small ROM coal stockpile (Scope 1);
- Emissions from the use of Liquefied Petroleum Gas (LPG), sulphur hexafluoride (SF_6), and oils and greases (Scope 1);
- Fugitive emissions from the extraction of coal (Scope 1);
- Fugitive emissions from post mining activities (stockpiled coal) (Scope 1);
- Electricity use (Scope 2 and 3);
- Indirect emissions from the combustion of the coal produced at Newstan Colliery by (Scope 3).

Newstan provided historical electricity and diesel use for the period – 2008/09, 2009/10 and predicted electricity and diesel use for the Newstan Colliery operating at 1 Mtpa.

Centennial Newstan monitors fugitive emissions associated with the extraction of coal at the ventilation shaft on a monthly basis as required by the NGER Act 2007. The mine monitoring data indicate that the gas concentration in the ventilation flow is in the main related to existing West Borehole Seam established workings and with some additional influence by production levels. As such, the fugitive emissions measured between July 2008 and June 2009 has been taken to be indicative of the mine fugitive emission characteristic and potential future emissions have been extrapolated considering changes in production and ventilation expected for the project (refer to **Section 4.2.5**).

The historical and predicted data for Newstan have been presented in a form consistent with the Commonwealth Department of Climate Change NGERS report as outlined in appendix 1.

4.2 Emission Estimates

4.2.1 Combustion of Liquid Fuel (Scope 1)

Fuel Combustion

The combustion of diesel fuel in vehicles is a source of GHGs. For this assessment, diesel-powered mobile vehicles used on site were included in the assessment. Emission factors for transport-related emissions are shown in **Table 3**.

Table 3: Emission Factors – Diesel Fuel Combustion (Transport)

Transport equipment type	Energy content factor	Emission Factor (kg CO_2-e/GJ)		
	(GJ/kL)	CO_2	CH_4	N_2O
General transport	38.6	69.2	0.2	0.5
Source: Schedule 1 Part 4 Item 54, NGERS Measurement Determination 2008				

Estimated emissions from diesel fuel combustion - Page 65, clause 2.41 Method 1 National Greenhouse and Energy Reporting (Measurement) Determination (2008) (refer to appendix 2).

Note: The combustion of liquid fuels produces emissions of carbon dioxide, methane and nitrous oxide.

Diesel usage at the Newstan Colliery is related to the coal production being the requirement to transport men in and out of the mine, the supply of support materials to the working faces and the handling and management of coal associated with the washing and distribution of coal to customers. Historical and predicted diesel use and the associated production levels are shown in

Table 4. Newstan has applied a key performance indicator (KPI) of 0.00028 kL/ t ROM for future fuel use based on historical production levels and diesel fuel use. This KPI was used to predict fuel use at the proposed maximum production level of up to 1 Mtpa as shown below.

Table 4: Historical and Predicted Diesel Use Data

Period	Year	Production (t ROM)	Diesel Use (kL)
Historical	2008-2009	1,668,877	585
	2009-2010	0	17
Predicted	2010-2011	373,000	73
	2011-2012	1,000,000	282
	2012-2013	1,000,000	282
	2013-2014	1,000,000	282
Maximum Production Predicted from this project	2010-2019	8,400,000	2,366

Emissions associated with the combustion of fuel on-site at Newstan Colliery are shown in

Table 5 (historical) and **Table 6** (proposed). Comparison of the data indicates an estimated emissions reduction of 817 t CO_2-e would result under the proposed production rate of 1 Mtpa.

Table 5: Scope 1 Emissions – Historical Fuel Combustion

Activity Data	Amount (kL)	Energy Content Factor	Energy Content	Emission Factors	Gases	NGERS Method	Scope 1 Emissions (t CO_2-e)
Diesel oil	585	38.6	22,.562	69.2	CO_2	Method 1	1561
				0.2	CH_4		5
				0.5	NO_2		11
Total							**1577**

Table 6: Scope 1 Emissions – Proposed Fuel Combustion

Activity Data	Amount (kL)	Energy Content Factor	Energy Content	Emission Factors	Gases	NGERS Method	Scope 1 Emissions (t CO_2-e)
Diesel oil	282	38.6	10,873	69.2	CO_2	Method 1	752
				0.2	CH_4		2
				0.5	NO_2		5
Total							**760**

4.2.2 Fugitive Emissions from the use of Liquefied Petroleum Gas (LPG) (Scope 1)

The Newstan Colliery uses a small quantity of LPG on site. This usage is not expected to change as a result of the proposed Project. GHG emissions associated with LPG use at the site are summarised in **Table 7**; these represent existing and predicted emissions.

Estimated emissions from Liquefied Petroleum Gas (LPG) combustion – Page 48, 2.2. Method 1, National Greenhouse and Energy Reporting (Measurement) Determination (2008) (refer to appendix 2).

Table 7: Scope 1 Emissions - LPG

Activity Data	Amount (kL)	Energy Content Factor	Energy Content	Emission Factors	Gases	NGERS Method	Scope 1 Emissions (t CO_2-e)
LPG	0.09	25.3	2.227	51.2	CO_2	Method 1	0
				0.1	CH_4		0
				0.03	NO_2		0
Total							0

4.2.3 Fugitive Emissions from Sulphur Hexafluoride (Scope 1)

The mine electrical distribution system uses switchgear insulated by sulphur hexafluoride (SF_6). The quantity of gas within switchgear at the mine is not expected to increase as a result of the proposed Project. GHG emissions associated with SF_6 use at the site are summarised in **Table 8** this data represents existing and predicted emissions

Estimated emissions from sulphur hexafluoride (SF_6) Page 161, chapter 4 - Method 1, National Greenhouse and Energy Reporting (Measurement) Determination (2008) (refer to appendix 2).

Table 8: Scope 1 Emissions – SF6

Activity Data	Amount (t)	Emission Factor	NGERS Method	Scope 1 Emissions (t CO_2-e)
SF_6	0.019	0.005	Method 1	2.27
Total				**2.27**
SF_6 . Global Warming Potential = 23.900				

4.2.4 Emissions from Energy Consumed by other than Combustion (Oils and Greases) (Scope 1)

In 2008/09, the mine consumed 122 kL of oils/ greases in the course of operating and maintaining production and ancillary plant and equipment. During this period, the mine had a total production of 1.67 Mt. GHG emissions associated with this use of materials were equivalent to132.42 t CO_2-e as shown in **Table 9**.

Estimated emissions of CO_2 from combustion of petroleum based oils/ grease from NGERS Determination, Division 2.4.5A - Method 1 (refer to appendix 2).

Table 9: Scope 1 Emissions – Oil/Grease (2008/09 - Existing)

Activity Data	Amount (kL)	Energy Content Factor	Emission Factors	Gases	NGERS Method	Scope 1 Emissions (t CO_2-e)
Petroleum based oils(other than petroleum based oil as fuel)	118.793	38.6	27.9	CO_2	Method 1	128.6
			0	CH_4		0
			0	NO_2		0
Petroleum based greases	3.534	38.6	27.9	CO_2	Method 1	3.83
			0	CH_4		0
			0	NO_2		0
Total						**132.42**

The use of oil/grease at the site is proportional to the coal produced and is expected to decrease proportionally with the proposed operation producing 1 Mtpa compared to 1.67 Mtpa in 2008/09. Predicted emissions associated with the use of oil/grease at the proposed production level of 1 Mtpa are shown in **Table 10** resulting in 53 t CO_2-e less for 2011/12 (refer to appendix 2).

Table 10: Scope 1 Emissions – Oil/Grease (proposed 1mtpa)

Activity Data	Amount (kL)	Energy Content Factor	Emission Factors	Gases	NGERS Method	Scope 1 Emissions (t CO_2-e)
Petroleum based oils(other than petroleum based oil as fuel)	71.18	38.6	27.9	CO_2	Method 1	77.06
			0	CH_4		0
			0	NO_2		0
Petroleum based greases	2.12	38.6	27.9	CO_2	Method 1	2.29
			0	CH_4		0
			0	NO_2		0
Total						**79.35**

4.2.5 Fugitive Emissions from the Extraction of Coal

Fugitive emissions associated with extraction of coal involve emissions of GHGs during production and emissions of residual GHGs from the coal after mining.

Newstan measures fugitive emissions of CH_4 and CO_2 from the mine ventilation shaft on a monthly basis using Method 4 as required by NGERS (refer to appendix 2). Fugitive emissions for July 2008 to June 2009 are presented in **Table 11**.

Table 11: Scope 1 Fugitive Emissions from Coal Extraction (2008/09 – Existing)

Activity Type	Amount	Unit	Gas	NGERS Method	Scope 1 Emissions (t CO_2-e)
Run of mine coal extracted from gassy underground mine	1,668,877	Tonnes of coal	CO_2	Method 4	3,299
			CH_4	Method 4	314,618
Total					**317,917**
Reported in Newstan Colliery NGERS Report, 2008/09					

The predicted fugitive emissions are unlikely to change in response to the proposed Project, rather fugitive emissions are determined on the coal seams being mined.

Total calculated emissions from the ventilation shaft in the 2008/09 financial year were 317,917 t CO_2-e[1]. The predicted emissions for the proposed Project operation at 1 Mtpa were extrapolated taking into account the gas make in the West Borehole Seam, changes in production and ventilation flow. This resulted in predicted fugitive emissions of 259,593 t CO_2-e as presented in **Table 12** which is 58,324 t CO_2-e less than emitted during 2008/09.

Table 12: Scope 1 Estimated Fugitive Emissions from Coal Extraction (proposed)

Activity Type	Amount	Unit	Gas	NGERS Method	Scope 1 Emissions* ($t CO_2$-e)
Run of mine coal extracted from gassy underground mine	1,000,000	Tonnes of coal	CO_2	Method 4	2905
			CH_4	Method 4	256,687
Total					**259,593**
*Calculated from gas density factors and ventilation volumes; data provided by Newstan.					

4.2.6 Fugitive Emissions from Post-Mining Activities (Stockpiled Coal)

Fugitive emissions from post mining activity (stockpiled coal) were estimated in accordance with the NGERS (Measurement) Determination, Method 1 using default values for gassy coal mines. Emissions from the post mining activity coal at the Newstan Colliery were reported in NGERS 2008/09 as 23,364 t CO_2-e and estimated as being 14,000 t CO_2-e for the project proposed production level of 1 Mtpa. This is an estimated reduction of 9,364 t CO_2-e as presented in **Table 13**.

Table 13: Fugitive Emissions – Stockpiled Coal

Scenario	Amount (ROMt)	Emission Factor methane ($t CO_2$-e/t raw coal)*	Fugitive emissions ($t CO_2$-e)
Existing	1,668,877	0.014	23,364
Proposed	1,000,000		14,000
Difference	668,877	-	-9,364
* NGERS Measurement Determination, Chapter 3, Part 3.2 section 3.17 – gassy underground coal mine. A gassy mine is defined as an underground mine that has at least 0.1 % methane in the mine's return ventilation [National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2009]			

Total fugitive emissions associated with the coal mining process would be 259,593 t CO_2-e (extraction of coal) plus 14,000 t CO_2-e (post mining stockpile) or 273,593 t CO_2-e in total. This represents a reduction of approximately 67,788 t CO_2-e per year at the proposed 1 Mtpa production level.

4.2.7 Emissions from Electricity Use (Scopes 2 and 3)

Coal production, coal handling plant and auxiliary equipment, are electrically-powered. Electricity consumption for 2008/09 was 35.52GWh; of this, approximately 60% was used in the production process (i.e. is subject to increase depending on the rate of production), and the other 40% represented base load (ventilation, compressed air, office/bathhouse and workshop facilities). Centennial Newstan estimated electricity consumption for 2011/12 based on the production-related electricity use in line with the proposed Project and increasing mine fan power. 30.7MWh of electricity use for the proposed 1 Mtpa production rate was determined. Results are shown in **Table 14.** The proposed 1 Mtpa production would result in a reduction of 4,281 t CO_2-e scope 2 and 866 t CO_2-e scope 3 or a total of 5147 t CO_2-e per year compared to the 08-09 levels.

Table 14: GHG Emissions from Electricity Use

Emission Type	08-09 Electricity (kWh)	Proposed Electricity (kWh)	Emission Factor (kg CO_2-e/kWh)*	GHG Emissions (t CO_2-e)		
				2008/09	Proposed	Difference
Scope 2	35,520,270	30,709,814	0.89*	31,613	27,332	4,281
Scope 3			0.18**	6,394	5,528	866
Full Fuel Cycle			**1.07**	**38,007**	**32,860**	**5,147**

** NGERS (Measurement) Determination 2008, Schedule 1, Part 6, Item 77*

***Table 39, NGA Factors, June 2009*

4.2.8 External Emissions (Scope 3)

External emissions are those associated with the operations of a facility but are not under the control of the facility. The external emission sources investigated in this assessment were derived from the hypothetical combustion of the maximum permitted ROM coal produced by Newstan Colliery per annum. The emission factors for calculating emissions from the combustion of black coal are shown in **Table 15**.

Table 15: Emission Factors - Combustion of Coal

Fuel type	Energy content factor (GJ/t)	Emission Factor (kg CO_2-e/GJ)		
		CO_2	CH_4	N_2O
Black coal (other than that used to produce coke)	27	88.2	0.03	0.2
Source: Table 1 of NGA Factors, June 2009				

The above emission factors were used to calculate the emissions associated with the combustion of the coal produced by the Newstan Colliery; results are outlined in **Table 16**.

Table 16: External Emissions - Combustion of Newstan Coal

Greenhouse Gas	Estimated GHG Emissions (t CO_2-e)		
	Existing	Proposed	Difference
CO_2	3,974,264	2,381,400	**1,592,864**
CH_4	1,352	810	**542**
N_2O	9,012	5,400	**3,612**
Total	**3,984,627**	**2,387,610**	**1,597,017**

As shown, the proposed 1 Mtpa production at the mine will contribute emissions (external to the site) of 2,387,610 t CO_2-e compared to 3,984,627 t CO_2-e for the 08-09 year (last year of production prior to care and maintenance). At the proposed 1 Mtpa rate there will be an estimated emissions saving as a result of consumption of the mine production external to the site of 1,597,017 t CO_2-e.

4.3 Emissions Summary

Emissions estimates from all sources described above are summarised in **Table 17**.

Table 17: Annual Greenhouse Gas Emissions Summary

Scope	Activity	Estimated Emissions (t CO_2-e)		
		08-09	Proposed	Difference
1	On-site transport (diesel oil)	1577	760	-817
	LPG	0	0	0
	SF_6	2.27	2.27	0
	Oil and grease	132	79	-53
	Extraction of coal	317,917	259,593	-58,324
	Stockpiled coal	23,364	14,000	-9,364
2	Electricity use	31,613	27,332	-4,281
	Total Scope 1 and 2 (mine operations only)	**374,605**	**301,766**	**-72,939**
3	*Electricity*	6,394	5,528	-866
	Combustion of mined coal	3,984,627	2,387,610	-1,597,017
	Total Scope 3	**3,991,021**	**2,393,138**	**-1,597,883**
	Total Scope 1,2 and 3	***4,365,626***	***2,694,904***	***-1,670,722***

The existing mine operations generated an estimated 0.375 Mt CO_2-e for 2008/09. Emissions would reduce to approximately 0.302 Mt CO_2-e at the proposed maximum production rate of 1 Mtpa. Fugitive emissions associated with the extraction of coal are the greatest source of emissions associated with on-site activities.

When indirect emissions (Scope 3), electricity emissions and emissions associated with the combustion of the produced coal, are taken into account, the emissions increase to 3.99 Mtpa CO_2-e and 2.34 Mtpa CO_2-e respectively. As indicated, combustion of the coal by others generates the most GHG emissions of all activities related to the site's operations.

At the proposed production level of 1 Mtpa, Newstan Colliery's total Scope 1 and 2 emissions represent an approximate decrease of 19% over 08-09 site emissions. On-site emissions represent approximately 0.94 % of coal mining emissions in Australia and 0.053% of total Australian emissions.

4.4 Emission Reduction Opportunities

As shown in **Table 17**, the greatest emission sources associated with the proposed Project are those associated with the combustion of the coal (Scope 3) followed by fugitive emissions from the mine (Scope 1). The combustion of the coal is not controllable by Centennial Newstan and the most likely method of reducing GHG emissions on the site is likely to be through the ongoing implementation of the Newstan Colliery's Energy Saving Action Plan (ESAP) that will continue to identify where potential savings in fuel and electricity could be made, together with the subsequent implementation of energy efficiency strategies where practical.

In addition, Centennial Coal will commit to the mitigation and offset of Scope 1 emissions across the Group, specifically by:

- Undertaking research into reducing the emissions generated by ventilation air methane (VAM). This includes government funding to investigate VAM technology at Mandalong Mine, and if proven successful and cost effective, then this technology will provide opportunities at other mines; and
- Committing to offset 10% of its Scope 1 and Scope 2 emissions per annum. This commitment will coincide with the reporting and auditing obligations outlined under the NGER Act, whereby the tonnes of

CO_2-e offset each year will go through a rigorous verification process. These offsets will be located in Australia, will be accredited to a recognised scheme or standard (or in the process of achieving accreditation), will be independently verified, and will be undertaken in accordance with any relevant Australian government policies and standards at that time. These offsets will be put in place where opportunities to avoid or mitigate emissions are not available, or until a National emissions trading scheme is imposed on the Colliery.

5.0 Conclusion

The Newstan Colliery proposes to recommence operations at the Colliery at a reduced production rate of 1 Mtpa.

Operations at the site generate GHG emissions associated with:

- Emissions from combustion of fuel by on-site vehicles used to transport men and materials associated with operations and to handle and manage the mine's small ROM coal stockpile (Scope 1);
- Emissions from the use of Liquefied Petroleum Gas (LPG), sulphur hexafluoride (SF_6), and oils and greases (Scope 1);
- Fugitive emissions from the extraction of coal (Scope 1);
- Fugitive emissions from post mining activities (stockpiled coal) (Scope 1);
- Electricity use (Scope 2 and 3);
- Indirect emissions from the combustion of the coal produced by Newstan Colliery (Scope 3).

Centennial Newstan provided historical electricity and diesel use for the period 2006/07 – 2008/09 and expected electricity and diesel use for the Newstan Colliery operating at 1 Mtpa for 2011/12 – 2013/14.

The historical data provided and predictions were used in the estimates for the projects emissions as described. The Newstan Colliery monitors fugitive emissions associated with the extraction of coal at the ventilation shaft on a monthly basis to meet the requirements of the NGER Act 2007. The mine will operate in the West Borehole seam, and since the monitoring data indicate that the gas concentration in the ventilation flow is related to the gassy West Borehole workings and coal production levels, the fugitive emissions measured and coal production figures for July 2008 and June 2009 were used to evaluate the impact of reducing production to 1 Mtpa on estimated future fugitive emissions.

The proposed project will decrease the potential GHG emissions from Newstan Colliery by approximately 19% of the emissions emitted during 08-09

External emissions associated with the combustion of the coal to generate electricity at a power station represent the greatest proportion of emissions associated with the site's activities (on-site and external). The proposed production of 1 Mtpa will additionally result in a reduced external emission level of about 40%

Centennial Newstan will commit to offset 10% of its Scope 1 and Scope 2 emissions per annum. Additionally, the ongoing implementation of the Newstan Colliery's ESAP will continue to identify where potential savings in fuel and electricity could be made.

GHG emission levels of the on-site activities represent approximately 0.053 % of total Australian emissions being a small percentage reduction (0.013 %) from the historical emissions levels.

6.0 Appendices

Appendix 1 - Climate Change Data Availability Guideline

Centennial Coal	Guideline
CLIMATE CHANGE DATA AVAILABILITY GUIDELINE	

1. PURPOSE

The purpose of this guideline is to:

- Ensure that only Climate Change Data related to Centennial Coal Company and its operations that has been independently audited and verified as complying with NGERS Legislation can be provided to other organisations.
- Ensure that before any Climate Change Data is provided to any 3rd party it is reviewed and approved by Centennial Coal Company's Group Environment Manager.
- Ensure that before any Climate Change Data modelling is provided to any 3rd party it is reviewed and found to be consistent with the changes in operations to be modelled.

2. SCOPE and APPLICATION

This guideline applies to all Centennial's operations, including corporate and regional offices, and where applicable, operations and activities not specifically on Centennial controlled premises, where these activities must be accounted for in Centennial's GHG emissions data.

Assessment of Climate Change Data to reflect changes in the activities at Centennial Coal Company and or any of its operations is to be based on comprehensive analysis.

3. PROCEDURE and TIMETABLE

3.1 Site Climate Change Data

- Site Climate Change Data will be measured and recorded as provided for in Measurement Standard - NGERS and GHG Emission Measurement Standard.
- Monthly Site Climate Change Data is to be entered into the facility NGERS Data Summary.
- Facility NGERS Data summary is to be included in the monthly site operational reports
- Group NGERS Data is collated and reviewed monthly by the Corporate NGERS coordinating Officer.
- Collated annual NGERS Data suitable for entry into the online reporting system (OSCAR) will be finalised by July 31 each year.
- Annual NGERS Data will be audited by a suitably qualified external Auditor by August 31 each year.

  Annual NGERS Data will be reported to Department of Climate Change (DCC) using OSCAR by October 30 each year

4. CLIMATE CHANGE DATA PRESENTATION

4.1 Site Climate Change Data presentation is to be consistent with the Department of Climate

Change Annual NGERS Data Report.

4.1.1 NGERS require Centennial operations to report emissions (t CO_2-e) from the following sources:

- Extraction of coal from Open Cut mines.
- Extraction of coal from Underground mines.
- Flaring of gas.
- Venting or other fugitive release before extraction of coal.
- Post Mining activities.
- Decommissioned mines
- Electricity consumed
- Diesel/ Gasoline Fuel consumed
- Liquefied Petroleum Gas (LPG) consumed
- Oils and Greases consumed
- Sulphur Hexafluoride (SF_6)
- Hydro fluorocarbons (HFCs)

4.1.2 NGERS also require centennial operations to report energy (GJ) consumption

- Electricity
- Diesel/ Gasoline
- Oils/ Greases
- Liquefied Petroleum Gas (LPG)

4.1.3 NGERS also require centennial operations to report energy (GJ) production

- Black coal other than that used to produce coke

4.1.4 For the purpose of estimating future emissions, energy use and energy production by Centennial operations directly or by 3rd parties

- Estimates/ modelling carried out MUST use the latest independently audited and verified data.
- Extrapolation to predict future emissions, energy use and energy production is to be based on detailed facility planning
- Facility GHG emissions and energy data table formats consistent with NGERS report to be used to by both Centennial operations or 3rd parties to display actual and future estimates of GHG emissions, energy use and energy production

4.1.5 Data in table form is to be presented using the following templates

Facility GHG emissions and energy data summary tables

GHG EMISSIONS			ENERGY	
Scope 1 ($t CO_2$-e)	Scope 2 ($t CO_2$-e)	Total of Scope 1 and Scope 2 ($t CO_2$-e)	Energy Consumed (GJ)	Energy Produced (GJ)

GHG Scope 1 Emission By Gas						
CO_2 Carbon Dioxide	CH_4 Methane	NO_2 Nitrous oxide	Perfluorocarbon CF_4 Tetrafluoro methane	Perfluorocarbon C_2F_6 Tetrafluoro ethane	SF_6 Sulphur Hexafluoride	HFCs Hydro fluorocarbons

Scope 1

Source Name	Activity Data Name	Activity Data Context Name	Criteria	Amount	Unit	Energy Content Factor	Energy Content	Emission Factors	Gas	Method	Scope 1 ($t CO_2$-e) Carbon Dioxide Equivalent
Other Stationary	*LPG*	*Non-Transport*	*A*	*Non-Transport*	*kL*	*25.3*		*51.2*	CO_2	*Method 1*	
								0.1	CH_4	*Method 1*	
								0.03	NO_2	*Method 1*	
Transport	*Diesel Oil*		*AA*	*Transport*	*kL*	*38.6*		*69.2*	CO_2	*Method 1*	
								0.2	CH_4	*Method 1*	
								0.5	NO_2	*Method 1*	
Transport	*Diesel Oil*		*A*	*Transport*	*kL*	*38.6*		*69.2*	CO_2	*Method 1*	
								0.2	CH_4	*Method 1*	
								0.5	NO_2	*Method 1*	
										TOTAL	

Greenhouse gas Emissions

Gas Insulated Switchgear and Circuit Breaker Application

Activity Type	Activity Context	Criteria	Amount	Unit	Gas	Method	Scope 1 ($t CO_2$-e) Carbon Dioxide Equivalent
Gas Insulated Switchgear and Circuit Breaker applications – SF_6 - Stock	*Synthetic Gases*	*AA*		*Tonnes*	*SF_6*	*Method 1*	
						TOTAL	

Post Mining Activities

Activity Type	Activity Context	Criteria	Amount	Unit	Gas	Method	Scope 1 ($t CO_2$-e) Carbon Dioxide Equivalent
Run of mine coal extracted from gassy underground mine (post mining)	*Fugitives*	*AAA*		*Tonnes*	*CH_4*	*Method 1*	
						TOTAL	

Underground Mine

Activity Type	Activity Context	Criteria	Amount	Unit	Gas	Emission Factor	Method	Scope 1 ($t CO_2$-e) Carbon Dioxide Equivalent
Run of mine coal extracted from gassy or non gassy underground mine	*Fugitives*	*AA*		*Tonnes*	*CO_2*		*Method 4*	
					CH_4		*Method 4*	
							TOTAL	

Open Cut Mine

Activity Type	Activity Context	Criteria	Amount	Unit	Gas	Emission Factor	Method	Scope 1 ($t CO_2$-e) Carbon Dioxide Equivalent
Run of mine coal extracted Open Cut Mine	*Fugitives*	*AA*		*Tonnes*	*CO_2*		*Method 1*	
					CH_4		*Method 1*	
							TOTAL	

Source Information

Name	Entered Amount	Unit
Methane captured for Production		*Tonnes*
Methane transferred of site		*Tonnes*
Methane Flared		*Tonnes*

4.1.6.3 Scope 2

Source Name	Activity Data Name	Activity Data Context Name	Criteria	Amount	Units	Scope 2 ($t CO_2$-e) Carbon Dioxide Equivalent
Energy commodities	*Electricity*	*Energy commodities*			*kWh*	
					TOTAL	

Other Energy Production

Energy Type	Criteria	Amount	Units	Converted Amount
Black coal (other than used to produce coke)			*Tonnes*	
			TOTAL	

Energy consumed by means of combustion for transport

Source Name	Activity Type	Activity type context	Usage	Criteria	Amount	Units	Energy Content Factor	Converted Amount
Transport	*Diesel Oil*	*Transport*	*Combusted*	*A*		*kL*	*38.6*	
Transport	*Diesel Oil*	*Transport*	*Combusted*	*AA*		*kL*	*38.6*	
							TOTAL	

Energy consumed by means of combustion for a purpose other than producing electricity, a chemical or metal product or for transport

Source Name	Activity Type	Activity type context	Usage	Criteria	Amount	Units	Energy Content Factor	Converted Amount
Other stationary	*LPG*	*Non-Transport*	*Combusted*	*A*		*kL*	*25.3*	
							TOTAL	

Energy consumed by means other than combustion

Source Name	Activity Type	Activity type context	Usage	Criteria	Amount	Units	Energy Content Factor	Converted Amount
Energy commodities	*Electricity*	*Energy commodity*	*Combusted*			*kWh*	*O.004*	
Energy consumed(not combusted)	*Petroleum based oils(other than petroleum based oil as fuel)*	*Non-Transport*	*Non-Combusted*	*A*		*kL*	*38.8*	
Energy consumed(not combusted)	*Petroleum based greases*	*Non-Transport*	*Non-Combusted*	*A*		*kL*	*38.8*	
							TOTAL	

Summary Table

Categories	Converted Amount	Unit
Amount of Energy consumed by means of combustion		*GJ*
Energy consumed by means other than combustion		*GJ*
		TOTAL

5 DEFINITIONS

The following definitions will be used in the Investment / Project Evaluation Procedure to maintain consistency:

Term	Definition
tCO_2-e	Tonnes of CO_2 equivalent
Controlling Corporation	A term defined in the NGER Act. For the purposes of this Standard, the Controlling Corporation is Centennial Coal Company Limited
Facility	A term defined in the NGER Act to describe an operation, site or activity that reports GHG emissions.
GHG	Greenhouse Gas
NGERS	The National Greenhouse and Energy Reporting System
NGER Act	The National Greenhouse and Energy Reporting Act 2007
NGERS (Measurement) Determination	The NGERS (Measurement) Determination 2009
NGERS Technical Guidelines	The NGERS Measurement Technical Guidelines dated June 2009
Operation Boundary	A term defined in the NGER Act that defines the extent of activities to be included in a Facility.
OSCAR	Online System for Comprehensive Activity reporting - the database and reporting system established by the Federal Government for the upload and reporting of Facility data pursuant to the NGER Act.

6 REFERENCES

6.1 Legislation

The National Greenhouse and Energy Reporting Act 2007

The Coal Health and Safety Act 2006 and Regulations

The Mining Act 2002 and Regulations

6.2 Standards

NGERS Technical Guidelines

NGERS Measurement Determination

NGERS Reporting Guidelines

National Greenhouse Accounts (NGA) factors

Centennial Coal - Management Standard - NGERS and GHG Emission Measurement Standard

6.3 Procedures and Policies

Facility NGERS Management Plan

Appendix 2 - Outline of Methods used by Centennial to Estimate Emissions in accordance with the NGERS Legislation

Fugitive emissions from extraction of coal (Subdivision 3.2.2.2)

3.6 Method 4 — extraction of coal

(1) For paragraph 3.4 (2) (b) and subsection 3.4 (3), method 4 is:

$$E_j = CO_{2\text{-}e_{j\ gen,\ total}} - \gamma_j \left(Q_{ij,cap} + Q_{ij,flared} + Q_{ijtr} \right)$$

Where:

E**j* is the fugitive emissions of gas type (j***) that result from the extraction of coal from the mine during the year, measured in CO_2-e tonnes.

CO2-e** j gen, total* is the total mass of gas type (j***) generated from the mine during the year before capture and flaring is undertaken at the mine, measured in CO_2-e tonnes and estimated using the direct measurement of emissions in accordance with subsection (2).

γj is the factor for converting a quantity of gas type (***j***) from cubic metres at standard conditions of pressure and temperature to CO_2-e tonnes, being:

(a) For methane — $6.784 \times 10^{-4} \times 21$; and

(b) For carbon dioxide — 1.861×10^{-3}.

Qij,cap is the quantity of gas type (***j***) in coal mine waste gas type (***i***) captured for combustion from the mine and used during the year, measured in cubic metres and estimated in accordance with Division 2.3.6.

Qij,flared is the quantity of gas type (***j***) in coal mine waste gas type (***i***) flared from the mine during the year, measured in cubic metres and estimated in accordance with Division 2.3.6.

Qijtr is the quantity of gas type (***j***) in coal mine waste gas type (***i***) transferred out of the mining activities during the year measured in cubic metres.

(2) The direct measurement of emissions released from the extraction of coal from an underground mine during a year by monitoring the gas stream at the underground mine may be undertaken by one of the following:

(a) Continuous emissions monitoring (***CEM***) in accordance with Part 1.3;

(b) Periodic emissions monitoring (***PEM***) in accordance with sections 3.7 to 3.12.

(3) For ***Qijtr*** in subsection (1), the quantity of gas type (***j***) must be estimated in accordance with Division 2.3.6 as if a reference in that Division to quantities of gaseous fuels combusted from the operation of a facility was a reference to quantities of gaseous fuels transferred out of the operation of a facility.

3.7 Estimation of emissions

(1) To obtain an estimate of the mass emissions rate of gas (***j***), being methane and carbon dioxide, at the time of measurement at the underground mine, the formula in subsection 1.21 (1) must be applied.

(2) The mass of emissions estimated under the formula must be converted into CO_2-e tonnes.

(3) The average mass emission rate for gas type (***j***) measured in CO_2–e tonnes per hour for a year must be calculated from the estimates obtained under subsections (1) and (2).

(4) The total mass of emissions of gas type (***j***) from the underground mine for the year is calculated by multiplying the average emissions rate obtained under subsection (3) by the number of hours during the year. Part 1.3 Method 4 — Direct measurement of emissions

Division 1.3.1 Preliminary

1.20 Overview

(1) This Chapter provides for method 4 for a source.

Note Method 4 as provided for in this Part applies to a source as indicated in the Chapter, Part, Division or Subdivision dealing with the source.

(2) Method 4 requires the direct measurement of emissions released from the source from the operation of a facility during a year by monitoring the gas stream at a site within part of the area (for example, a duct or stack) occupied for the operation of the facility.

(3) Method 4 consists of the following:

(a) Method 4 (CEM) as specified in section 1.21 that requires the measurement of emissions using continuous emissions monitoring (***CEM***);

(b) Method 4 (PEM) as specified in section 1.27 that requires the measurement of emissions using periodic emissions monitoring (***PEM***).

Division 1.3.2 Operation of method 4 (CEM)

Subdivision 1.3.2.1 Method 4 (CEM)

1.21 Method 4 (CEM) — estimation of emissions

(1) To obtain an estimate of the mass of emissions of a gas type (***j***), being methane, carbon dioxide or nitrous oxide, released at the time of measurement at a monitoring site within the area occupied for the operation of a facility, the following formula must be applied:

$$M_{jct} = \frac{MM_j \times P_{ct} \times FR_{ct} \times C_{jct}}{8.314 T_{ct}}$$

Where:

M_{jct} is the mass of emissions in tonnes of gas type (***j***) released per second.

MM_j is the molecular mass of gas type (***j***) measured in tonnes per kilomole which:

(a) For methane is 16.04×10^{-3}; or

(b) For carbon dioxide is 44.01×10^{-3}; or

(c) For nitrous oxide is 44.01×10^{-3}.

P_{ct} is the pressure of the gas stream in kilopascals at the time of measurement.

FR_{ct} is the flow rate of the gas stream in cubic metres per second at the time of measurement.

C_{jct} is the proportion of gas type (***j***) in the volume of the gas stream at the time of measurement.

T_{ct} is the temperature, in degrees Kelvin, of the gas at the time of measurement.

(2) The mass of emissions estimated under subsection (1) must be converted into CO_2-e tonnes.

(3) Data on estimates of the mass emissions rates obtained under subsection (1) during an hour must be converted into a representative and unbiased estimate of mass emissions for that hour.

(4) The estimate of emissions of gas type (***j***) during a year is the sum of the estimates for each hour of the year worked out under subsection (3).

(5) The total mass of emissions for a gas from the source for the year calculated under this section must be reconciled against an estimate for that gas from the facility for the same period calculated using method 1 for that source.

Division 2.4.1 Preliminary

2.39 Application

This Part applies to liquid fuels.

2.39A Definition of *petroleum based oils* for Part 2.4

In this Part:

Petroleum based oils means petroleum based oils (other than petroleum based oils used as fuel).

(iv) Method 4 under Part 1.3; and Part 2.4 Emissions released from the combustion of liquid fuels

Available methods

(1) Subject to section 1.18, for estimating emissions released from the combustion of a liquid fuel, other than petroleum based oils and petroleum based greases, consumed from the operation of a facility during a year:

(a) One of the following methods must be used for estimating emissions of carbon dioxide:

(i) Method 1 under section 2.41;

(ii) Method 2 under section 2.42;

(iii) Method 3 under section 2.47;

(iv) Method 4 under Part 1.3; and

(b) One of the following methods must be used for estimating emissions of methane and nitrous oxide:

(i) Method 1 under section 2.41;

(ii) Method 2 under section 2.48.

2.40

(2) Under paragraph (1) (b), the same method must be used for estimating emissions of methane and nitrous oxide.

(3) However, for incidental emissions another method may be used that is consistent with the principles in section 1.13.

Note The combustion of liquid fuels releases emissions of carbon dioxide, methane and nitrous oxide. Method 1 may be used to estimate emissions of each of these gases. There is no method 3 or 4 for emissions of methane or nitrous oxide.

Subdivision 2.4.1.2 Liquid fuels — petroleum based oils and greases

2.40A Available methods

(1) Subject to section 1.18, for estimating emissions of carbon dioxide released from the consumption, as lubricants, of petroleum based oils or petroleum based greases, consumed from the operation of a facility during a year, one of the following methods must be used:

(a) Method 1 under section 2.48A;

(b) Method 2 under section 2.48B;

(c) Method 3 under section 2.48C.

(2) However, for incidental emissions, another method may be used that is consistent with the principles in section 1.13.

Note The consumption of petroleum based oils and greases, as lubricants, releases emissions of carbon dioxide. Emissions of methane and nitrous oxide are not estimated directly for this fuel type.

Division 2.4.2 Method 1 — emissions of carbon dioxide, methane and nitrous oxide from liquid fuels other than petroleum based oils or greases

2.41 Method 1 — emissions of carbon dioxide, methane and nitrous oxide

(1) For subparagraphs 2.40 (1) (a) (i) and (b) (i), method 1 for estimating emissions of carbon dioxide, methane and nitrous oxide is:

$$E_{ij} = \frac{Q_i \times EC_i \times EF_{ijoxec}}{1\,000}$$

Where:

E_{ij} is the emissions of gas type (***j***), being carbon dioxide, methane or nitrous oxide, released from the combustion of fuel type (***i***) from the operation of the facility during the year measured in CO_2-e tonnes.

Q_i is the quantity of fuel type (***i***) combusted from the operation of the facility for:

(a) Stationary energy purposes; and

(b) Transport energy purposes;

during the year measured in kilolitres and estimated under Division 2.4.6.

$EC_{i\ is}$ the energy content factor of fuel type ***(i)*** estimated under section 6.5.

EF_{ijoxec} is the emission factor for each gas type (***j***) released from the operation of the facility during the year (which includes the effect of an oxidation factor) measured in kilograms CO_2-e per gigajoule of fuel type (***i***) according to source as mentioned in:

(a) for stationary energy purposes — Part 3 of Schedule 1; and

(b) for transport energy purposes — Division 4.1 of Schedule 1.

(2) In this section:

stationary energy purposes means purposes for which fuel is combusted that do not involve transport energy purposes.

transport energy purposes includes purposes for which fuel is combusted that consist of:

(a) transport by vehicles registered for road use; and

(b) rail, marine navigation and air transport.

Note The combustion of liquid fuels produces emissions of carbon dioxide, methane and nitrous oxide.

Division 2.4.5A Methods for estimating emissions of carbon dioxide from petroleum based oils or greases

2.48A Method 1 — estimating emissions of carbon dioxide using an estimated oxidation factor

(1) For paragraph 2.40A (1) (a), method 1 for estimating emissions of carbon dioxide from the consumption of petroleum based oils or petroleum based greases using an estimated oxidation factor is:

$$E_{pogco2} = Q_{pog} \times EC_{pogco2} \times \frac{EF_{pogco2oxec}}{1\,000}$$

where:

***E*$_{pogco2}$** is the emissions of carbon dioxide released from the consumption of petroleum based oils or petroleum based greases from the operation of the facility during the year measured in CO_2-e tonnes.

***Q*$_{pog}$** is the quantity of petroleum based oils or petroleum based greases consumed from the operation of the facility for stationary energy purposes.

***EC*$_{pogco2}$** is the energy content factor of petroleum based oils or petroleum based greases measured in gigajoules per kilolitre as mentioned in Part 3 of Schedule 1.

***EF*$_{pogco2oxec}$** has the meaning given in subsection (2).

(2) ***EF*$_{pogco2oxec}$** is:

(a) the emission factor for carbon dioxide released from the operation of the facility during the year (which includes the effect of an oxidation factor) measured in kilograms CO_2-e per gigajoule of the petroleum based oils or petroleum based greases as mentioned in Part 3 of Schedule 1; or

(b) to be estimated as follows:

$$EF_{pogco2oxec} = OF_{pog} \times EF_{pogco2ec}$$

where:

***OF*$_{pog}$** is the estimated oxidation factor for petroleum based oils or petroleum based greases.

***EF*$_{pogco2ec}$** is 69.9.

(3) For ***OF*$_{pog}$** in paragraph (2) (b), estimate as follows:

$$OF_{pog} = \frac{\left(C_{pog} - \text{Waste Oil}_{pog}\right)}{C_{pog}}$$

where:

***C*$_{pog}$** is the consumption of petroleum based oils or petroleum based greases estimated in accordance with Division 2.4.6.

***Waste Oil*$_{pog}$** is the quantity of waste oils, derived from petroleum based oils or petroleum based greases, transferred outside the facility, and estimated in accordance with Division 2.4.6.

Part 4.5 Industrial processes — emissions of hydro fluorocarbons and sulphur hexafluoride gases

4.97 Application

This Part applies to emissions of hydro fluorocarbons and sulphur hexafluoride gases.

4.98 Available method

(1) Subject to section 1.18, for estimating emissions of hydro fluorocarbons or sulphur hexafluoride during a year from the operation of a facility that is constituted by synthetic gas generating activities, one of the following methods must be used:

(a) method 1 under section 4.102;

(b) method 2, for both hydro fluorocarbons and sulphur hexafluoride, under section 4.103;

(c) method 3:

(i) for hydro fluorocarbons under subsection 4.104 (1); and

(ii) for sulphur hexafluoride under subsection 4.104 (2).

(2) However, for incidental emissions another method may be used that is consistent with the principles in section 1.13.

Note There is no method 4 for this Part.

4.99 Meaning of *hydro fluorocarbons*

Hydro fluorocarbons means any of the hydro fluorocarbons listed in the table in regulation 2.04 of the Regulations.

4.100 Meaning of *synthetic gas generating activities*

Hydro fluorocarbons

(1) ***Synthetic gas generating activities***, for emissions of hydro fluorocarbons, are activities of a facility that:

(a) require the use of any thing:

(i) mentioned in paragraph 4.16 (1) (a) of the Regulations; and

(ii) containing a refrigerant charge of more than 100 kilograms of refrigerants for each unit; and

(iii) using a refrigerant that is a greenhouse gas with a Global Warming Potential of more than 1 000; and

(b) are attributable primarily to any one of the following ANZSIC industry classifications:

(i) food product manufacturing (ANZSIC classification, Subdivision 11);

(ii) beverage and tobacco product manufacturing (ANZSIC classification, Subdivision 12);

(iii) retail trade (ANZSIC classification, Division G);

(iv) warehousing and storage services (ANZSIC classification, number 530);

(v) wholesale trade (ANZSIC classification Division F);

(vi) rental, hiring and real estate services (ANZSIC classification, Division L).

Sulphur hexafluoride

(2) ***Synthetic gas generating activities***, for emissions of sulphur hexafluoride, are any activities of a facility that emit sulphur hexafluoride.

4.101 Reporting threshold

For paragraph 4.22 (1) (b) of the Regulations, the threshold mentioned in column 3 of an item in the following table resulting from a provision of this Determination mentioned in column 2 of that item is a reporting threshold.

Item	Provision in Determination	Threshold
1	Subparagraph 4.100 (1) (a) (ii)	100 kilograms for each unit (hydro fluorocarbons)
2	Subsection 4.100 (2)	Any emission (sulphur hexafluoride)

4.102 Method 1

(1) Method 1 is:

$$E_{jk} = Stock_{jk} \times L_{jk}$$

where:

E_{jk} is the emissions of gas type (***j***), either hydro fluorocarbons or sulphur hexafluoride, summed over each equipment type (***k***) during a year measured in CO_2-e tonnes.

$Stock_{jk}$ is the stock of gas type (***j***), either hydro fluorocarbons or sulphur hexafluoride, contained in equipment type (***k***) during a year measured in CO_2-e tonnes.

L_{jk} is the default leakage rates for a year of gas type (***j***) mentioned in columns 3 or 4 of an item in the table in subsection (4) for the equipment type (***k***) mentioned in column 2 for that item.

(2) For the factor ***$Stock_{jk}$***, an estimation of the stock of synthetic gases contained in an equipment type must be based on one of the following sources:

(a) Stated capacity of the equipment according to the manufacturer's nameplate;

(b) Estimates based on:

(i) The opening stock of gas in the equipment; and

(ii) Transfers into the facility from additions of gas from purchases of new equipment and replenishments; and

(iii) Transfers out of the facility from disposal of equipment or gas.

(3) For equipment type (***k***), the equipment are the things mentioned in sub regulation 4.16 (1) of the Regulations.

(4) For subsection (1), columns 3 and 4 of an item in the following table set out default leakage rates of gas type (***j***), for either hydro fluorocarbons or sulphur hexafluoride, in relation to particular equipment types (***k***) mentioned in column 2 of the item:

Item	Equipment type (*k*)	Default annual leakage rate of gas (*j*)	
		Hydro fluorocarbons	**Sulphur hexafluoride**
1	Commercial air conditioning	0.09	
2	Commercial refrigeration	0.23	
3	Industrial refrigeration	0.16	
4	Gas insulated switchgear and circuit breaker applications		0.005

Chapter 7 Scope 2 emissions

7.1 Outline of Chapter

This Chapter specifies a method of determining scope 2 emissions from the consumption of purchased electricity.

Note Scope 2 emissions result from activities that generate electricity, heating, cooling or steam that is consumed by a facility but that do not form part of the facility (see paragraph 2.23 (2) (b) of the Regulations).

7.2 Method 1 — purchase of electricity from main electricity grid in a State or Territory

(1) The following method must be used for estimating scope 2 emissions released from electricity purchased from the main electricity grid in a State or Territory and consumed from the operation of a facility during a year:

$$Y = Q \times \frac{EF}{1\,000}$$

Where:

Y is the scope 2 emissions measured in CO_2-e tonnes.

Q, subject to subsection (2), is the quantity of electricity purchased from the electricity grid during the year and consumed from the operation of the facility measured in kilowatt hours.

EF is the scope 2 emission factor, in kilograms of CO_2-e emissions per kilowatt hour, for the State or Territory in which the consumption occurs as mentioned in Part 6 of Schedule 1.

Note There is no other method for this section.

(2) For a facility the operation of which is constituted by an electricity transmission network or distribution network, ***Q*** is the quantity of electricity losses for that transmission network or distribution network during the year.

(3) For ***Q***, if the electricity purchased is measured in gigajoules, the quantity of kilowatt hours must be calculated by dividing the amount of gigajoules by 0.0036.

(4) The ***main electricity grid***, for a State or Territory, means:

(a) For Western Australia — the Southwest Interconnected System; and

(b) For each other State or Territory — the electricity grid that provides electricity to the largest percentage of the State's or Territory's population.

7.3 Method 1 — purchase of electricity from other sources

(1) The following formula must be used for estimating scope 2 emissions released from electricity:

(a) Purchased from a grid other than the main electricity grid in a State or Territory; and

(b) Consumed from the operation of a facility during a year:

$$Y = Q \times \frac{EF}{1\,000}$$

Where:

Y is the scope 2 emissions measured in CO_2-e tonnes during the year.

Q, subject to subsection (2), is the quantity of electricity purchased during the year and consumed from the operation of the facility, measured in kilowatt hours.

EF is the scope 2 emission factor, in kilograms of CO_2-e emissions per kilowatt hour, either:

(a) Provided by the supplier of the electricity; or

(b) If that factor is not available, the emission factor for the Northern Territory as mentioned in Part 6 of Schedule 1.

Note There is no other method for this section.

(2) For a facility the operation of which is constituted by an electricity transmission network or distribution network, ***Q*** is the quantity of electricity losses for that transmission network or distribution network during the year.

(3) For ***Q***, if the electricity purchased is measured in gigajoules, the quantity of kilowatt hours must be calculated by dividing the amount of gigajoules by 0.0036