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Berrima Cement Works Mod 9

Greenhouse Gas Assessment

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1 INTRODUCTION

This Greenhouse Gas (GHG) assessment has been prepared by SLR Consulting Australia (SLR) on behalf of Boral Cement Limited (Boral), as part of the Environmental Assessment (EA) that will accompany an application made pursuant to Section 75W of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), seeking modification of the current consent.

The application relates to the Cement Works at New Berrima (the Works) in the Wingecarribee Local Government Area. The cement works operate subject to development consent issued by the Department of Planning and Environment (DA 401-11-2002, May 2003 and DA 85-4-2005, Aug 2005). Eight subsequent modifications have also been approved by DP&E. The location of the site in relation to the local town of New Berrima is shown in **Figure 1**.

An Environment Protection Licence (EPL 1698) issued by the Environment Protection Authority (EPA) is also held by Boral for the operation of the facility.

This modification, Modification 9, seeks approval for the following:

- the use of Solid Waste Derived Fuel as an energy source;
- changes to the air emission limits of particulate matter (PM), nitrous oxides (NOx) and Volatile Organic Compounds (VOC); and
- construction of a fuel storage and kiln feeding system.

Figure 1 Aerial Photograph Showing Proximity to New Berrima Town

1.1 The Project

The Works are a significant contributor to the local economy and are facing increasing pressure from cheaper local imports and rising energy costs. Until recently coal from the Berrima Colliery at Medway has been used to fire the cement kiln. In October 2013 the colliery ceased operation and as such Boral is pursuing other fuel sources to ensure its operation remains economically viable into the future.

1.1.1 Solid Waste Derived Fuels

Boral seeks approval to use solid waste derived fuel in Kiln 6. Subject to approval, Boral proposes to use up to 100,000 tonnes of solid waste derived fuels each year, made up of the following various waste derived fuels:

- AKF-5 (waste tyres) which are already approved for use by the current DA;
- industrial and commercially sourced wood waste; and
- Refuse Derived Fuel (RDF) from municipal waste residues, which would include paper, wood, plastics and organics.

It is the use of these latter two waste derived fuels that are the subject of this modification application. Both are considered to be an ideal fuel source for Kiln 6 and would be sorted, tested and shredded by suppliers to maintain compliance with relevant specifications.

1.1.2 Fuel Storage and Feeding System

The use of waste derived fuels in Kiln 6 beyond trial status has been contingent on Boral obtaining approval to construct the necessary fuel storage and kiln feeding system. The proposed plant and equipment required to store and feed the type of solid waste derived fuels envisaged in Kiln 6 can be seen in Attachment 2.

The storage and handling facility is designed to store and handle solid waste derived fuels such as tyre chips, shredded wood waste and refuse derived fuels (residual municipal waste) received in both bulk and bailed form.

The solid waste fuel storage, handling and feeding system comprises:

- a receival and storage building located on the southern side of the Kiln 6 pre-heater tower. The building will be 33 metres long, 50 metres wide and 13 metres high;
- a de-bailer and walking floor system at the back end of the storage shed;
- an enclosed conveyor from the storage building to the existing pre-calciner vessel located in the preheater tower;
- installing a hopper, screw conveyor and air sealing device around the pre-calciner within the preheater tower; and
- a designated outdoor storage area for solid waste derived fuels in the form of covered (plastic wrapped) bails or within covered delivery vehicles.

1.2 GHG Assessment Objectives

The purpose of this report is to undertake a greenhouse gas assessment that addresses Scope 1, 2 and key Scope 3 emissions relating to the operation of the Project.

2 GREENHOUSE GAS EMISSIONS

2.1 Emission types

The Australian Government Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSTRE) document, "National Greenhouse Accounts Factors" Workbook (NGA Factors) (DIICCSRTE, 2014) defines two types of greenhouse gas emissions (see **Table 1**), *direct* and *indirect*. This assessment seeks to consider both direct emissions and indirect emissions.

Table 1 Greenhouse Gas Emission Types

Emissions	Definition
Direct	Produced from sources within the boundary of an organisation and as a result of that organisation's activities (e.g. consumption of petrol in on-site vehicles).
Indirect	Generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation (e.g. consumption of purchased electricity).

Note: adapted from NGA Factors 2014

2.2 Emission Scopes

The NGA Factors identifies two 'scopes' of emissions for greenhouse gas accounting and reporting purposes as shown in **Table 2**.

Table 2 Greenhouse Gas Scopes

Scope	Definition
Scope 1	Direct (or point-source) emission factors give the kilograms of carbon dioxide equivalent (CO_2-e) emitted per unit of activity at the point of emission release (i.e. fuel use, energy use, manufacturing process activity, mining activity, on-site waste disposal, etc.). These factors are used to calculate scope 1 emissions.
Scope 2	Indirect emission factors are used to calculate scope 2 emissions from the generation of the electricity purchased and consumed by an organisation as kilograms of CO_2-e per unit of electricity consumed. Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station.

A third scope of emissions – *Scope 3 Emissions* are also recognised in some greenhouse gas assessments. The *Greenhouse Gas Protocol (GHG Protocol)* (World Business Council for Sustainable Development 2004) defines Scope 3 emissions as "*other indirect GHG emissions":*

> *Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.*

Scope 3 emissions related to the transport of goods and materials to and from the Project Site are considered in this assessment. Whilst the emissions associated with these activities are from sources not owned or controlled by Boral (e.g. generated by transport contractors), it is noted that these emissions occur as a result of the Project operations and should therefore be considered when conducting an assessment of this nature.

2.3 The Potential Impact of Greenhouse Gas Emissions on the Environment

Increased emissions of GHG are widely accepted to exert a warming influence on climate. Increasing concentrations of the long-lived GHG's (LLGHGs) (CO_2, CH_4, N_2O, halocarbons and SF_6) have led to a combined radiative forcing (RF) of +2.63 [±0.26] Watts per square metre (W m^{-2}) (IPCC 2007). A 9% increase in this RF since the publication of the Third Assessment Report of the IPCC (IPCC 2007) is the result of concentration changes since 1998 (IPCC 2007). The IPCC state that it is very likely that there has been a substantial anthropogenic (man-made) contribution to surface temperature increases in every continent except Antarctica since the middle of the 20th Century, although difficulties exist in the attribution of temperature changes on smaller than continental scales and on timescales of less than 50 years.

Scientists at the 2005 conference, 'Avoiding Dangerous Climate Change: Symposium on Stabilisation of Greenhouse Gases' concluded that at the level of 550 parts per million (ppm) CO_2 concentration, a 2°C increase in global mean temperature above present levels would be experienced, and that stabilisation at a concentration of 400 ppm would be necessary to avoid a 2°C warming. IPCC reports (IPCC 2007) have suggested that stabilising concentrations at 450 ppm by 2020 would only result in a 50% likelihood of limiting global warming to 2°C.

The *Garnaut Climate Change Review* (2008) provides a summary of anticipated impacts on the environment as a result of warming described in the IPCC reports:

> *For the next two decades or so, the major impacts of climate change are likely to include stressed urban water supply and the effects of changes in temperature and water availability on agriculture. All major cities and many regional centres are already feeling the strain of declining rainfall and runoff into streams. Most major cities are beginning to develop high-cost infrastructure for new water sources. In the absence of effective global mitigation, continued investment in expensive new sources of water is likely to be a necessity.*
>
> *By mid-century, there would be major declines in agricultural production across much of the country. Irrigated agriculture in the Murray-Darling Basin would be likely to lose half of its annual output. This would lead to changes in our capacity to export food and a growing reliance on food imports, with associated shifts from export parity to import parity pricing.*
>
> *A no-mitigation case is likely also to see, by mid-century, the effective destruction of the Great Barrier Reef and other reef systems such as Ningaloo. The three-dimensional coral of the reefs is likely to disappear. This will have serious ramifications for marine biodiversity and the tourism and associated service industries reliant on the reefs.*
>
> *By the close of the century, the impacts of a no-mitigation case can be expected to be profound (see Figure 6.2). The increased frequency of drought, combined with decreased median rainfall and a nearly complete absence of runoff in the Murray-Darling Basin, is likely to have ended irrigated agriculture for this region. Depopulation will be under way.*
>
> *Much coastal infrastructure along the early 21st century lines of settlement is likely to be at high risk of damage from storms and flooding.*

3 ASSESSMENT METHODOLOGY

This assessment considers Scope 1 and 2 emissions as well as key Scope 3 emissions from the operation of the Project.

Emissions from *construction* of the Project were not considered within the scope of the assessment. Estimates were not undertaken, however the emissions are *expected to be immaterial* (less than 5%[1]) in the context of the broader Project operating emissions, given the short construction timeframe, minimal use of construction plant and equipment, and relatively simple design of the building.

3.1 Source Identification and Boundary Definition

The boundary for the Project was determined to be the geographical boundary of the Project Site for Scope 1 and Scope 2 emissions. Scope 3 emissions associated with the transport of products and materials to and from the site as part of general operations were also considered within the broader reporting boundary.

3.1.1 Emissions Sources

The emissions sources identified for the assessment are shown in **Table 3**.

Table 3 Emission Sources for Operation

Scope	Activity	Source
Scope 1	Diesel fuel for transport purposes	On site diesel use in vehicles
	Diesel fuel for stationary purposes	On site diesel use in plant and equipment
	Fuel oil for stationary purposes	On site fuel oil use in plant and equipment
	Sub-bituminous coal	Use of coal in combustion
	Coke Coal	Use of coal in combustion
	Waste derived fuel	Waste derived fuel used in combustion
Scope 2	Electricity	On site electricity use
Scope 3	Diesel fuel for transport purposes	Material transport diesel use in vehicles

3.2 Quantitative Assessment

The quantitative assessment used the source data and emissions factors as outlined in **Section** 4 to determine the overall emissions for each source.

3.3 GHG Management

This phase of the methodology involved identification of possible measures to minimise, mitigate or offset the Project emissions and is discussed in Section **6**.

[1] 5% is a nominal, though commonly used, threshold for materiality in greenhouse gas accounting. The *National Greenhouse and Energy Reporting Act 2007* includes a threshold for reporting of energy consumption at 5%.

4 SOURCE DATA AND EMISSIONS FACTORS

4.1 Source Data

The source data was generally based on raw data provided by Boral for the key activities, including electricity consumption, coal combustion on site, and fuels used on site. Source data for diesel used in the transport of materials to and from site was estimated based on known travel distances and estimated vehicle fuel efficiencies and loads.

The data is presented here as a comparison between the existing approved operations and proposed operations, with the intent of showing the overall change in emissions expected as a result of the proposed operations.

4.1.1 Fuel consumption on site

Data for fuel used on site by plant, machinery and vehicles is shown in **Table 4** and was provided by Boral.

Table 4 Fuel Consumption Source Data

Source	Existing operations	Proposed operations	Change in quantity
Transport Diesel	108 kL	108 kL	0 kL
Stationary Diesel	107 kL	107 kL	0 kL
Stationary Fuel Oil	303 kL	303 kL	0 kL

4.1.2 Electricity Consumption

The source data for annual electricity consumption during operations is shown in **Table 5** which was provided by Boral.

Table 5 Electricity Consumption Source Data

Source	Existing operations	Proposed operations	Change in quantity
Electricity consumption	150,593,669 kWh	153,331,169kWh	+2,737,500 kWh

4.1.3 Coal combustion

The source data for coal combustion is shown in **Table 6** which was provided by Boral.

Table 6 Coal combustion Source Data

Source	Existing operations	Proposed operations	Change in quantity
Sub-bituminous coal	208,648 t	170,000 t	-38,648 t
Coke coal	18,576 t	0 t	-18,576 t

4.1.4 Waste derived fuel

The source data for waste derived fuel is shown in **Table 7** which was provided by Boral.

Table 7 Waste Derived Fuel Source Data

Source	Existing operations	Proposed operations	Change in quantity
Waste derived fuel	0 T	100,000t	+100,000 t

4.1.5 Clinker and cement products

The source data for clinker and cement products is shown in **Table 8** which was provided by Boral.

Table 8 Clinker and cement products Source Data

Source	Existing operations	Proposed operations	Change in quantity
Clinker and cement products	1,560,000 t	1,560,000 t	0 t

4.1.6 Emissions from Fuel consumption from materials transport

Data for fuel used by vehicles used in the transport of materials (e.g. coal, waste) to and from site is shown in **Table 9** and was provided by Boral.

Table 9 Transport Fuel Consumption Emissions (kL) (Scope 3)

Source	Existing operations	Proposed operations	Change in quantity
Transport Diesel	5,514 kL	5,935 kL	+420 kL

4.1.7 Aggregated Source Data

The aggregated estimations for source data are shown in **Table 10**.

Table 10 Aggregate Source Data

	Existing Operations		Proposed Operations	
Source	Quantity	Unit	Quantity	Unit
Transport Diesel	108	kL	108	kL
Stationary Diesel	107	kL	107	kL
Fuel Oil	303	kL	303	kL
Electricity	150,593,669	kWh	153,331,169	kWh
Sub-bituminous coal	208,648	t	170,000	t
Coke coal	18,576	t	0	t
Waste derived fuel	0	t	100,000	t
Clinker and cement products	1,560,000	t	1,560,000	t

4.2 Emission Factors

Emissions factors used for operation of the Project were taken from the NGA Factors (see **Table 11**).

Table 11 Emissions Factors

Scope	Source	Emissions factor	Energy Content Factor[3]
Scope 1	Transport Diesel	69.9 kg CO_2-e /GJ	38.6 GJ/kL
	Stationary Diesel	69.5 kg CO_2-e /GJ	38.6 GJ/kL
	Fuel Oil	73.13 kg CO_2-e /GJ	39.7 GJ/kL
	Sub-bituminous coal	88.43 kg CO_2-e /GJ	21 GJ/t
	Coke coal	105.13 kg CO_2-e /GJ	27 GJ/t
	Waste derived fuel	1.8 kg CO_2-e /GJ[2]	12.2 GJ/t
	Clinker and cement products	Calculation equation in Section 4.1 of NGA Factors 2014	
Scope 2	Electricity	0.86 kg CO_2-e/kWh	NA

Scope 3	Transport Diesel	69.9 kg CO_2-e /GJ	38.6 GJ/kL

1. Transport purposes include machinery and vehicles which by law can drive on the road
2. Taken from the NGA Factors emissions factor for *Biomass municipal and industrial materials, if recycled and combusted to produce heat or electricity*
3. Not all emission sources have an energy content factor, as per the NGA Factors this has been represented by an NA (Not Applicable).

5 GREENHOUSE GAS ASSESSMENT

5.1 Operational Emissions Quantitative Assessment

This assessment presents estimated annual GHG emissions for the existing and proposed operational elements of the Project.

5.1.1 Emissions from Fuel consumption on site

Emissions from fuel used on site by plant, machinery and vehicles is shown in **Table 12**.

Table 12 On site Fuel Consumption Emissions (tCO_2-e)

Source	Existing operations	Proposed operations	Change in emissions
Transport Diesel	291.4	291.4	0
Stationary Diesel	287.05	287.05	0
Stationary Fuel Oil	879.69	879.69	0

5.1.2 Emissions from Electricity Consumption

Emissions attributable to annual electricity consumption during operations is shown in **Table 13**.

Table 13 Electricity Consumption Emissions (tCO_2-e)

Source	Existing operations	Proposed operations	Change in emissions
Electricity consumption	129,510.6	131,864.8	+2,354.2

5.1.3 Emissions from Coal combustion

Emissions from coal combustion is shown in **Table 14**.

Table 14 Coal combustion Emissions (tCO_2-e)

Source	Existing operations	Proposed operations	Change in emissions
Sub-bituminous coal	387,466	315,695	-71,770
Coke coal	52,728	0	-52,728

5.1.4 Emissions from Waste derived fuel

Emissions from use of waste derived fuels is shown in **Table 15**.

Table 15 Waste Derived Fuel Emissions (tCO_2-e)

Source	Existing operations	Proposed operations	Change in emissions
Waste derived fuel	0	2,196	+2,196

5.1.5 Emissions from production of Clinker and cement products

Emissions from clinker and cement products is shown in **Table 16**.

Table 16 Clinker and cement products production emissions (tCO_2-e)

Source	Existing operations	Proposed operations	Change in emissions
Clinker and cement products	848,640	848,640	0

5.1.6 Emissions from Fuel consumption from materials transport

Emissions from fuel used by vehicles used in the transport of materials (e.g. coal, waste) to and from site is shown in **Table 17**.

Table 17 Transport Fuel Consumption Emissions (tCO_2-e) (Scope 3)

Source	Existing operations	Proposed operations	Change in emissions
Transport Diesel	14,879	16,013	+1,134

5.1.7 Aggregated Emissions

The aggregated estimations for source data are shown in **Table 18**.

Table 18 Aggregated Emissions (tCO_2-e)

Source	Activity	Existing Operations	Proposed Operations	Change in emissions
Scope 1	Transport Diesel	291.4	291.4	0
	Stationary Diesel	287	287	0
	Fuel Oil	879.69	879.69	0
	Sub-bituminous coal	387,466	315,695	-71,770
	Coke coal	52,728	0	-52,728
	Waste derived fuel	0	2,196	+2,196
	Clinker and cement products	848,640	848,640	0
	Scope 1 Sub total	**1,290,292**	**1,167,989**	**-122,302**
Scope 2	Electricity	129,511	131,865	+2,354
	Scope 2 Sub total	**129,511**	**131,865**	**+2,354**
Scope 3	Transport Diesel	14,879	16,013	+1,134
	Scope 3 Sub total	**14,879**	**16,013**	**+1,134**
	Total	**1,434,682**	**1,315,867**	**-118,814**

The total estimated annual operational GHG emissions for the *existing* operations are **1,435 $ktCO_2$-e per year.** This is comprised of 1,290 $ktCO_2$-e per year Scope 1 emissions, 130 $ktCO_2$-e per year Scope 2 emissions and 15 $ktCO_2$-e per year Scope 3 emissions.

This compares with estimated annual operational GHG emissions for the *proposed* operations of **1,316 $ktCO_2$-e per year.** This is comprised of 1,168 $ktCO_2$-e per year Scope 1 emissions, 132 $ktCO_2$-e per year Scope 2 emissions and 16 $ktCO_2$-e per year Scope 3 emissions**.**

The results indicate a *potential reduction* in overall GHG emissions from the proposed operations of approximately **119 $ktCO_2$-e per year** when compared with existing operations.

5.1.8 Emissions context

The total annual operational GHG emissions for the *proposed* Operations are estimated to be **1,316 kt CO_2-e**.

The NSW Office of Environment and Heritage (OEH) has published the NSW state emissions profile for 2010 as 157 million t CO_2-e per year. Therefore in the NSW state context **the Project represents approximately 0.84% of the total annual state emissions**.

6 GHG MITIGATION AND MANAGEMENT MEASURES

GHG mitigation has been considered in the design of the Project, particularly in relation to energy efficiency. The following actual and potential emission mitigation and management measures are being considered when developing the project specifications and detailed design.

6.1 Electricity Usage

6.1.1 Existing management and mitigation measures

The following points could be considered to reduce the emissions caused from on-site electricity usage:

- A percentage of the total electricity for the site could be offset through purchasing *green power* from an electricity supplier;
- Sensor lighting could be used in some areas to minimise the number of lights on during all hours of operation;
- Where possible, high efficiency lighting should be used.

6.1.2 Existing management and mitigation measures

The following points could be considered to reduce the overall fuel use from onsite and transport vehicles:

- All vehicles/plant and machinery should be turned off when not in use and regularly serviced to ensure efficient operation;
- Truck routes and loading capacity should be designed to reduce the distance and effort required by the vehicles;
- Relocation of raw material stockpiles to reduce fuel usage on site where possible
- Ensure correct vehicle mass limits not exceeded by use of the heavy vehicle weighbridge.

6.1.3 Other potential management and mitigation measures

The following points could be considered to reduce the overall fuel use from onsite and transport vehicles:

- Where possible, B5 and E10 fuel should be used in plant and equipment.

7 CONCLUSIONS

This Greenhouse Gas (GHG) assessment has been prepared by SLR Consulting Australia (SLR) on behalf of Boral Cement Limited (Boral), as part of the Environmental Assessment (EA) that will accompany an application made pursuant to Section 75W of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), seeking modification of the current consent.

This assessment has determined Scope 1, 2 and key Scope 3 GHG emission estimates for the operation of the Project, and found the emissions to be minimal, particularly when compared to the emissions from the State of NSW as a whole. Annual emissions for the existing operations were determined to be **1,435 kt CO2-e**, and predicted to be **1,316 ktCO_2-e** for the proposed Project. This shows that undertaking the Project is expected to result in a net positive GHG benefit.

Annual emissions from the proposed operations represent 0.84% of the annual GHG emissions in NSW.

Key elements in the design of the Project have ensured that GHG emissions will be minimised where possible. In addition, this report provides a suite of mitigation and management measures that, if implemented, could reduce GHG emissions further.