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Boral Cement Limited

Use of Waste Derived Fuels
Kiln 6, Berrima Cement Works

DA 401-11-2002 – Modification 9

ENVIRONMENTAL ASSESSMENT

July 2015

global environmental solutions

Berrima Cement Works

Modification 9

Environmental Assessment

Use of Solid Waste Derived Fuels

Report Number 610.14460

July 2015

Boral Cement Limited

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Berrima Cement Works

Modification 9

Environmental Impact Assessment

Use of Solid Waste Derived Fuels

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Glossary of Terms

CLG	Community Liaison Group
DA	Development Application
DG	Dangerous Goods
DPE	NSW Department of Planning and Environment
EA	Environmental Assessment
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
GHG	Greenhouse Gas
ICNG	Interim Construction Noise Guideline
LEP	Local Environment Plan
LWDF	Liquid Waste Derived Fuel such as Liquid Oil Residues (AKF1) which is already approved as a Non-Standard Fuel
MVEC	Moss Vale Enterprise Corridor
NMHCs	Non-methane hydrocarbons
NOx	Nitrous oxides
NSF	The EPA *Guidance Note on the Assessment of Non-Standard Fuels (DEC, 2005)* defines' Standard Fuels' as: coal or coal derived fuel other than any tar or tar residues; liquid or gaseous petroleum-derived fuels, such as natural gas and LPG (propane and butane); untreated timber residues, such as from forest operations or sawmilling, but excluding any form of treated or painted timber; bagasse from sugar cane. 'Non-standard fuels' are all other substances that are used or proposed to be used as fuel.
PHA	Preliminary Hazard Assessment
PAHs	Polycyclic aromatic hydrocarbons
PM	Particulate matter, a general term for a complex mixture of extremely small particles and liquid droplets. The size of particles is directly linked to their potential for causing health problems with a focus on particles less than 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs.
POEO Act	NSW Protection of the Environment Operations Act
RDF	Refuse Derived Fuel
RMS	NSW Roads and Maritime Service
RNP	Road Noise Policy
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SWDF	Solid Waste Derived Fuels: Encompasses a range of solid waste derived fuel streams made from materials recovered from general waste, including wood waste and refuse derived fuel. They are sourced from waste industry operators who screen and recover appropriate materials out of general waste streams that are collected from commercial, industrial and residential properties before processing for consumption as fuel. These are the types of fuel that are the subject of this assessment. It also includes rubber tyre

	chips, for which Boral already has approval to use.
TOC	Total Organic Carbon
VOCs	Volatile Organic Compounds
WARR Act	NSW Waste Avoidance and Resource Recovery Act 2001
WDF	Waste Derived Fuels, including solid and liquid waste fuels
WID	European Waste Incineration Directive 2000

1 INTRODUCTION

This Environmental Assessment (EA) report constitutes an application made pursuant to Section 75W of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), seeking modification of the current approval at the Boral Cement Works (the Cement Works) in New Berrima.

Boral Cement Limited (Boral) operates the Cement Works at New Berrima in the Wingecarribee Local Government Area and is a significant contributor to the local economy.

The Cement Works operate subject to two development consents issued by the Department of Planning and Environment (DPE) (DA 401-11-2002 (Kiln 6), May 2003 and DA 85-4-2005 (Mill 7), Aug 2005). The development consent for Kiln 6 has since been modified eight times. 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:

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

In addition, Boral wishes to surrender Modification No. 6 (June 2012) relating to the stockpiling of coal for sale and transport to Port Kembla.

The modification is needed to maintain the viability of Boral as a cement manufacturer in an industry that is facing increasing pressure from less expensive imported products and rising energy costs. Up until recently coal from the Berrima Colliery at Medway was used to fire the cement kiln. In October 2013 the colliery ceased operation, consequently Boral is pursuing other fuel sources to ensure its operation remains economically viable into the future. The modification would also have associated environmental benefits of reducing carbon emissions and diverting waste from landfill.

The proposed modification is considered to be minor in the context of the overall operations at New Berrima and would not significantly alter the operation of the Cement Works, other than to allow the use of different fuel sources in the manufacturing process. The project as modified would be substantially the same development as approved previously.

2 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Boral wrote to the DPE on 3 September 2014 seeking Secretary's Environmental Assessment Requirements (SEAR's) in relation to the proposed modification. The Department responded to Boral on 28 October 2014 setting out SEAR's which are reproduced in **Table 1** below. The table indicates where in the EA report each of the SEAR's has been addressed.

Table 1: Secretary's Environmental Assessment Requirements

Ref	Subject	EA Report Reference
WM	***Waste Management***	
WM1	A description of the classes and quantities of waste that would be thermally treated at the facility	Table 4
WM2	A demonstration that waste used as a feedstock in Kiln 6 would be the residual from a resource recovery process that maximises the recovery of material in accordance with the Environmental Protection Authority (EPA) Guidelines	Section 4.5.1
WM3	Procedures that would be implemented to control the inputs to Kiln 6, including contingency measures that would be implemented if inappropriate materials are identified	Section 4.5.1
WM4	Details on the location and size of stockpiles of unprocessed and processed recycled waste at the site	Section 4.5.1
WM5	A demonstration that any waste material (e.g. biochar) produced from Kiln 6 for land application is fit-for-purpose and poses minimal risk of harm to the environment in order to meet the requirements for consideration of a resource recovery exemption by the EPA under Clause 51A of the *Protection of the Environment Operations (Waste) Regulation 2005*	Not applicable as it is not proposed to use waste material for land application
WM6	Procedures for the management of other solid, liquid and gaseous waste streams	Only applicable to air quality emissions. Dealt with in Section 7.1
WM7	The measures that would be implemented to ensure that the development is consistent with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2007	Section 5.4
AQO	***Air Quality and Odour***	
AQO1	A quantitative assessment of the potential air quality and odour impacts of the development on surrounding landowners and sensitive receptors under the EPA guidelines	Section 7.1
AQO2	Details of any pollution control equipment and other impact mitigation measures for fugitive and point source emissions	Section 7.1
AQO3	A demonstration of how the facility would be operated in accordance with best practice measures to manage toxic air emissions with consideration of the European Union's Waste Incineration Directive 2000 and the Environment Protection Authority's draft policy statement NSW Energy from Waste	Section 4.1
AQ04	Details of the proposed technology and a demonstration that it is technically fit for purpose	Section 4.1
GHG	***Greenhouse Gas***	
GHG1	A full greenhouse gas assessment (including an assessment of the potential scope 1, 2 and 3 greenhouse gas emissions) of the proposed development, and an assessment of the potential impact of these emissions on the environment	Section 7.2

Ref	Subject	EA Report Reference
GHG2	A detailed description of the measures that would be implemented on site to ensure that the project is energy efficient	Section 7.2
HAZ	***Hazards and Risk***	
HAZ1	A Preliminary Hazard Analysis in accordance with Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis and Multi-Level Risk Assessment (if necessary) and details of fire/emergency measures and procedures	Section 7.3
HAZ2	Contingency plans for any potential incidents or equipment failure during the operation of the project	n/a screening assessment concluded proposed development is not potentially hazardous
HAZ3	An assessment of the potential fire risks of the proposed development	n/a screening assessment concluded proposed development is not potentially hazardous
N	***Noise***	
N1	A quantitative assessment of the potential construction, operational and transport impacts on surrounding receivers	Section 7.4
N2	Details of the proposed management and monitoring measures	Section 7.4
T	***Traffic and Transport***	
T1	An assessment of additional traffic movements and updated site access plans	Section 7.5
T2	The impact to the function and performance of key local roads and intersections associated with the proposed modification	Section 7.5
V	***Visual***	
V1	Details of the proposed management and monitoring measures, particularly from private receptors and key vantage points	Section 7.6
S&W	***Soils and Water***	
S&W1	Details of the proposed management and monitoring measures, including the proposed erosion and sediment controls and consideration of potential surface water, groundwater, contamination impacts that could result during construction	Section 8

3 BACKGROUND

3.1 Location

The Cement Works are located immediately south of New Berrima in the Southern Highlands of NSW in the Wingecarribee local government area, approximately 2.5 km from the Hume Highway (refer to **Figure 1** and **Figure 2**). The closest residential area is New Berrima, the closest point of which is approximately 650m from Kiln 6. Isolated farms are also located at Chesley Park Farm and Candowie Farm to the east and south east respectively.

3.2 Site description

3.2.1 Topography

The Berrima region is flanked by hills on all sides within about 10-20km of the Cement Works. These hills rise to an elevation of approximately 60-130m above local ground level at the cement works, which is approximately 675m above mean sea level. The works site itself is flat and the immediate surrounding area is characterised by gently rolling shallow hills and valleys with some flat areas.

3.2.2 Meteorological conditions

Boral Cement operates an ambient monitoring station beyond the site boundary, approximately 790m to the east of the No.6 Kiln Stack, in pasture land.

A windrose of wind speeds and directions from the monitoring site for January 2011 - December 2013 is shown in **Figure 3**. The windrose features a prevalence of winds from the west and west-northwest direction, and also from the north-northeast and southwest directions. The site also shows a relatively frequent occurrence of calm or very light winds. Windroses for individual years 2011 – 2013 are attached in Appendix D (Air Quality Impact Assessment).

3.2.3 Land Use

Figure 4 illustrates the land use zones applying to the Cement Works and surrounding area as per the Wingecarribee Local Environment Plan 2010 (LEP). The site and the area to the east and south is zoned industrial. The area to the south east of the Cement Works between New Berrima and Moss Vale is part of the Moss Vale Enterprise Corridor (MVEC) set aside for employment generating development under the Wingecarribee LEP.

The closest residential zone to the works site is located in New Berrima, approximately 650m north from the No. 6 kiln stack at the closest points. Residential zones are also located in Berrima, at least 2,150m north of the No. 6 kiln stack.

The New Berrima residential area is flanked to the south and east by “Private Recreation” areas.

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Site Location: Regional Context

FIGURE 1

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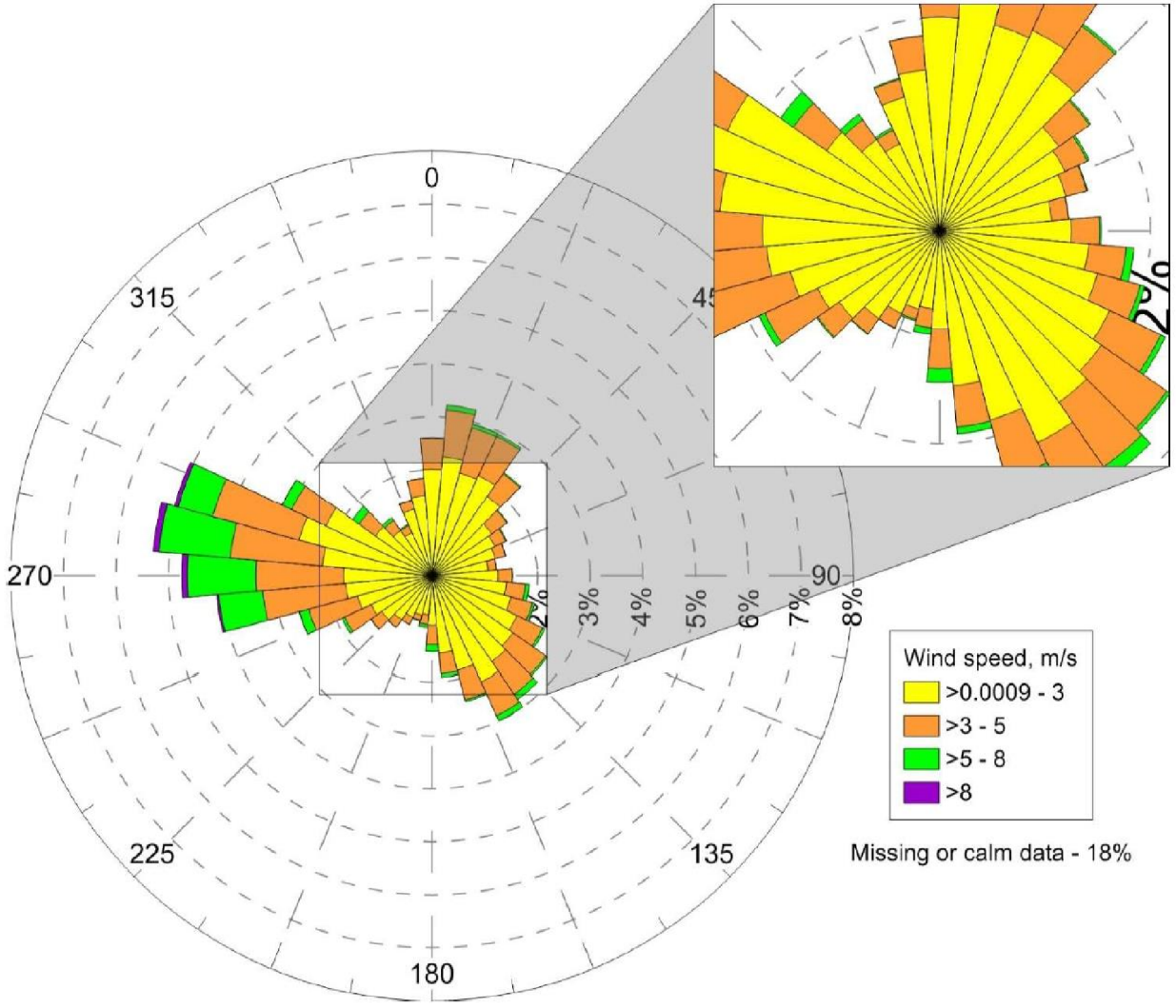
Site Location: Local Context

FIGURE 2



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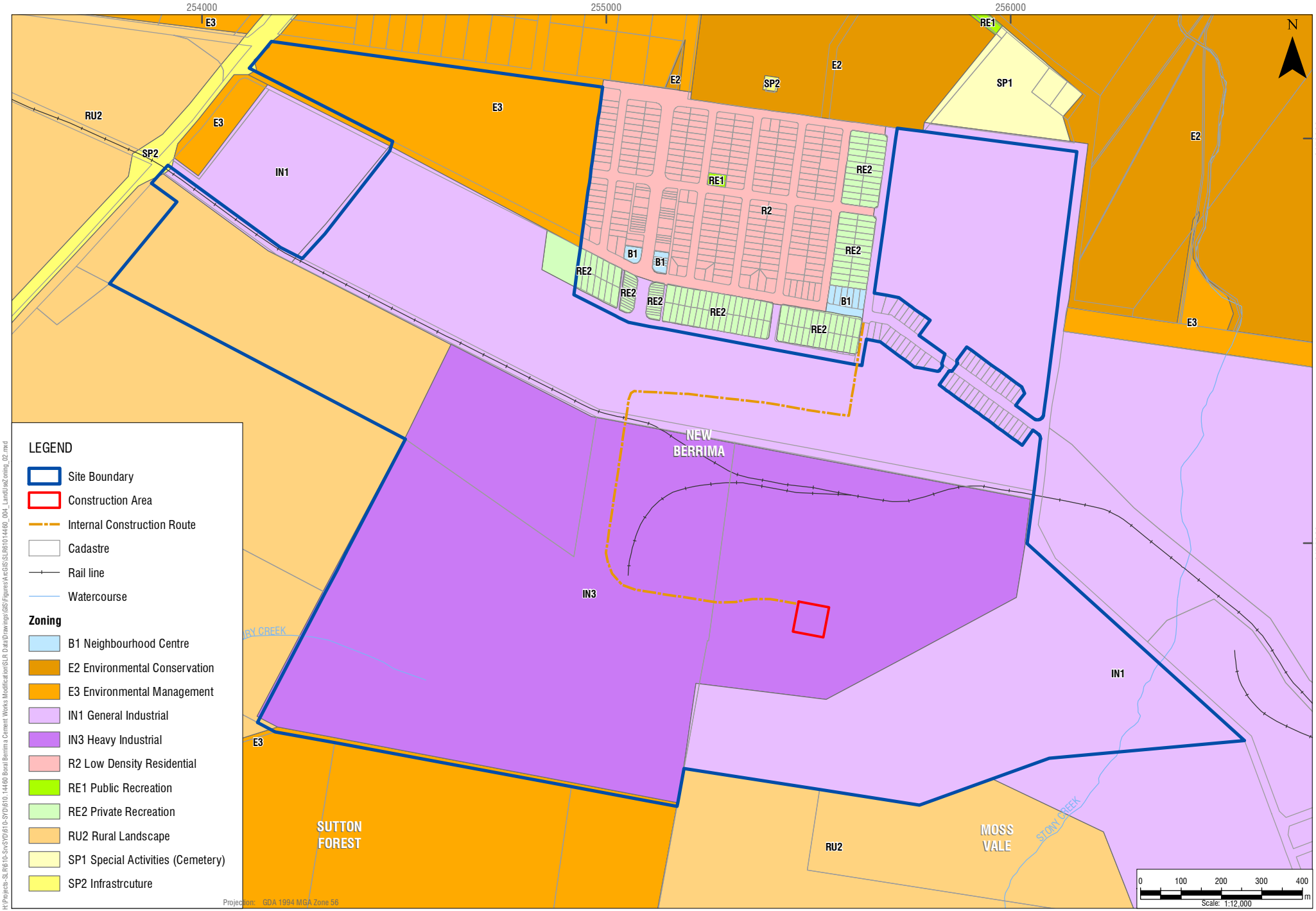
Windrose of Meteorological Monitoring Data for Berrima Site

FIGURE 3



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Land-use Zones Surrounding the Cement Works

FIGURE 4

3.3 Proponent

The proponent and owner of the Cement Works is Boral Cement Limited, formerly known as Blue Circle Southern Cement Ltd., which is a wholly owned subsidiary of Boral Limited.

3.4 Existing Operations

Berrima Cement Works has been operating since 1929 and produces cement products (cement and clinker) for sale in NSW, the ACT and for export. The Cement Works is approved to produce up to 1.56 million tonnes per annum of cement products which has historically represented 60% of cement sold for building and construction in NSW. Cement products are dispatched to domestic customers by train and truck and international customers through Port Kembla.

The facility operates one kiln and two cement mills, along with storage and stockpile facilities, and a substantial fleet of heavy vehicles for transportation.

The clinker, which looks like small balls of pumice, is stored before being passed to the grinding mill where it is ground into cement. The cement is stored on site before being loaded for transport off-site.

Cement manufacture is an energy intensive process due to the high temperatures required for the production of clinker. Currently 220,000 tonnes per year of coal is used to heat the kiln to a temperature of up to 1500°C. Up until 2013 coal was sourced from the nearby Medway Colliery but since the colliery's closure, coal is currently sourced from the Illawarra area by road. This reliance on coal contributes to the total energy cost at the facility, which represents 40% of Boral's costs in the cement production process.

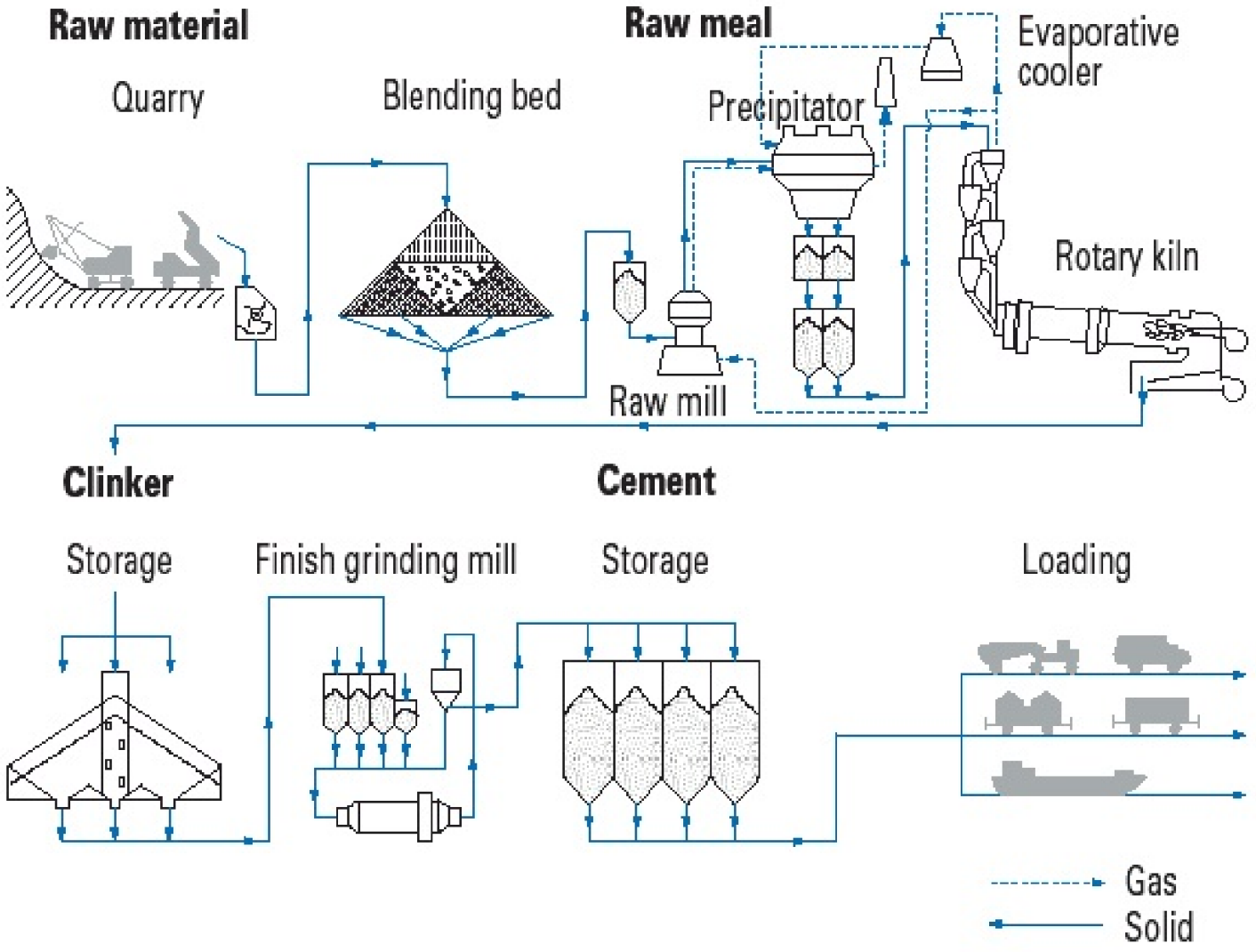
The facility supports a direct workforce of 130 employees, a further 20 in engineering and procurement, as well as many indirect jobs in the region through logistics, contractors and suppliers.

Some of the pressures on the facility's existing operation include:

- increased energy prices;
- increased costs of raw materials;
- increased affordability in importing clinker from overseas.

Boral has implemented a number of efficiency measures over the years to address these pressures and reduce its operating costs. The use of SWDF is another such measure which would reduce energy costs and help secure the commercial and environmental sustainability of the Cement Works into the future.

Figure 5 provides a flow diagram of the current operating process at the facility. The main raw material inputs are limestone, sourced from the Marulan mine, and shale, sourced on site. Limestone is transported via rail and combined with the shale and other materials in the blending bed. The blended material is passed through a raw milling and gas cleaning system and into the rotary kiln where the material elements are combined at very high temperature to form clinker.



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Current Process Operations

FIGURE 5

3.5 Existing emission control equipment

Cement kilns offer a superior solution for handling wastes due to high temperatures and residence times with no solid residues. In 2004, Boral upgraded Kiln 6 and installed additional equipment specifically suited to the burning of SWDF.

The key features of this equipment are:

- a large volume pre-calciner combustion vessel, which gives fuels longer time to burn out (>6 seconds) at high temperatures (>800 Deg C). This means that all of the solid fuel is given the chance to burn out and eliminates residues like smoke;

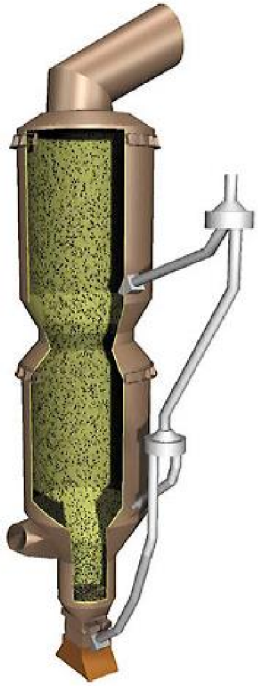
- the raw mill dust collector, which filters kiln exhaust gas particulates and provides additional high efficiency cleaning capacity to minimise stack emissions; and

- the installation of continuous monitoring equipment for key gaseous pollutants, which allows prompt response to any adverse trends in stack emissions.

Figure 6 illustrates some of this equipment and the emissions benefits.

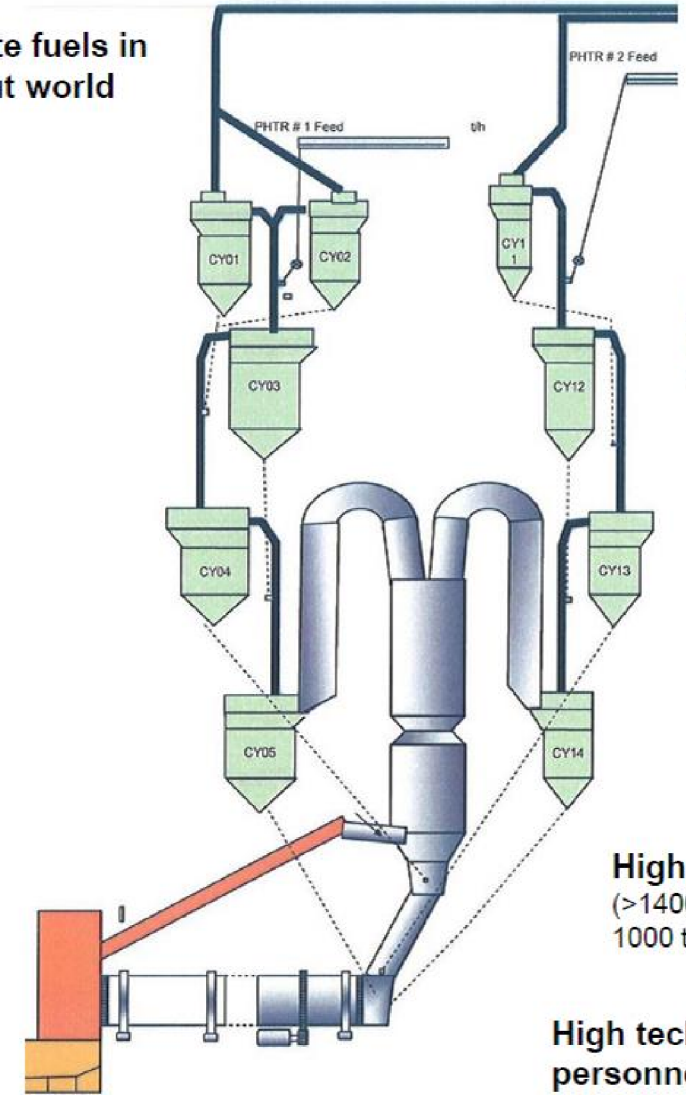
Use of wide range of solid waste fuels in cement kilns proven throughout world

Reduces CO2 emissions with biomass fuels



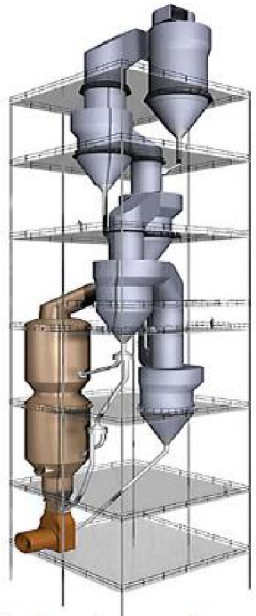
High combustion residence time in kiln and pre-calciner (>6 seconds gas residence time @>800 Deg C) in calciner)

No solid residues to dispose of (ash combined in clinker)



High efficiency filtration of kiln exhaust gas particulates (ash combined in clinker)

High level of automated combustion and chemistry control



Preheater acts as efficient acid gas scrubber (high limestone/lime environment)

High gas temperatures (>1400 deg C in kiln 1000 to 800 deg C in calciner)

High technical competency of personnel

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Existing Emissions Control Equipment

FIGURE 6

4 PROPOSED MODIFICATION

4.1 Site History

Construction of the Cement Works began in late 1927 and first operations started in May 1929. The neighbouring town of New Berrima was originally established in 1928 as housing for employees of the site. In response to demand additional kiln and cement mill capacity was added up to 2007, however subsequent fall off in demand has seen the decommissioning and/or removal of kiln capacity.

Operating today with one kiln (No. 6), the Cement Works takes limestone delivered by rail from Marulan South and burns it at high temperature (after blending with other materials) to produce 'clinker'.

4.2 Current Approvals and Recent Modifications

Berrima Cement Works operates under two development consents that were granted by the Minister in 2003 (Kiln 6) and 2005 (Mill 7). Boral Cement is permitted to produce up to 1.56 million tonnes of cement a year at the facility. These consents have since been modified as per **Table 2.**

Table 2: Modifications to the original development approvals

Modification	Reference/Date	Scope
1	MOD 2-1-2004 Sept 2005	Use of non-standard fuels, including used tyres, liquid oil residues and spent aluminium electrode carbon
2	MOD 109-9-2006 Sep 2006	Removal of hazardous waste prohibition
3	MOD 12-2-2007 Feb 2007	Trial use of tyre chips
4	MOD 4 April 2008	Varying usage of coke fines
5	MOD 5 Aug 2009	Coal deliveries by rail
6	MOD 6 June 2012	Stockpiling of coal for sale and transport to Port Kembla
7	MOD 7 April 2012	Trial and use of blast furnace slag
8	MOD 8 July 2012	Administrative changes to align DA and EPL conditions

4.3 Non-Standard Fuels

Boral has been investigating the use of non-standard fuels in Kiln 6 since 1999. The types of non-standard fuels considered included: carbon anode dust, used tyres, recycled oils and grease, and waste wood with preliminary trials conducted in 2000 and 2001.

On 12 May 2003 the Minister for Infrastructure and Planning approved a development application for an upgrade to Kiln 6 at the existing Cement Works. The Minister's consent only permitted the use of standard fuels at the upgraded development as no assessment had been undertaken as part of the application for use of any non-standard fuels.

Further trials were conducted in 2003 to inform a modification application seeking approval for the use of non-standard fuels at Berrima (MOD 2-1-2004). The Modification application sought approval for:

- use of three non-standard fuels (being used tyres (AKF5), liquid oily residues (AKF1) and carbon anode dust (Hi Cal 50) which had been trialed and tested in accordance with an EPA licence; and

- a protocol describing the trialing, testing and approval procedures for possible new fuels at the upgraded Kiln 6.

The Department granted approval for the use of the three trialed and tested non-standard fuels, subject to stringent environmental controls, but did not grant approval to the implementation of any protocol. This would result in any future proposal to use additional non-standard fuels requiring further approvals under the *Environmental Planning and Assessment Act 1979.*

Approval for used tyres (AKF5) was granted subject to the necessary approvals under the Act being obtained for storage facilities and kiln feeding infrastructure. No AKF5 is permitted to be received at the site until the necessary storage facilities and kiln feeding infrastructure have been constructed in accordance with any such approvals.

Approval for Hi Cal 50 and AKF1 was granted subject to the detailed design for any necessary storage facilities and kiln feeding infrastructure being approved by the Director-General.

A subsequent modification application (MOD 12-2-2007) granted approval for Boral to undertake a single operational trial of chipped tyres in the development, ahead of the construction of storage facilities and kiln feeding infrastructure for AKF5, subject to a number of requirements.

4.4 Outcome of trials involving non-standard fuels

As part of Modification 2-1-2004-i of the Kiln 6 Development Consent, trials of waste-derived fuels were conducted on two days in August 2003 and two days in October 2003.

Blends of the waste-derived fuels were tested against a baseline of coal and 5% coke as follows:

- Coal/coke + HiCal 1.3 tph (Trial Blend 1);
- Coal/coke + HiCal + Waste Oil (AKF1) 1 tph (Trial Blend 2); and
- Coal/coke + HiCal 1.3 tph+ Waste Oil (AKF1) 1 tph + chipped tyres (AKF5) 4.5 tph (Trial Blend 3).

The stack emissions were monitored during the trial by the external provider, Air Labs (report dated 4 December 2004). The trial was regarded as a success. This success was measured in terms of:

- No adverse impact on emissions, land, noise and traffic;
- No adverse impact on clinker quality; and
- No community complaints or adverse comments.

Stack emission testing summary

Most of the parameters tested were well below the safe emission limits imposed later in the modified consent for the combustion of waste-derived fuels. The only exceptions were Total Particulate and Nitrogen Oxides.

During the trials, Total Particulates were measured at 40, 44 and 51 mg/m^3 for the trial blends 1, 2 and 3, respectively against the limit of 30 mg/m^3 that was later applied to the Consent. For MOD 9, Boral is proposing to change this limit to 50 mg/m^3 in line with the *NSW Energy from Waste Policy, 2014*. Total Particulate levels measured during the past year have been well below this proposed limit.

Nitrogen Oxides were at the level of 1700 mg/m^3 for the baseline (coal and coke), dropping down to approximately 1200 mg/m^3 which was still higher than the limit of 800 mg/m^3 that was applied in the consent. For MOD 9, Boral is proposing to change this limit to 1000 mg/m^3 being the same level currently being complied with for standard fuels.

The potential for Dioxin and Furan emissions was a key concern for the community at the time. The baseline measurement was 0.0034 ng/m3 while blend 1 was 0.0049 and blend 3 was 0.013 ng/m3. There was no adequate sample obtained for blend 2 due to a process upset during the 6-hr timeframe required for dioxin sample collection. The highest level recorded during blend 3 was nearly 8 times below the limit of 0.1 ng/m^3 that was later applied to the consent. The trials demonstrated that even with all three waste-derived fuels being fed into the kiln simultaneously, there were no potentially unsafe dioxin emissions.

Heavy metal emissions were at a similar level to the baseline or lower, including the more volatile metals such as cadmium and mercury.

VOC emissions were up to two times higher with the use of waste-derived fuels but still well within the applicable emission limit. Due to the marked variability of VOC emissions observed over the years from the contribution of blue shale, in MOD 9 Boral are proposing to change this limit to 40 ppm when waste-derived fuels are used.

4.5 Proposed Activities

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

- use of Solid Waste Derived Fuel (SWDF) 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.

The Kiln 6 consent and EPL for the Cement Works includes a number of conditions relevant to the fuel storage and feeding system for SWDF. These are discussed in Chapter 5 and Appendix C.

4.5.1 Use of Waste Derived Fuels

Boral seeks approval to use SWDF in Kiln 6. All SWDF proposed to be used by Boral would be consistent with the EPA's *NSW Energy from Waste Policy (2014).*

In 2005 Boral was granted conditional approval to use some Waste Derived Fuels, including spent aluminium electrode carbon (Hi Cal 50), liquid oil residues (AKF-1) and waste tyre chips (AKF-5) (condition 1.4A, MOD 2-1-2004). However, the use of these fuels has not been explored beyond trial stage as approval to construct the necessary infrastructure has not been pursued and emission limits have been too restrictive.

Due to a number of market pressures, Boral is now seeking to expedite the use of these and the newly-proposed SWDF.

The fuels that are the subject of this modification are the following SWDF:

- Wood Waste - material left over from industrial processes like milling, furniture making, and building and construction; and
- Refuse Derived Fuel (RDF) - fuel made from the combustible materials recovered and processed from waste streams, such as papers, cardboards, packaging, and construction and demolition materials

Table 3 provides an indicative breakdown of the waste streams that make up Wood Waste and Refuse Derived Fuel based on information provided by potential suppliers. It should be noted that the actual breakdown could vary from the data presented here, depending on the final product specification prepared by each supplier and the ability to tailor the specification to the specific requirements of the Berrima site.

Table 3: Indicative breakdown of Solid Waste Derived Fuels waste streams

Wood Waste				Refuse Derived Fuel			
Supplier 1		Supplier 2		Supplier 1		Supplier 2	
Component	% (range)	Component	% (range)	Component	% (range)	Component	% (range)
Plastics	5-15%	Plastics and textiles	5-10%	Plastics	35%	Plastics	45% (+/- 15%)
Paper and cardboard	5- 20%	Furniture (lacquered / painted MDF and Wood	10-15%	Paper and Cardboard	20%	Paper / cardboard	35% (+/- 15%)
Wood	60-80%	Untreated boards	30-40%	Organic materials	14%	Wood	5-10%
Other (textiles, fines)	5-15%	MDF / chipboard	30-40%	Textiles	11%	Other	0-5%
				Other including fines	20%		

These fuels are considered to be an ideal fuel source for Kiln 6 and would be sorted, tested and shredded off-site by authorised waste suppliers to maintain compliance with relevant specifications.

Boral proposes to use up to 100,000 tonnes per year of SWDF in Kiln 6 operations. This would replace 20-30% of the coal used in the facility. **Table 4** compares the quantities of fuel that Boral currently has approval to use with the quantities proposed by this modification.

Table 4: Approved and Proposed Classes and Quantities of Standard and Waste Derived Fuel

Fuel	Category	Tonnes per annum	% of total fuel (by mass)	Tonnes per annum	% of total fuel (by mass)
		Current		Proposed	
Natural Gas, Fuel Oil, Diesel	Standard Fuel	No Limit		No change	
Coal	Standard Fuel	No Limit	≥ 60.0	No Limit	No Limit
Coke Fines	Standard Fuel	No Limit	≤ 30.0	No Limit	≤ 30.0
Aluminium electrode carbon (Hi Cal 50)	SWDF	10,000	≤ 6.0	10,000	≤ 6.0
Liquid Oil Residues (AKF1)	LWDF	20,000	≤ 4.7	20,000	≤ 4.7
Waste Tyres (AKF5)	SWDF	30,000	≤ 21.0	100,000	≤ 50
Wood Waste	SWDF	Not currently approved			
RDF	SWDF				

Boral would only source feedstock from suppliers that have agreed to meet the requirements of the EPA guidelines, including the resource recovery criteria for energy recovery facilities set out in the NSW *EPA Energy from Waste Policy* (2014). This would be a prerequisite when establishing supply contracts for kiln feedstock.

The policy specifies what is considered to be an ‘eligible waste fuel’ which would be reviewed over time.

Boral proposes to adopt a risk based approach to minimise any potential environmental impact of using SWDF. Boral's approach would involve four levels of risk protection as follows:

Detailed fuel specifications

Boral has developed detailed fuel specifications for the proposed SWDF based on established European and USA standards. The levels of contaminants, such as heavy metals, in these standards are low enough to ensure that when used as a fuel in the cement kiln, emissions are unlikely to exceed the limits defined in the *Energy from Waste Policy* and the sites EPL. The fuel specifications would be the basis of acceptance of deliveries of fuels from suppliers.

Supplier control systems

Suppliers of SWDF to Berrima would be required to establish rigorous Quality Assurance / Quality Control procedures to ensure the SWDF products produced from their operations meet Boral's specifications. The QA/QC of suppliers would be subject to regular audit by Boral or external parties.

Check sampling and testing of waste fuels supplied

Regular statistical check sampling and testing of dispatched waste fuel products would be established based on the European standards. Using this methodology, samples of fuel would be taken at either the supplier’s site or at the Cement Works on a regular basis and analysed to determine compliance with the fuel specification. This will provide a regular check of the effectiveness of the supplier’s quality assurance processes. Analysis of test results would be undertaken by suitably accredited laboratories using standard test methods..

Inherent capture efficiency of the cement kiln process

Boral and industry data demonstrates that cement kilns have inherently high capture efficiency for contaminants such as heavy metals which are captured as a stable component of the kilns clinker product. Therefore in the unlikely event that the preceding three stages fail to prevent out-of-

specification fuels being fed into the kiln, the risk of a significant environmental impact resulting from such an event is low.

Concrete is an artificial stone made of cement, aggregates, sand and water and is known for its high environmental performance. This performance is not impaired when waste derived fuels are used for cement production. Concrete made from cement manufactured using waste derived fuels has the same properties as concrete made from cement manufactured using fossil fuels.

One aspect of the environmental performance of concrete is the behaviour of heavy metals in concrete. These trace elements are found in various concentrations in the raw materials and fuels used in the manufacture of cement and may be found at a slightly higher proportion in the waste-derived fuels. However, high temperatures maintained in the clinker kiln and the kiln's highly alkaline environment cause most of the metals to precipitate becoming irreversibly bound into the newly-formed clinker. The metals will not solubilise again which is a pre-requisite for leaching to occur; with the clinker matrix acting as a permanent immobiliser. As heavy metals are found in raw materials and fuels used in clinker manufacture only at trace concentrations, the added quantities are negligible in comparison with the bulk of the cement material produced.

The heavy metals bound in the cement are further chemically bound in the alkaline reaction between the cement and water which produces concrete. This fixation as well as the high density and low permeability of concrete result in a very low potential for heavy metals to be released from the concrete structures.

The leaching of heavy metals from concrete has been examined in a number of investigations (Alternative Fuels in Cement Manufacture, Cembureau, Brussels 1997; M.T. Webster and R.C. Loehr, Long-Term Leaching of Metals from Concrete Products, Journal of Environmental Engineering, Vol. 122, No. 8, 1996; S.R. Hilliera, C.M. Sangha, B.A. Plunkettb, P.J. Walden, Long-term leaching of toxic trace metals from Portland cement concrete, Cement and Concrete Research, Vol. 29, No.4, 1999). They all show that the release is very low, independently of the kind of fuels used for cement clinker production. The leached quantities have always been found to be either not measurable or significantly below allowable environmental and/or public health limits. The only benchtop leaching tests that can demonstrate any extent of leaching of heavy metals from cement or concrete are those based on acid extraction.

European Union countries have been using waste derived fuels extensively in cement manufacture for around 50 years now. Many concrete structures in Europe have therefore been built using cement that incorporates heavy metals from the waste derived fuels, with no evidence of any environmental impacts that may have originated from heavy metals that have leached out of concrete.

4.5.2 Emission changes

Emission limits

Boral seeks a modification to the emission limits of three air pollutants to align with the requirements of the EPA's *NSW Energy from Waste Policy (2014).*

Boral Cement holds the Development Consent (DA 401-11-2002) for Kiln 6, last modified in August 2012, and the EPL 1698 for the site, last updated May 2013. The DA and EPL regulate the discharges of contaminants to air from the burning of standard fuels (such as coal, diesel, and heavy oil). From 2005, the DA and EPL also allow for the burning of "non-standard fuels" (NSF)[1] in the kiln with specific air discharge conditions. These conditions associated with the burning of NSF are onerous and difficult to meet. As a result, the NSF programme has never been implemented.

[1] The EPA *Guidance Note on the Assessment of Non-Standard Fuels (DEC, 2005)* defines' Standard Fuels' as: coal or coal derived fuel other than any tar or tar residues; liquid or gaseous petroleum-derived fuels, such as natural gas and LPG (propane and butane); untreated timber residues, such as from forest operations or sawmilling, but excluding any form of treated or painted timber; bagasse from sugar cane. 'Non-standard fuels' are all other substances that are used or proposed to be used as fuel.

Condition 3.10, Table 3 of the Development Consent and Conditions L3.1 and L44-L3.5 in EPL 1698 define permitted contaminant emission limits for the four discharge points during the burning of standard fuels, and are shown in **Table 5** and **Table 6**.

Table 5: Emissions limits for particulate matter for burning of Standard Fuels

Discharge point (and EPL point reference number)	Particulate matter 100 percentile concentration limit
No. 6 Kiln Stack (2)	95 mg/Nm^3
No. 6 Cement Mill (4)	100 mg/ Nm^3
No. 6 Kiln Cooler (5)	100 mg/ Nm^3
No. 7 Cement Mill (10)	20 mg/ Nm^3

Table 6: Emission limits for other contaminants from No. 6 Kiln Stack for burning of Standard Fuels

Contaminant	100 percentile concentration limit
Nitrogen oxides	1000 mg/ Nm^3

Condition 3.10 Table 4 of the Development Consent and Conditions L3.6 to L3.8 of EPL 1698 define permitted contaminant emission limits for the No.6 Kiln Stack during the burning of NSF, as shown in **Table 7**.

Table 7: Emission limits for particulates, NOx and VOCs from No. 6 Kiln Stack for burning of Non-Standard Fuels

Contaminant	100 percentile concentration limit
Nitrogen oxides	800 mg/ Nm^3
Particulate matter	30 mg/ Nm^3
Volatile organic compounds	20 ppm

Table 8 provides a comparison of the current emission limits for particulate matter, NOx and VOCs for burning of Standard Fuels and Non-Standard Fuels.

Table 8: Comparison of current emission limits for Particulates, NOx and VOCs from No. 6 Kiln Stack for burning of Standard Fuels and Non-Standard Fuels

Contaminant	Non-Standard Fuels	Standard Fuels
	100 percentile concentration limit	100 percentile concentration limit
Nitrogen oxides	800 mg/ Nm^3	1000 mg/ Nm^3
Particulate matter	30 mg/ Nm^3	95 mg/ Nm^3
Volatile organic compounds	20 ppm	No limit specified

Boral has undertaken monitoring and annual reporting on air emissions from the No. Kiln 6 stack, which demonstrates that the Cement Works complies with the emission limits for standard fuels. However, the more onerous conditions with regard to WDF would be more difficult to comply with, and therefore Boral has never progressed the use of WDF.

Additionally, and of relevance to this proposed modification, is the release of the EPA's *NSW Energy from Waste Policy (2014)*, which defers to the emission limits specified in the *Protection of the Environment Operations Regulation (Clean Air) 2010*. To align with the regulation and policy, as well as to facilitate the use of SWDF, Boral proposes changes to the emission limits of particulate matter (PM), nitrogen oxides (NOx) and volatile organic compounds (VOCs). **Table 9** details the current air emission limits and the proposed changes.

Table 9: Proposed emission limits for burning Non-Standard Fuel

Emission types	Limit using standard fuel	Current limit using non standard fuel	Proposed limit using non standard fuel
Particulate matter (PM)	95 mg/m^3	30 mg/ m^3	50 mg/ m^3 *
Nitrogen Oxides (NOx)	1000 mg/ m^3	800 mg/ m^3	1000 mg/ m^3 **
Volatile Organic Compounds (VOCs)	N/A	20 ppm	40 ppm **

* NSW Group 6 emission criteria as per *Energy from Waste Policy 2014*
** Alternative emission standards applied for as per Clause 36 of *POEO (Clean Air) Regulation 2010*

These proposed emission limits are considered safe with regards to public health and environmental impacts (refer Air Quality Technical Report, Appendix D) and are also realistic for Boral to achieve at a commercially acceptable cost. Section 7.1 discusses the air quality impacts of this change in more detail.

If limits were to remain overly stringent, the use of SWDF would continue to be an unviable option and the benefits of diverting waste from landfill and reducing carbon emissions would be unrealised. Furthermore, without this change and in consideration of the pressures on the cement industry, it is likely that the manufacture of cement clinker in Kiln 6 would have a lifespan of less than 5 years.

Emissions reporting

Boral also seeks minor changes in the development consent to the way two emissions are reported. The changes sought are:

- the definition of Volatile Organic Compounds to be changed to Non-Methane Volatile Organic Compounds; and
- the averaging period for the reporting of Nitrogen Oxides changed from 1-hour averaging, to 24-hour averaging.

The reasons for these changes are outlined below.

Volatile Organic Compounds

Within Kiln 6, it can be demonstrated that VOC emissions are not associated with the combustion of fuels. Rather, the VOC's are associated with the natural composition of onsite blue shale used as a raw material in Kiln 6.

In Europe, where there is widespread use of WDF in cement kilns, there is recognition in their policy document (Waste Incineration Directive, 2000 (WID)) that VOC emissions are not necessarily linked to the use of waste-derived fuels. Rather, it is recognised that these emissions may be caused by other factors, therefore providing the regulator with discretion to allow exemptions based on other parameters such as Total Organic Carbon (TOC).

The WID states:

"Exemptions may be authorised by the competent authority in cases where TOC (i.e. VOC) and SO_2 do not result from incineration of waste".

Boral seeks recognition of established practices used in WID and submits that Non-Methane Volatile Organic Compounds as Propane (C3) are the appropriate VOC to measure compliance to account for the inherent VOC levels within the blue shale. Accordingly, Boral seeks modification of Condition 3.10A, Table 4 in the consent to acknowledge Non-Methane Volatile Organic Compounds as Propane.

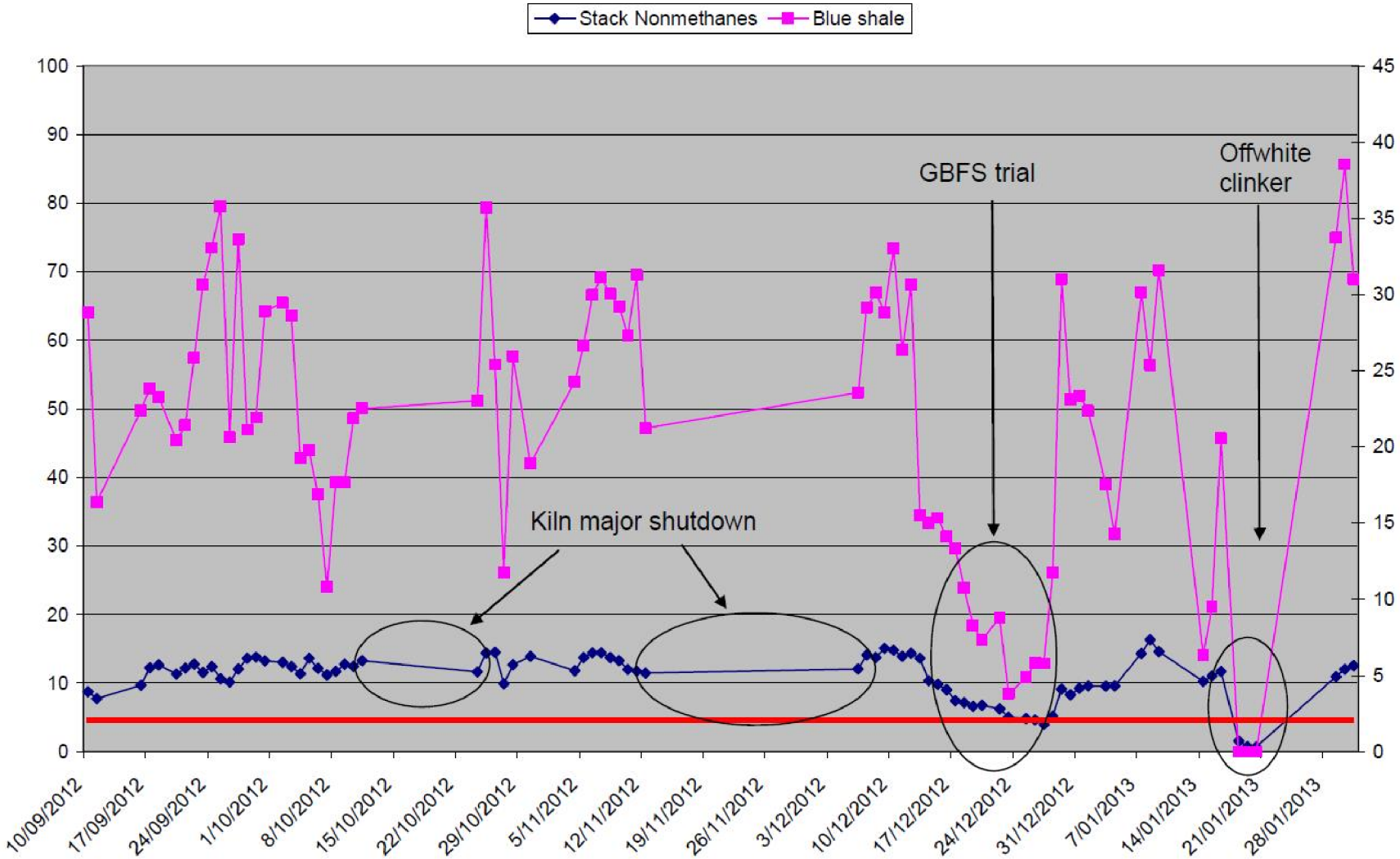
Figure 7 shows that when Kiln 6 made off-white clinker with non-blue shale and substituted some blue shale with Granulated Blast Furnace Slag (GBFS), VOC levels reported as non-methane reduced or were eliminated.

Averaging period for Nitrogen Oxides

Continuous monitoring results for Nitrogen Oxides (NOx) are currently required to be averaged over a 1 hour period when burning non-standard fuels. However, other pollutants, like particulate matter, are required to be averaged over 24 hours.

Interactions between fuel combustion and chemical processes in a cement kiln can result in significant hourly variations in NOx which are not reflective of the environmental impact of the kiln emissions. This is important from a regulatory and community point of view, so that reporting is consistent and an accurate reflection of potential environmental impact, rather than short term variations.

Boral seeks consistency of averaging periods across monitoring of all pollutants when using non-standard fuels and requests that the averaging period for NOx be changed to a 24-hour average, counted from midday to midday.



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Changes in VOC Emissions with Different Raw Materials

FIGURE 7

4.5.3 Fuel storage and feeding system

The following sections discuss the design, construction and operation of the necessary fuel storage and feeding system to enable the use of SWDF at the Cement Works.

Design

Appendix A includes detailed drawings showing the process for receival, storage and conveyance of the SWDF as well as general layout arrangements for the storage shed. Elevations are provided for the storage shed and enclosed conveyor as well as discharge arrangements for the pre-heater enclosed conveyor.

The storage and handling facility is designed to store and handle SWDF such as waste tyre chips (AKF5), wood waste and RDF. The SWDF 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 would be 33m long, 50m wide and 13m high;
- a RDF bale feed conveyor to feed bales into the receival shed;
- a de-baler/shredder and feed 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;
- a screw conveyor and air sealing device around the pre-calciner within the preheater tower; and
- a designated ground outdoor storage area for SWDF received in the form of covered (plastic wrapped) bales or within covered delivery vehicles.

Potential suppliers of RDF have nominated bales as the preferred method of transporting in the short term. However, in the future, as the market develops, transportation may move to using shipping containers, which would necessitate an alternate feeding system. This would be subject to future development assessment.

Construction

The construction of the fuel storage and feeder system would involve the following sequence of activities:

- pre-construction activities including survey and geotechnical investigations, relocation of existing shed, site office set up and fencing of construction area;
- earthworks and civil, including site preparation, form work for storage building and enclosed conveyor, and new pavements and truck access;
- installation of prefabricated receival and storage building, including lighting and electrical works;
- installation of prefabricated moving floor system;
- assembly and installation of modularised material handling and storage system including two weight belt feeders, enclosed conveyor and support trestles, transfer screw, chutes and air lock valves and gate valve;
- configuration of electrical and control system; and
- upgrade of internal rotating assembly of the existing electrostatic precipitator fan.

Construction is anticipated to take approximately 40 weeks, commencing from November 2015. Construction activities would be limited to normal working hours and the maximum number of construction staff on site at any one time would be approximately 36 personnel. **Table 10** lists the likely plant and equipment that would be required for the construction phase of the proposal.

Table 10: Construction plant and equipment

Rear mounted drill rig on 4x4 vehicle	4t capacity tele-handler	10t tip truck
Mobile crane (18t franna)	25t capacity excavator	Grader
Mobile Crane (35t)	D4 dozer	Concrete agitator truck
Mobile Crane (80t)	10t road roller	Mobile welder
Mobile Crane (150t)	Flat top truck	Diesel welder/generator
Concrete pump	Elevated work platform and boom lift	Cable puller - winch
Hand tools, grinders, drill, welder, rattle gun		

Operation

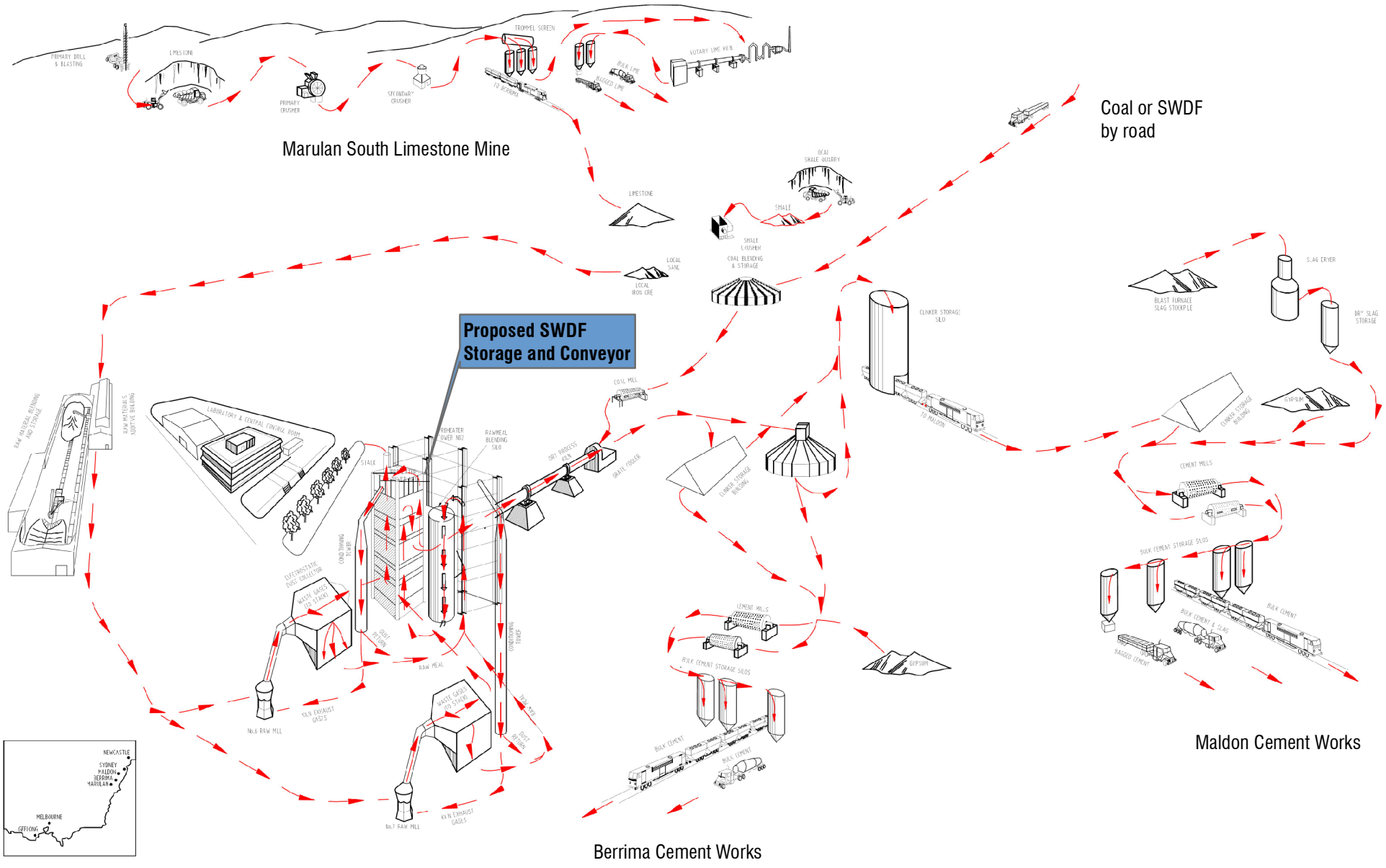
Figure 8 provides a process flow diagram of the Berrima site operations incorporating the use of Solid Waste Derived Fuel and related infrastructure.

SWDF would be supplied by tier one waste management facilities who have a demonstrated quality control system for the handling, transport, sampling and analysis of SWDF. Boral is currently negotiating agreements with a number of such providers.

The SWDF would be delivered by trucks with covered tippers with ten deliveries expected over a day. While the Cement Works operates 24 hours a day 7 days a week, deliveries of SWDF would typically be between 6am and 6pm on weekdays and 7am and 1pm on Saturdays. Tyre chips and wood waste would be delivered in bulk to the storage shed, while RDF would be delivered in $1m^3$ bales to the designated indoor or outdoor storage area. Bales stored in the outdoor storage area would be plastic wrapped. The stockpile size for each of the waste types will vary but would be approximately:

- Tyre chips: 10,000 t/annum
- Wood waste: 40,000 t/annum
- RDF: 50,000 t/annum

Figures in Appendix A provide a diagrammatic illustration of the operating process, along with the new elements of the operation within the existing general arrangement of Kiln 6. In summary, SWDF would be received at the purpose built $1650m^2$ storage shed where it would be mixed by two feed control units to ensure different SWDF are blended prior to use. Following this blending, the material would be transferred and weighed via a conveyor to control the fuel dosage that is delivered to the calciner. An enclosed conveyor would then transfer the blended and weighed material to the pre-heater tower where it would be discharged via chute into the twin shaft screw conveyor. The injection system would be controlled by a new double flap gate and a new slide gate prior to the SWDF material entering the calciner.



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Process Flow at Berrima Cement Works Incorporating Solid Waste Derived Fuel and Related Infrastructure

FIGURE 8

4.6 Need for Modification

The Cement Works is a significant contributor to the local economy and is facing increasing pressure from cheaper local imports and rising energy costs. Up 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.

4.7 Alternatives

Do nothing

Doing nothing would mean continuing to use third party coal for heat energy in Kiln 6 and not pursue using SWDF. Boral's energy costs, which represent 40% of all production costs, would be subject to fluctuating coal prices and over the short to medium term may make clinker manufacturing too costly when compared to cheaper imports. When this occurred in Victoria at Boral's Waurn Ponds Cement Works, the decision was made to cease manufacturing and import clinker, resulting in the loss of 90 jobs[2]. Doing nothing would also see the continued reliance on extracted virgin coal, instead of diverting up to 100,000 tonnes per year of solid waste materials from landfill.

The do nothing approach is not sustainable and could limit the lifespan of the Cement Works as a manufacturer of clinker to around 5 years.

Continue mining at Berrima Colliery

Boral's Berrima (Medway) Colliery supplied coal to the Cement Works for heat energy since its establishment in 1926. In October 2013, Boral announced that it would place the colliery on care and maintenance and buy coal from elsewhere, due to the planning uncertainty created by the legal proceedings brought against the colliery's continued operations by the Southern Highlands Coal Action Group. Due to the significant carrying costs in care and maintenance, Boral has since announced that it is seeking approval to permanently close the colliery.

Using coal from Berrima Colliery is therefore not considered a viable alternative due to planning uncertainty and the further costs associated in obtaining a long term development approval for the mine.

Use of virgin timber

Virgin timber has been considered as a possible alternative for kiln fuel in the past. Historically, virgin timber has been more expensive than coal, and its high moisture content has made it operationally unsuitable. Aside from the commercial and operational constraints, it has also been ruled out on sustainability grounds.

Use of Natural Gas

A branch line of the Sydney to Moomba gas line adjoins the eastern end of Boral's property at New Berrima fronting Berrima Road. Natural gas is approximately double the price of coal on a heat basis, and has therefore been ruled out on commercial grounds.

There would also be a significant capital cost in connecting Kiln 6 to the gas line, which at present, could only supply 25% of the energy needs for Kiln 6 due to a narrow gauge capacity constrained line.

[2] http://www.boral.com.au/Images/common/pdfs/Media_Releases/ASX-media-release-Waurn-Ponds-cement-plant-6-12-2012.pdf

The Proposal

Boral has been exploring the use of WDF for heat energy in Kiln 6 for approximately 10 years. It has been common practice in cement plants in Europe for around 20 years, and all other cement kilns in Australia have been using these fuels for a number of years. Purely on commercial grounds, using SWDF like wood waste and RDF would reduce energy costs, and in turn, overall production costs to a point where manufacturing clinker in Kiln 6 can continue to be competitive against imported products. This would help secure the medium term future of the Cement Works as a manufacturer of clinker. The added benefit of using these fuels is that it would divert up to 100,000 tonnes of waste from landfill each year, reduce reliance on coal and recover energy from waste that would otherwise generate greenhouse gas (methane) while decomposing in landfill.

If approved, and established as a sustainable ongoing fuel in Kiln 6, there is the opportunity to increase the use of SWDF (subject to further approval) in the future and further reduce waste going to landfill. The proposal to use SWDF in Kiln 6 for heat energy is viewed as the most commercial and sustainable alternative.

The Capital Investment Value (CIV) of the proposed development is approximately $10 million.

5 STATUTORY FRAMEWORK

5.1 Current Approvals and Recent Modifications

Berrima Cement Works operates under two development consents that were granted by the Minister in 2003 (Kiln 6) and 2005 (Mill 7). Boral Cement is permitted to produce up to 1.56 million tonnes of cement a year at the facility. These consents have since been modified as per **Table 11**.

Table 11: Modifications to the original development approvals

Modification	Reference/Date	Scope
1	MOD 2-1-2004 Sept 2005	Use of non-standard fuels, including used tyres, liquid oil residues and spent aluminium electrode carbon
2	MOD 109-9-2006 Sep 2006	Removal of hazardous waste prohibition
3	MOD 12-2-2007 Feb 2007	Trial use of tyre chips
4	MOD 4 April 2008	Varying usage of coke fines
5	MOD 5 Aug 2009	Coal deliveries by rail
6	MOD 6 June 2012	Stockpiling of coal for sale and transport to Port Kembla
7	MOD 7 April 2012	Trial and use of blast furnace slag
8	MOD 8 July 2012	Administrative changes to align DA and EPL conditions

Of particular relevance to this modification is MOD 2-1-2004, which resulted in a number of conditions of approval relevant to Boral in implementing the use of WDF. Appendix C provides a list of these relevant conditions and how Boral intends to meet these obligations or the changes it seeks for each condition.

5.2 NSW Environmental Planning and Assessment Act 1979

The Cement Works was approved under Part 4 of the EP&A Act in May 2003. Under clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000*, an approval prior to August 2005 relating to a State Significant Development under Part 4 of the Act is taken to be a Part 3A approval for the purposes of modifications only. Any modifications to such an approval are to be under Section 75(W) of the EP&A Act. Therefore Section 75(W) is the appropriate pathway for consideration of this modification.

5.3 Protection of the Environment Operations Act 1997

The Cement Works operates under Environment Protection Licence 1698 issued under the *Protection of the Environment Operations Act 1997* (POEO Act) for the Scheduled activities of cement production, extractive activity and recovery of general waste. If this modification were to be approved by DPE it would trigger a variation of the EPL to reflect the use of additional fuels and changes to emission limits.

5.4 NSW Waste Policy and Legislation

In NSW, a series of regulatory and policy instruments are in place to safely manage waste and promote effective resource recovery from waste.

The POEO Act defines 'waste' for regulatory purposes and establishes management and licensing requirements along with offence provisions to deliver environmentally appropriate outcomes. The Act also establishes the ability to set various waste management requirements via the regulation.

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs, such as the extended producer responsibility scheme for industry.

The recently published *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (Waste Strategy) is informed and driven by the waste hierarchy which also underpins the objectives of the WARR Act. The primary goal of the Waste Strategy is to enable all of the NSW community to improve environment and community well-being by reducing the environmental impact of waste and using resources more efficiently.

Importantly, the Waste Strategy now recognises energy recovery from waste as a viable pathway within the waste hierarchy. Energy recovery is now part of Key Result Area 3, after avoiding waste and increasing recycling, as a means of diverting more waste from landfill. MOD 9 is therefore consistent with the Waste Strategy as the Proposal would contribute to the 2021 target of increasing the waste diverted from landfill from 63% (in 2010–11) to 75% by recovering energy from up to 100,000 tonnes of SWDF.

The EPA's *Energy from Waste Policy*, published in March 2014, recognises that the recovery of energy and resources from the thermal processing of waste has the potential, as part of an integrated waste management strategy, to deliver positive outcomes for the community and the environment, where:

- further material recovery through reuse, reprocessing or recycling is not financially sustainable or technically achievable; and
- community acceptance to operate such a process has been obtained.

The policy provides a framework for the industry and has been considered in the development of this proposed modification.

Except for tyre chips, the wastes proposed for use, being wood waste and RDF are not currently listed as eligible waste fuels. However, the policy provides for the use of such wastes if the energy recovery facility implements best practices to ensure air emissions are below risk levels. Boral proposes to comply with the following technical criteria in the policy to enable the use of such wastes:

- gas from the process would be raised to a minimum temperature of 850°C for at least 2 seconds;
- air emissions would comply with the Group 6 emissions standards specified in the Clean Air Regulation. It is noted that in accordance with clause 36 of the regulation, an existing facility may apply to the EPA for an alternative NOX and VOCs emission standard;
- continuous monitoring would be undertaken for specified air emissions, including NOx, TSP and VOCs, and data made publically available; and
- continuous monitoring would be undertaken of specified operational parameters, including temperature in the combustion chamber and stack, oxygen concentration and water content.

5.5 Energy from Waste Policy Statement – Criteria for Energy Recovery Facilities

Part 4 of the NSW Energy from Waste Policy Statement states that: "Any facility proposing to thermally treat a waste or waste-derived material that is not a listed eligible waste fuel (Section 3) must meet the requirements to be an energy recovery facility."

The Statement states that energy recovery facilities must demonstrate that they meet a number of criteria under the following headings:

- Use of international best practice techniques
- Technical criteria
- Thermal efficiency criteria
- Resource recovery criteria

The following table describe how the current operations and proposed modification would address these criteria.

Table 12: Requirements for Energy Recovery Facility (Part 4 of the NSW Energy from Waste Policy Statement)

Use of international best practice techniques	
Process design and control	The kiln feeding system has been designed to incorporate measures to control the quantity of SWDF fed into the pre-calciner at the appropriate rate to replace 30% of the heat energy required for Kiln 6. The design features a weighing and programmable control system which will control the feed rate by pre-programmed loading volume rates and conveyor speed. The system will be calibrated during dry commissioning. An air lock on the pre-calciner screw conveyor will also form part of the design to control oxygen levels in the process, and interlocks linked to the plant control system to ensure SWDF is only fed when kiln temperatures are appropriate.
Emission control equipment design and control	In 2004, Boral upgraded Kiln 6 and installed additional equipment specifically suited to the burning of WDF. The key features of this equipment are: • a large volume pre-calciner combustion vessel, which gives fuels longer time to burn out (>6 seconds) at high temperatures (>800 Deg C). This means that all of the solid fuel is given the chance to burn out and eliminates residues like smoke; • the raw mill dust collector, which filters kiln exhaust gas particulates and provides additional high efficiency cleaning capacity to minimise stack emissions; and • installation of continuous monitoring equipment for key gaseous pollutants, which allows prompt response to any adverse trends in stack emissions.
Emission monitoring with real-time feedback to the controls of the process	As part of the Kiln 6 upgrade in 2004, Boral installed continuous monitoring equipment for key gaseous pollutants, which allows prompt response to any adverse trends in stack emissions. Continuous monitoring would be undertaken for specified air emissions, including NOx, TSP and VOCs. Continuous monitoring would be undertaken of specified operational parameters, including temperature in the combustion chamber and stack oxygen concentration. Boral operate an ambient monitoring station beyond the site boundary which records meteorological data continuously and TSP, PM_{10} and other compounds on a one-day-in-six basis.

Use of international best practice techniques	
Arrangements for the receipt of waste	Appendix A includes detailed drawings showing the process for receival, storage and conveyance of the SWDF as well as general layout arrangements for the storage shed. The storage and handling facility is designed to store and handle SWDF such as waste tyre chips (AKF5), wood waste and RDF. The SWDF 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 would be 33m long, 50m wide and 13m high; • a RDF bale feed conveyor to feed bales into the receival shed; • a de-baler/shredder and feed 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; • a screw conveyor and air sealing device around the pre-calciner within the preheater tower; and • a designated ground outdoor storage area for SWDF received in the form of covered (plastic wrapped) bales or within covered delivery vehicles. Potential suppliers of RDF have nominated bales as the preferred method of transporting in the short term. However, in the future, as the market develops, transportation may move to using shipping containers, which would necessitate an alternate feeding system. This would be subject to future development assessment.
Management of residues from the energy recovery process	There are no residues
Energy recovery facilities must use technologies that are proven, well understood and capable of handling the expected variability and type of waste feedstock. This must be demonstrated through reference to fully operational plants using the same technologies and treating like waste streams in other similar jurisdictions.	Boral has been exploring the use of SWDF for heat energy in Kiln 6 for approximately 10 years. It has been common practice in cement plants in Europe for around 20 years, and all other cement kilns in Australia have been using these fuels for a number of years. Cement plants across Europe have been using up to 92% thermal substitution from SWDF and other fuels for many years. Some examples of similar plant using SWDF include: • Lafarge Tarmac Tunstead and Lowe Plants, UK - Similar kiln/precalciner design burning tyre chips, wood chips, RDF, carpet and meat and bone meal up to 50% heat replacement • Cemex Rugby Plant UK - Precalciner plant burning RDF and other solid waste derived fuels • Heidelberg Padeswood Plant UK - Precalciner plant burning RDF and other solid waste fuels.

Technical Criteria	
The gas resulting from the process should be raised, after the last injection of combustion air, in a controlled and homogenous fashion and even under the most unfavourable conditions to a minimum temperature of 850°C for at least 2 seconds (as measured near the inner wall or at another representative point of the combustion chamber).	An average gas temperature for the combustion section of the cement kiln preheater/pre-calciner will be measured to demonstrate compliance with this condition. Gas residence time in this section of the plant is well in excess of 2 seconds. In addition, as part of the 2004 Kiln upgrade, additional equipment was installed, including a large volume pre-calciner combustion vessel, which gives fuels longer time to burn out (>6 seconds) at high temperatures (>800 Deg C). This means that all of the solid fuel is given the chance to burn out and eliminates residues like smoke.
If a waste has a content of more than 1% of halogenated organic substances, expressed as chlorine, the temperature should be raised to 1100°C for at least 2 seconds after the last injection of air.	Fuel specifications would limit the Chlorine content of SWDF to <1.0%
The process and air emissions from the facility must satisfy **at a minimum** the requirements of the Group 6 emission standards within the Protection of the Environment Operations (Clean Air) Regulation 2010 (Note: An existing facility may apply to the EPA for an alternative NO and VOCs emission standard in accordance with clause 36 of the Protection of the Environment Operations (Clean Air) Regulation 2010).	The process would meet the requirements of Group 6 for gaseous emissions noting that modified limits for NOx and VOCs are proposed as per Clause 36 of the Protection of the Environment (Clean Air) Regulation 2010.
There must be **continuous measurements** of **NOx, CO, particles (total), total organic compounds, HCl, HF** and **SO_2**.	Continuous emissions monitoring will be provided for NOx, particulates, VOC (as Non-methane), SO_2 and HCl. Continuous emission monitoring for HF is not necessary (see below). While continuous emission monitoring of CO will be provided this will be for indication purposes only and emission limits for combustion will be based on VOC as per Group 6 requirements.
This data must be made available to the EPA in real-time graphical publication and a weekly summary of continuous monitoring data and compliance with emissions limits published on the internet.	Continuous emissions monitoring data can be made available to the EPA on request. Regular updates of 24-hr average emissions data (corrected to standard temperature and pressure and 10% oxygen) and their relationship to relevant emission limits will be published on Boral Cement's website.
The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded.	Due to the nature of the cement manufacturing process HF emissions are typically very low and follow similar trends to HCl. It is therefore proposed to continuously monitor HCl only. HF emissions will be monitored routinely as part of periodic stack emission tests.

Technical Criteria	
There must be **continuous measurements** of the following operational parameters: **temperature** at a representative point **in the combustion chamber**; concentration of **oxygen**; **pressure** and **temperature in the stack**; and **water vapour** content of the exhaust gas. This must be conducted and held by the proponent for a period of three years.	Kiln 6 has continuous measurements for all the following operational parameters: **temperature** at a representative point **in the combustion chamber**; concentration of **oxygen**; **pressure** and **temperature in the stack**; and **water vapour** content of the exhaust gas.
As part of the environment protection licence conditions of any energy recovery facilities, the EPA will require operators to undertake proof of performance (POP) trials to demonstrate compliance with air emissions standards. Following successful POP trials, there must be **at least two measurements per year of heavy metals**, **polycyclic aromatic hydrocarbons**, and **chlorinated dioxins and furans**. One measurement at least every three months shall be carried out for the first 12 months of operation. If and when appropriate measurement techniques are available, continuous monitoring of these pollutants will be required.	Noted
The total organic carbon (TOC) or loss on ignition (LOI) content of the slag and bottom ashes must not be greater than 3% or 5%, respectively, of the dry weight of the material.	There will be no slag or bottom ash produced from the process
Waste feed interlocks are required to prevent waste from being fed to the facility when the required temperature has not been reached either at start-up or during operation.	Such interlocks will be provided as part of the plant control system . Temperatures outside of the required operating band will initiate a controlled ramp down to stop the SWDF at a defined rate.
An air quality impact assessment must be undertaken in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*.	An Air Quality Impact Assessment has been undertaken. Refer to Appendix D.
An energy recovery facility processing wastes other than 'eligible waste fuels' must satisfy all of the above requirements, regardless of whether the facility is an existing or purpose-built facility and the waste input is	Noted

Technical Criteria	
the sole feedstock or a fuel for co-firing.	

Thermal Efficiency Criteria	
To meet the thermal efficiency criteria, facilities must demonstrate that at least 25% of the energy generated from the thermal treatment of the material will be captured as electricity (or an equivalent level of recovery for facilities generating heat alone).	As the heat energy from SWDF combustion will be a direct substitute for the heat energy currently provided by coal combustion in the cement manufacturing process, the heat recovery rate for SWDF in the proposed process is effectively 100%.
Energy recovery facilities must also demonstrate that any heat generated by the thermal processing of waste is recovered as far as practicable, including use of waste heat for steam or electricity generation or for process heating of combined heat and power schemes.	The cement kiln at Berrima recovers most of the heat input as part of clinker manufacturing process. Combustion gases from the kiln are used to heat up raw materials from ambient temperature to 1450°C to make clinker. Clinker leaving the kiln is cooled down by air at ambient temperature. The heat from clinker is recovered as hot air at 1200°C and used for combustion of fuel into kiln and calciner.

Resource Recovery Criteria	
Energy recovery facilities may only receive feedstock from waste processing facilities or collection systems that meet the criteria outlined in Table 1 (Resource Recovery Criteria for Energy Recovery Facilities).	SWDF specifications will require suppliers to meet the criteria in Table 1.
Proponents wishing to use waste or waste-derived materials for energy recovery that are not defined in Table 1 must contact the EPA to discuss their proposal. The EPA will consider any such proposals on a case-by-case basis in accordance with the energy from waste considerations outlined in this policy statement and the principles set out in the POEO Act and WaRR Act.	This Environmental Assessment supports a modification application seeking approval for materials not defined in Table 1. The EPA is the key agency being consulted as part of the modification process and will consider these matters as part of their assessment.

6 CONSULTATION

Consultation has occurred with a number of stakeholder groups regarding the proposal prior to and during the preparation of this EA. These stakeholders are:

- NSW Environment Protection Authority;
- NSW Roads & Maritime Services;
- Wingecarribee Shire Council; and
- Berrima Cement Works Community Liaison Group (CLG);

Table 13 provides a summary of the issues raised from consultation activities and how these issues have been addressed.

Table 13: Summary of consultation

Issue Category	Issue raised	How has the issue been addressed
Air Quality	Correspondence from the EPA dated 9 May 2014 clarified its position in relation to potential changes to VOC, NOx and particulate matter limit changes, as well as oxygen reference conditions, monitoring confidence intervals and averaging periods (see Appendix J).	Boral has not sought changes in relation to an oxygen reference or monitoring confidence intervals. Changes have been sought in regard to the other matters, which are outlined in Section 4.1.2
	Berrima CLG: during meetings on 11 September and 19 December 2014 questions were raised regarding compliance with existing air quality limits and whether burning waste fuels like tyres would result in smoke coming out of the kiln stack, levels of dioxins and odour.	Boral reported its compliance with existing air quality limits during each of the meetings. Waste tyres are already approved as a non-standard fuel and are not targeted for use in the short term. The high operating temperatures, process control and emissions equipment outlined in Sections 3.4 and 4.1.1 address control and monitoring of emissions. Odour is addressed in Section 7.1.
Noise	Berrima CLG: during meetings on 11 September and 19 December 2014 questions were raised regarding whether the plant and conveyors would be enclosed to reduce noise.	The solid waste fuels receival shed, feeding equipment and conveyor would all be enclosed. The external RDF feeding equipment would not be enclosed as the bales would be enclosed with wrapped plastic. The small conveyor drives would be located within the receival shed. The proposed equipment is described in Section 4.5.3 and drawings included in Appendix A.
Traffic	RMS email dated 5 December 2014 provided initial comments on the Proposal as follows: • A Traffic Impact Study is required • TIS to include existing and likely additional traffic movements • Impact of changes to traffic volumes on key intersections • Use of peak rather than average	A Traffic Impact Assessment is appended in Appendix H and summarised in Section 7.5. The TIA describes existing and additional traffic movements associated with the proposed modification. The TIA concludes that the minor increase in traffic is of such a low order that there would be no material impact on the performance or safety of the local road network including key intersections, and therefore no external

	movements • Consideration of road works in the road reserve	infrastructure upgrades are required.
	Berrima CLG: during meeting on 19 December 2014 asked about the additional volume of trucks on Taylor Avenue.	Minor increase in traffic volumes addressed in Section 7.5.

7 ENVIRONMENTAL ASSESSMENT

7.1 Air Quality

The air quality assessment describes the changes to air pollutant concentrations at selected receptor locations as a result of the proposed development. The potential for air quality impacts arises from:

- The proposal to burn non-standard fuels (NSF) in the kiln;
- Changes to the air emission or discharge limits from the stack of particulate matter, nitrous oxides and volatile organic compounds; and
- Construction and operation of the fuel storage and kiln feeding system (which potentially may give rise to dust, odour and other fugitive emissions).

The methodology used to carry out this assessment follows the NSW EPA guidelines: “Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005)”.

The air quality assessment addresses the following areas:

- A description of current and proposed emission limits for burning of standard and non-standard fuels, and proposed new limits for non-standard fuels;
- A description of the sources and nature of emissions at the cement works site along with data on actual stack emissions;
- The existing air quality environment in the vicinity of the cement works site;
- An assessment of the impacts at local receptors as a result of the burning of NSF and with the proposed new emission limits applied to emissions from the stack;
- An assessment of the impacts at local receptors as result of fugitive emissions (for example, dust and odour); and
- Proposed measures to monitor and manage air quality impacts during the construction and operation of the proposed development.

7.1.1 Current and proposed emission limits

Table 14 describes the current emission limits for particulate matter, nitrous oxides and volatile organic compounds for burning of both standard fuels and non-standard fuels, along with the proposed new limits for burning of non-standard fuels. No changes are proposed to the emission limits for burning of standard fuels.

Changes to the emission limits for non-standard fuels are sought to align the approved limits with the NSW Energy from Waste Policy and regulations.

Table 14: Proposed emission limits for burning Non-Standard Fuels

Emission types	Limit using standard fuel	Current limit using non standard fuel	Proposed limit using non standard fuel
Particulate matter	95 mg/m^3	30 mg/m^3	50 mg/m^3 *
Nitrogen Oxides (NOx)	1000 mg/m^3	800 mg/m^3	1000 mg/m^3 **
Volatile Organic Compounds (VOCs)	N/A	20 ppm	40 ppm **

* NSW Group 6 emission criteria as per *Energy from Waste Policy 2014*
** Alternative emission standards applied for as per Clause 36 of *POEO (Clean Air) Regulation 2010*

7.1.2 Description of air quality emissions

Sources of emissions

Air discharges from the cement works can be described as point sources (ie discharged from a stack or vent such as the kiln and cement mills) or fugitive sources (ie open to the air and/or spread over an area such as stockpiles).

There are four point source emissions at the cement works site as shown in **Figure 9** and described in **Table 15**.

Sources of fugitive dust and fine particulates emissions can be described in the following categories:

- Stockpiles of bulk dry materials such as coal, blue shale, yellow shale, steel slag or blast furnace slag;
- Cement fibreboard and gypsum;
- Trucks and loaders generating dust from vehicle tracks and movement of materials;
- Unpaved roads and dusty surfaces in stockpile areas;
- Quarry area; and
- Crushing and mixing of materials prior to kiln processing.

The proposed development will introduce a potential new source of fugitive emissions, in the form of dust and odour, through the fuel storage, handling and feeding system.

Nature of emissions

Emissions to the air from the typical cement works, with or without the use of non-standard fuels, may include:

- fine particulate, sulphur dioxide (SO_2), nitrogen oxides (NOx) and carbon monoxide (CO) resulting from combustion processes and dry goods handling/milling processes;
- smaller amounts of other air contaminants, including:
    - volatile organic compounds, or “VOCs” - also called “non-methane hydrocarbons” or “NMHCs”;

- polycyclic aromatic hydrocarbons, or “PAHs”;
- heavy metals;
- hydrogen halides (such as hydrogen chloride, hydrogen fluoride); and
- dioxins.

- dust emissions from raw material and bulk dry goods handling and storage, and yard areas; and
- odour emissions from storage and handling of Solid Waste Derived Fuels.

A detailed description of each of these emissions is provided in the Air Quality Technical Paper.

Emissions Rates

A range of sampling and analysis programmes are carried out at the Berrima cement works site to monitor air emissions from the four point source discharge points. Based on a review of sampling data, described in detail in the Air Quality Technical Paper, it can be demonstrated that the cement works is complying fully with the air discharge requirements of existing approval and licence conditions for the burning of standard fuels (refer to **Table 15** and **Table 16**).

Table 15: Emission limits from EPL 1698 for particulate matter for burning Standard Fuels compared to Annual Stack test data 2011-2013

Discharge point	Particulate matter concentration limit	Results from annual stack test data
No. 6 Kiln Stack	95 mg/Nm^3	Max measured concentration: 56.8 mg/Nm^3
No. 6 Cement Mill	100 mg/Nm^3 (reduced from 250 mg/Nm^3 in March 2012)	Max measured concentrations: 5.0 mg/Nm^3
No. 6 Kiln Cooler	100 mg/Nm^3 (reduced from 175 mg/Nm^3 in March 2012)	Max measured concentrations: 5.3 mg/Nm^3
No. 7 Cement Mill	20 mg/Nm^3	Max measured concentration: 18.5 mg/Nm^3

Table 16: Emission limits from EPL 1698 for other contaminants from No. 6 Kiln Stack for burning of Standard Fuels compared to Annual Stack test data 2011-2013

Contaminant	100 percentile concentration limit	Stack testing results
Nitrogen oxides	1000 mg/Nm^3	Max measured concentration from annual tests: 891 mg/Nm^3

7.1.3 Existing Environment

Land Use

The closest residential zone to the works site is located in New Berrima, approximately 650m north from the No. 6 kiln stack at the closest points. Residential zones are also located in Berrima, at least 2,150m north of the No. 6 kiln stack.

The New Berrima residential area is flanked to the south and east by “Private Recreation” areas. Based on the land uses allowed in the Private Recreation area, it is assumed for the purposes of the air quality assessment that people could carry out recreational activities within the area, but would not carry out residential dwelling and sleeping activities.

Figure 10 provides a representation of the spread of dwellings and potentially sensitive locations around the cement works site. These locations were used as discrete receptor locations for dispersion model predictions.

Air quality

Boral operates an ambient air quality monitoring station (AQMS) beyond the site boundary. The AQMS records data for Total Suspended Particulates (TSP), PM_{10} and heavy metals. A detailed analysis of the ambient monitoring data is provided in the Air Quality Technical Report (Appendix D), however, in summary:

- The concentrations of PM_{10} and TSP, measured on annual average basis, are less than or equal to half of the criteria set by the NSW EPA;

- The concentrations of PM_{10}, measured on a 24-hour basis, were below the national air quality standard for PM_{10} for most of the time. However, on five days, the 24-hour concentration of PM_{10} approached or exceeded the national standard. It is not possible to distinguish the relative contribution of PM_{10} discharges from the cement works from other sources. However, wind direction indicates that the cement works was likely to be the source of these PM_{10} emissions on three of the five days.

- The concentrations of heavy metals were below the applicable air quality criteria.

7.1.4 Environment Assessment

Introduction

The air quality assessment methodology is described in detail in the Air Quality Technical Paper. In summary, the approach to air quality assessment involves:

- Establishing the existing air quality conditions in the vicinity of the site;
- Identifying receptors in the vicinity of the site likely to be sensitive to changes in air quality;
- Identifying the sources of air quality emissions resulting from the proposed development; and
- Estimating, using a dispersion model, the impact of the proposed development on receptor locations, and comparing these impacts to air quality criteria.

The pollutants included in the dispersion modelling include:

- Total Suspended Particulates (TSP);
- Particular Matter up to 10 micrometres in size (PM_{10});
- Particulate Matter up to 2.5 micrometres in size ($PM_{2.5}$);
- Nitrogen Dioxide (NO_2);
- Sulphur Dioxide (SO_2);
- Non-methane Hydrocarbons (NMHC);
- Dioxins;
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Heavy metals;
- Halides; and
- Sulphuric acid mist.

Fugitive dust emissions from raw material stockpiling and handling were also modelled for TSP, PM_{10} and $PM_{2.5}$ emission as well as odour emissions from the proposed new storage building for solid waste derived fuel.

The predicted concentrations at each receptor location were combined with background data and compared to EPA assessment criteria. The assessment considered the incremental impact caused by proposed development as well as cumulative impact.

Assessment

The following section provides a summary of the outcome of the environmental assessment for each of the assessed pollutants, with a detailed description provided in the Air Quality Technical Paper.

Total Suspended Particulates (TSP)

Cumulative annual average concentrations of TSP from the proposed development are below the concentrations specified by the NSW EPA.

Particulate Matter up to ten micrometres (PM_{10}*)*

Cumulative annual average concentrations of PM_{10} from both fugitive and point sources are below the concentrations specified by the NSW EPA.

In relation to 24-hour average PM_{10}, a small number of receptors near the site boundary do show some exceedances of NSW EPA criteria. However, the conservatism built into the modelling assumptions lead to a significant overestimate of concentrations. The real-life long-term PM_{10} measured data from the local ambient air quality monitoring station indicates that PM_{10} levels at that location stay consistently below the NSW 24-hr and annual limits.

It was concluded that there would be no effective change to off-site local air quality impacts of PM_{10} due to the proposed development as the model results are insensitive to Kiln 6 stack PM_{10} emission rates at the equivalent TSP emission concentrations proposed during the burning of NSF.

Particulate Matter up to 2.5 micrometres ($PM_{2.5}$*)*

Cumulative annual average concentrations of $PM_{2.5}$ from both fugitive and point sources are below the NSW EPA criteria.

In relation to 24-hour average $PM_{2.5}$, no additional exceedance of NSW EPA criteria arise from the proposed development.

The model results are insensitive to large changes in Kiln 6 stack $PM_{2.5}$ emission rates, therefore, there will be no effective change to off-site local air quality impacts of $PM_{2.5}$ due to the proposed development.

Nitrogen Dioxide (NO_2*)*

The assessment results for both 1-hour and annual average cumulative concentrations of NO_2 are below the criteria specified by the NSW EPA.

Sulphur Dioxide (SO_2*)*

The assessment results for 1-hour, 24-hour and annual average cumulative concentrations are below the criteria concentrations specified by the NSW EPA.

Non-Methane Hydrocarbons (NMHC)

The cumulative concentrations of all of the NMHCs considered are well below NSW EPA criteria. The assessment also demonstrates that there is minimal risk that the EPA's 1-hour average NMHC impact assessment criteria will be exceeded at any time if the proposed 24-hour average emission concentration of 40 ppm during burning of non-standard fuel is adopted.

Dioxins

The predicted ground level concentrations of dioxins are very small (approximately 83,000 times less that the NSW EPA criteria). Therefore, the air quality impacts due to dioxin emissions are negligible.

Polycyclic aromatic hydrocarbons (PAH)

The predicted ground level concentrations of PAHs are very small (approximately 0.004% of NSW EPA criteria). Therefore, the air quality impacts due to PAHs emissions are negligible.

Heavy metals

Lead emissions are assessed separately from other heavy metals due to the requirements for lead to be assessed as an annual averaging period. Predicted lead concentrations are well within NSW EPA criteria (6% of criteria), therefore air quality impacts due to lead emissions are negligible.

For other heavy metals, predicted concentrations are well below NSW EPA assessment criteria, therefore air quality impacts due to heavy metals emissions are negligible.

Halides and other

Predicted emissions of sulphuric acid mist/sulphur trioxide exceeds the NSW EPA criteria for sulphuric acid. The exceedance is due to a conservative emission rate for sulphuric acid mist/sulphur trioxide leading to a significant over estimation of emissions. Sampling data indicates that sulphuric acid mist/sulphur trioxide has only been detected on one occasion. Applying the measured emission rate to the model the predicted emissions would be well within NSW EPA criteria for sulphuric acid (1.5% of the criteria). The reason for the low acidic emissions is the nature of the cement kiln which acts a large alkaline scrubber neutralising acid gases.

Predicted emissions of chlorine are close to exceeding the NSW EPA assessment criteria. However, using measured concentrations from the annual testing campaign, the predicted concentration of chlorine would be well within criteria (0.4% of NSW EPA criteria). Chlorine is a carefully controlled operational parameter in the feed as it impacts clinker quality and marked increases in emission concentrations for this element are unlikely.

Predicted emissions for hydrogen chloride are small when compared to NSW EPA criteria, and further reduced when measured concentrations from the annual testing campaign are applied to the model, leading to a revised predicted emission of 0.1% of criteria.

Hydrogen fluoride emissions were assessed separately due to the requirement for hydrogen fluoride to be assessed at a number of different averaging periods. The predicted emissions of hydrogen fluoride are well within NSW EPA criteria for the 24-hour averaging period and for the other longer term averaging period.

Odour

The predicted odour concentrations are much less than the applicable NSW EPA threshold criteria which are 1.3 Odour Units (OU) for the residential areas of New Berrima and Berrima and 2.6. OU for other areas.

The assessment concluded that the potential for odour emissions to carry beyond the site boundary at concentrations that could cause nuisance is very low. Nuisance impacts due to odour are therefore not expected to occur.

The odour emission rates used in the model are derived from assumed building air concentrations and air flow rates, in the absence of actual emission data. However, the significant gap between predicted concentrations and EPA criteria allows for a large margin of safety in the event that odour emission rates have been underestimated.

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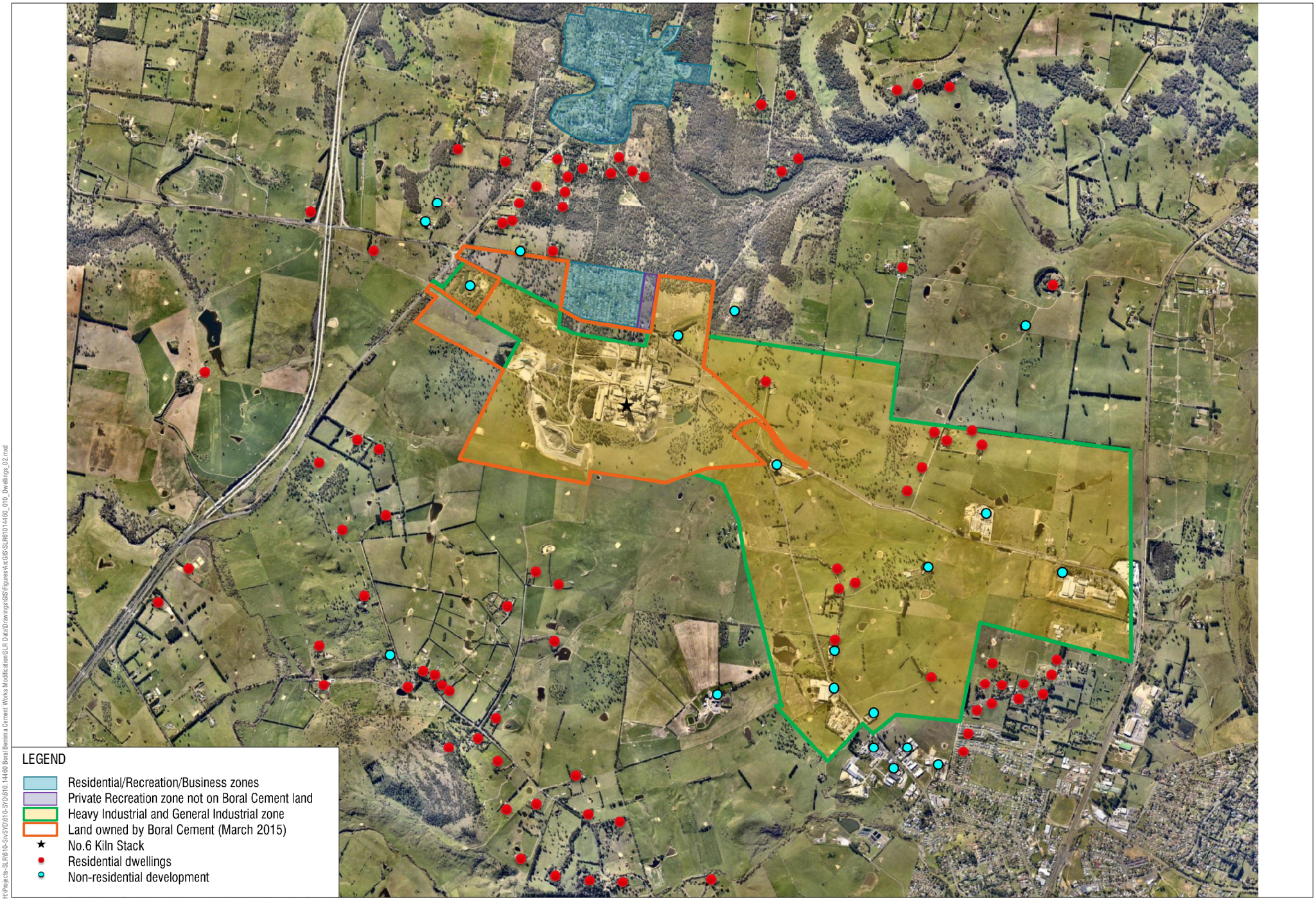
Stack Locations

FIGURE 9



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Berrima Cement Works and Surrounding Dwelling Locations

FIGURE 10

7.1.5 Environmental Management

A range of sampling and analysis programmes are conducted at the Berrima site to monitor air discharges from the four discharge points. These programmes are as follows:

Monitoring required by the EPL during combustion of standard fuels

- annual stack testing - this applies to all four discharge points; and
- continuous measurement of TSP in No.6 Kiln stack (required in EPL since 30 March 2012, although the measurement has been conducted for several years outside of this EPL requirement as a voluntary process control measure).

Additional monitoring that is only required by the EPL during combustion of NSF

This requirement has not been initiated yet because the site hasn't been using any NSF. However, this testing is currently carried out voluntarily by the site during combustion of standard fuels as well:

- additional campaign testing on discharges from No.6 Kiln stack, as would be required if NSF were being used; and
- continuous measurement in No.6 Kiln stack of nitric oxide (NO), nitrogen dioxide (NO_2), VOCs, and other chemical species.

All monitoring is carried out and equipment is maintained and calibrated by independent, suitably qualified contractors. In accordance with Special Condition E2 of the EPL and condition 4.1B of the DA (required only when NSF are used, currently undertaken on a voluntary basis), Boral Cement also operates an ambient monitoring station beyond the site boundary which records meteorological data continuously and TSP, PM_{10} and other compounds on a one-day-in-six basis.

7.1.6 Summary and conclusions

The air quality assessment describes air quality impacts due to emissions of various pollutants to air from stack sources and fugitive dust and odour sources at the Berrima cement plant.

Due to the introduction of the Energy from Waste Policy in NSW in 2013, Boral Cement has proposed the following variations to maximum emission concentrations in the EPL for the burning of non-standard fuels (NSF) to align the licence limits with current NSW regulations:

- TSP: 50 mg/Nm3, calculated over a midday-to-midday 24-hour basis;
- NOx: 1000 mg/Nm3, calculated over a midday-to-midday 24-hour basis; and
- VOC (as NMHC): 40 ppm, calculated over a midday-to-midday 24-hour basis.

No changes are proposed to other emission limits in the EPL for NSF.

To demonstrate that the proposed development will meet the environmental outcomes adopted by the EPA as a result of discharges at these proposed emission limits during burning of NSF, dispersion modelling has been carried out to predict ambient concentrations of TSP, PM_{10}, $PM_{2.5}$, NO_2, SO_2, NMHC, dioxins, PAHs, heavy metals, halides, and sulphuric acid mist in the region around the Works site.

Fugitive dust emissions from raw material stockpiling and handling were also modelled for TSP, PM_{10} and $PM_{2.5}$ emissions, as well as potential odour emissions from a proposed new storage building for solid waste derived fuel.

Model results were extracted for discrete receptor points in the environment around the cement works site, representing the locations of residential dwellings, residential zones, and non-residential buildings.

The predicted concentrations were combined with background data and compared to assessment criteria specified by NSW Environment Protection Authority (EPA) in the 2005 Guideline publication "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW".

For some of the NMHC individual chemical species, no assessment criteria are specified by NSW EPA, so applicable assessment criteria were adopted from the United States.

The modelling found that with the exception of 24-hour average PM_{10}, for all pollutants the maximum applicable ground level concentrations were lower than the relevant ambient air assessment threshold limits, and therefore no adverse impacts are expected.

It was concluded that the NOx and NMHC assessments robustly demonstrated that there is minimal risk that the EPA's 1-hour average NO_2 and NMHC impact assessment criteria will be exceeded at any time if the proposed 24-hour average emission concentrations for NOx and NMHC during burning of NSF are incorporated into the EPL.

In regards to 24-hour average PM_{10}, for most of the discrete receptors, no additional exceedances of the 24- hour average PM_{10} air quality criteria over and above current impacts are caused by the proposed development compared to proposed development not proceeding. However a small number of discrete receptors near the site boundary do show some possible additional exceedances of the 24 hour PM_{10} criteria compared with background levels, although this is dependent entirely on the magnitude of the fugitive dust concentrations. Those fugitive dust concentrations are considered to be over-estimates of actual maximum incremental ground level concentrations at receptors close to the site boundary because of the assumptions required for the fugitive dust dispersion analysis.

The real-life long-term PM_{10} measured data from the local ambient air quality monitoring station indicates that PM_{10} levels at that location stay consistently below the NSW 24-hr and annual limits.

It was concluded that there would be no effective change to off-site local air quality impacts of PM_{10} due to the Project as the model results are insensitive to Kiln 6 stack PM_{10} emission rates at the equivalent TSP emission concentrations proposed during the burning of NSF.

7.2 Greenhouse Gas

7.2.1 Introduction

The purpose of the greenhouse gas assessment is to assess Scope 1, 2 and key Scope 3 emissions relating to the operation of the proposed modification and recommend appropriate mitigation measures, where possible.

The "National Greenhouse Accounts Factors" Workbook (NGA Factors) (DIICCSRTE, 2014) identifies two 'scopes' of emissions for greenhouse gas accounting and reporting purposes as shown in **Table 17**.

Table 17: 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 proposed operations are considered in this assessment. While 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.

7.2.2 Environment Assessment

For the full Greenhouse Gas Assessment refer to Appendix E.

This assessment presents estimated annual GHG emissions for the existing and proposed operational elements of the proposed modification using data for fuel and electricity consumption on site provided by Boral and shown in **Table 18**.

Table 18: Fuel and electricity consumption 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

Emissions factors for each of the identified fuels and electricity used for operation of the Project were taken from the NGA Factors (see **Table 19**).

Table 19: 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).

Based on fuel and electricity consumption data for the existing and proposed operations and the relevant emissions factors, the emissions for the existing and proposed operations are shown in **Table 20**.

Table 20: Existing and proposed operations 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.

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 proposed operations represent approximately 0.84% of the total annual state emissions**.

This assessment has determined Scope 1, 2 and key Scope 3 GHG emission estimates for the operation of the proposed operations, 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 operations. This shows that undertaking the proposed operations is expected to result in a net positive GHG benefit.

7.3 Hazard Assessment

7.3.1 Introduction

A preliminary risk screening has been undertaken to provide an assessment of the hazards associated with the storage of dangerous goods on the site of the Cement Works in accordance with *NSW State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33). The purpose of the initial SEPP 33 risk screening is to exclude from more detailed studies those developments which do not pose significant risk.

Where SEPP 33 identifies a development as potentially hazardous and/or offensive, developments are required to undertake a Preliminary Hazard Analysis (PHA) to determine the level of risk to people, property and the environment at the proposed location and in the presence of controls.

A development may also be considered potentially hazardous with respect to the transport of dangerous goods. A proposed development may be potentially hazardous if the number of generated traffic movements (for significant quantities of hazardous materials entering or leaving the site) is above the cumulative annual or peak weekly vehicle movements provided for in SEPP 33.

The preliminary risk screening presents information on hazardous materials, flammable substances, and compressed or liquefied gases stored or handled in the area including on site or transported to or from the site, including any associated risk issues.

7.3.2 Environmental Assessment

For the full Preliminary Risk Screening refer to Appendix F.

The assessment provides an inventory of Dangerous Goods (DG) in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) and is provided in **Table 21**.

The information contained in the table compares the total storage quantity of the required dangerous goods classes against the storage screening threshold presented in the relevant assessment guidelines (*Applying SEPP 33* (DUAP 1994 and as updated by NSW Planning, 2011). The proposed dangerous goods planned to be stored on site are below the screening thresholds.

Table 21: Dangerous Goods Classes in Storage*

Substance	Hazardous Class	Packing Group	Total Storage on Site	Threshold Quantity	SEPP 33 Threshold Level Findings
Petroleum gases, liquefied (LPG)	Dangerous Goods Class 2.1	-	7 tonnes	10 tonnes (if stored above ground	**Below**
Diesel *	C1	-	365,000 L	N/A*	N/A

* Note Diesel is present on site but stored separately and therefore not considered hazardous.

Additionally an assessment was undertaken of the generated traffic movements for significant quantities of dangerous goods entering and leaving the site against the cumulative vehicle movements of the SEPP 33 guideline. The levels of maximum proposed movements at the site per week are provided in **Table 22**.

Table 22: Dangerous Goods Vehicle Movements

ADG Class	Maximum Proposed DGs Vehicle Movements (per week)	SEPP 33 Threshold Vehicle Movements (per week)	SEPP 33 Threshold Minimum Quantity (per load)	Load Type (relevant to the facility)	SEPP 33 Threshold Level Findings
2.1	< 1	>30	2 tonnes	Bulk	**Below**

Note: Assumes each dangerous good class is transported separately.

The actual site needs are substantially below the SEPP 33 Thresholds on both load quantity and weekly movement thresholds.

Therefore each of the listed dangerous goods classes that will require transportation to and from the facility, are not classified as potentially hazardous with respect to the transport of dangerous goods.

Due to the limited storage and transportation of dangerous goods the preliminary risk screening concludes that the proposed modification of the Cement Works is not “potentially hazardous” in accordance with SEPP 33 and therefore a Preliminary Hazardous Assessment is not required. No site specific environmental management measures are required outside of best practice in the management of dangerous goods.

7.4 Noise and Vibration

7.4.1 Existing Environment

The location of the proposed operations in relation to the nearest noise sensitive receivers is shown in **Figure 11** and described in **Table 23**.

Table 23: Sensitive Receiver Locations

Receiver ID	Location
R1	4 Melbourne Street
R2	Chesley Park Farm
R3	Candowrie Farm House

Condition 3.3 of the Development Consent and Conditions L6.1 and L6.2 of EPL No. 1698 specify the noise limit condition with respect to noise contributions from the Kiln 6 upgrade project. These are presented in **Table 24**.

Table 24: Noise limits associated with noise contributions from Kiln 6 upgrade project only

Location	Day LAeq(15minute)	Evening LAeq(15minute)	Night LAeq(15minute)
4 Melbourne Street	37	37	37
Chesley Park Farm	30	30	30
Candowrie Farm House	37	37	37

a) Day is defined as the period from 7:00am to 6:00pm Monday to Saturday and 8:00am to 6:00pm on Sundays and public holidays

b) Evening is defined as the period from 6:00pm to 10:00pm

c) Night is defined as the period from 10:00pm to 7:00am Monday to Saturday and 10:00pm to 8:00am on Sundays and public holidays

Note: noise contributions specified in **Table 24** are to be interpreted as contributions from the new and upgraded components forming part of Cement Works upgrade only and not as noise limits for the site as a whole.

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Noise - Sensitive Receiver Locations

FIGURE 11

7.4.2 Environment Assessment

For the full Noise Impact Assessment refer to Appendix G.

Methodology and project specific noise levels

Potential changes to the noise environment associated with the modification proposal would arise from:

- construction related noise;
- traffic related noise; and
- noise from the operation of the proposal.

Construction related noise

Construction related noise is assessed in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) which sets procedures for management of noise in relation to construction activities for residential and other sensitive receivers by defining Noise Management Levels (NMLs) and how they are applied.

The ICNG states that where construction works are planned to extend over more than two consecutive nights, the impact assessment should consider the maximum noise level from the proposed works. In addition to the NMLs, where construction would be required during the night-time period the potential for sleep disturbance to residential receivers should be assessed. The ICNG also identifies NMLs for ground-borne or regenerated construction noise, where vibration from activities such as rock breaking, road heading, rotary cutting and rock drilling/sawing can be transmitted through the ground and into the habitable areas of nearby buildings.

The EPA's current approach to assessing potential sleep disturbance (*Application Notes to Industrial Noise Policy)* is to apply an initial screening criterion of background plus 15 dB and to undertake further analysis if the screening criterion cannot be achieved. The sleep disturbance screening criterion applies outside bedroom windows during the night-time period.

Construction vibration is also considered in the assessment with respect to both human comfort vibration and structural damage vibration. The EPA's *Assessing Vibration: a technical guideline* (DEC 2006) provides guideline values for continuous, transient and intermittent events that are based on a Vibration Dose Value (VDV) rather than a continuous vibration level. Structural damage vibration limits are based on Australian Standard AS 2187: Part 2-2006 *Explosives – Storage and Use – Part 2: Use of Explosives* and British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2*.

Based on the typical nature of the area (and as a worst case scenario), a background noise level of 30 dBA has been assumed for the purpose of the construction noise assessment. The resulting construction Noise Management Levels are presented in **Table 25.**

Table 25: Construction Noise Goals

Receiver Area	Estimated Ambient Noise Levels			Noise Management Levels – NMLs (dBA)					
	Daytime[1]	Evening[1]	Night-time[1]	Standard Hours Daytime	Highly Noise Affected	Out of Hours Daytime	Out of Hours Evening	Out of Hours Night-time	Sleep Disturbance Screening Criterion
4 Melbourne Street	30[2]	30[2]	30[2]	40	75	35	35	35	45
Chesley Park Farm	30[2]	30[2]	30[2]	40	75	35	35	35	45
Candowrie Farm House	30[2]	30[2]	30[2]	40	75	35	35	35	45

Note 1: Standard hours are 7.00 am to 6.00 pm Monday to Friday, 8.00 am to 1.00 pm on Saturdays with no work on Sundays or Public Holidays. Evening is 6.00 pm to 10.00 pm. Night-time is 10.00 pm to 7.00 am Sundays to Saturday and 10.00 pm to 8.00 am on Sunday.

Note 2: A minimum background noise of 30 dBA has been assumed as per the NSW Industrial Noise Policy.

The relevant applicable human comfort and structural damage vibration criteria for the nearest residential and commercial receivers are presented in **Table 26** and **Table 27** respectively.

Table 26: Acceptable Vibration Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime		Night-time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26

Source – Assessing Vibration: a technical guideline

Table 27: Transient Vibration Guide Values for Minimal Risk of Cosmetic Damage (BS 7385-2)

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Traffic related noise

For traffic operating on public roads, the NSW Government's *Road Noise Policy* (RNP) (DECCW, 2011) is appropriate for assessing potential road traffic noise impacts.

The RNP noise criteria aims to protect amenity inside and immediately around permanent residences, schools, hospitals and other sensitive land uses, rather than at all points in a given locality, which would not be practical or possible.

Taylor Avenue is considered to be a sub-arterial road. The RNP specifies this class of road as the following:

> *Sub-Arterial Road*
> *A road that collects local traffic leaving a locality and connects to another local road, freeway or arterial or sub-arterial road.*

The RNP describes a minor impact to be an increase of up to 2 dB, which is considered to be a barely perceptible change to the average person.

The RNP provides the following with regard to assessment of private haul roads:

> *Noise from vehicles travelling on private roads associated with an industrial activity, such as a mine or quarry, is to be assessed as an industrial noise source under the NSW Industrial Noise Policy. Further guidance on this approach is provided in the 'Application Notes' to the policy.*

The operational noise assessment in this report considers whether the proposed modification has the potential to increase noise at any residential receiver by 2 dB or more.

Noise from the operations of the proposal

The operational noise targets have been established from the existing noise limits stated in the EPL for the Kiln 6 upgrade project only. In order for the proposed modification to Kiln 6 to incorporate the SWDF modification, the noise targets have been established in order to have a minimal effect on the existing noise levels from the Kiln 6 project.

In order for the modifications to have a minimal impact on the total noise emissions from the operation of Kiln 6, the noise targets have been established to be a minimum of 6dB below the existing noise limits and are presented in **Table 28**.

Table 28: Operational Noise Targets

Location	Day LAeq(15minute)	Evening LAeq(15minute)	Night LAeq(15minute)
4 Melbourne Street	31	31	31
Chesley park Farm	24	24	24
Candowrie Farm House	31	31	31

Based on these noise targets, a maximum noise increase from the total operation of Kiln 6 would be less than 1 dB.

Construction Noise Assessment

The construction activities are proposed to occur during standard construction hours, i.e., 7.00 am and 6.00 pm Monday to Friday and 8:00am to 1:00pm on Saturday.

Sound Power Levels for construction activities and equipment were identified and construction scenarios defined based on likely combination of activities. This was used to assess construction noise levels at the nearest receiver locations. The resultant daytime, evening and night-time $L_{Aeq(15minute)}$ construction noise predictions are presented in **Table 29** for the various activities together with the relevant noise management levels.

In practice, the construction noise levels would depend on the number of plant items and equipment operating at any one time and their location relative to the receiver of interest. Noise levels would vary due to the movement of plant and equipment about the worksites and the concurrent operation of plant. In some cases, reductions in noise levels would occur when plant are located in cuttings or behind embankments, buildings or other items of equipment.

Notwithstanding, the predictions in **Table 29** are representative of the worst-case scenario with all plant and equipment likely to operate simultaneously at the point of works closest to the affected sensitive receiver.

The predicted construction noise levels at the residential receivers surrounding the proposed operations are not expected to exceed the daytime (standard construction hours) $L_{Aeq(15minute)}$ noise management level of 40 dBA. The reported construction noise level predictions are representative of the worst case scenarios with the loudest plant and equipment operating simultaneously at the point of works closest to the affected receiver.

It is not expected that any residential receivers would be considered to be highly noise affected as defined by the *Interim Construction Noise Guideline* (ICNG).

Table 29: Summary of Construction Noise Predictions - dBA

Scenario	Receiver ID	Noise Level - $L_{Aeq(15minute)}$			
		Worst Case Predicted	Assumed Rating Background Level (RBL)	Noise Management Level	Exceedances
			Standard Daytime Hours	Standard Daytime Hours	Standard Daytime Hours
S1 Compound Establishment	R1	26	30	40	-
	R2	25	30	40	-
	R3	25	30	40	-
S2 Earthworks	R1	35	30	40	-
	R2	34	30	40	-
	R3	34	30	40	-
S3 Concrete Works	R1	27	30	40	-
	R2	26	30	40	-
	R3	26	30	40	-
S4 Crane Works	R1	39	30	40	-
	R2	22	30	40	-
	R3	21	30	40	-
S5 Traffic Movements	R1	35	30	40	-
	R2	35	30	40	-
	R3	35	30	40	-

Traffic Noise Assessment

As a general rule, traffic noise associated with the proposed modification would not increase the existing traffic noise levels by more than 2 dBA so long as the increase in light and heavy vehicles (HVs) movements for the proposed modification is no greater than 60%.

Based on the data provided by Traffix Pty Ltd, the expected increase in project related vehicles is expected to be 9% during the daytime period, as detailed in **Table 30.**

Table 30: Project Traffic Increase

Period	Existing HV Traffic	Proposed HVs Increase	Total Proposed	Increase %
Daytime	223	20	243	9%
Night-time	74	0	74	0%

Note: the traffic data presented in the above table has been modified from the data presented in the Traffic Section to align with the daytime period defined by the Road Noise Policy.

Based on this increase, the overall noise level is expected to increase by less than 2 dB and therefore no further assessment is required.

Operational Noise Assessment

Table 31 provides the relevant acoustically significant plant and equipment and associated sound power levels incorporated into the noise model.

Table 31: Sound Power Levels

Plant and Equipment	Sound Power Level (SWL) dB re 1pW
Waste Derived Fuels Reception Shed	
Internal Conveyors (per metre)	78 dBA
Front End Loader	108 dBA
Debaler Unit	100 dBA
Road Truck	102 dBA
External Plant and Equipment	
External Conveyors (per metre)	78 dBA
Road Trucks (per truck)	102 dBA
Conveyor Drive (1 unit)	102 dBA
Hoppers	90 dBA
Hydraulic Power Pack[1]	84 dBA
Fork Lift[2]	94 dBA

Note 1: Measurement of a similar Hydraulic Power Pack performed by Manufacturer.
Note 2: Measurement of fork lift performed by Boral at Berrima.

Table 32 presents the predicted noise emissions from the operation of the additional infrastructure associated with the proposal with no mitigation measures in place and with an assumption that only one reception shed vehicle access door would be open when the Front End Loader is operating.

Table 32: Predicted Operational Noise Levels – One Vehicle Access Door Open

Location	Predicted Noise Level ($L_{Aeq(15minute)}$)			Noise Target
	Day	Evening	Night	
4 Melbourne Street	31 dBA	31 dBA	31 dBA	31 dBA
Chesley Park Farm	24 dBA	24 dBA	24 dBA	24 dBA
Candowrie Farm House	23 dBA	23 dBA	23 dBA	31 dBA

Based on the results of the noise modelling, the predicted noise levels at the surrounding receiver locations are expected to achieve the noise targets established.

The noise level at 4 Melbourne Street is expected to be lower than predicted, as the noise model does not consider any barrier effect that the pre-heater tower may have on the conveyor noise emissions.

Truck movements were excluded from the calculation as the total truck movements from the existing operation (243 during the day, 74 during the night or 4 movements per 15 minute period during the day and 2 movements during the night-time) are the same as the proposed operation (223 during the day, 74 during the night or 4 movements per 15 minute period during the day and 2 movements during the night-time).

The Sound Power Levels reported in **Table 31** must be achieved in order for the noise levels at the receiver locations to meet the construction noise management levels nominated.

The reverberant sound pressure level within the Solid Waste Derived Fuel Receiving Shed has been calculated to be 86 dBA based on the Sound Power Levels provided in **Table 31.**

7.4.3 Environmental Management

Construction noise management

The ICNG describes strategies for construction noise mitigation and control that are applicable to this project. Construction noise control options include time restrictions, level restrictions and other feasible and reasonable mitigation measures.

Specific mitigation measures which are considered appropriate for these works are:

- scheduling of the higher noise management level exceedance activities to be undertaken during less noise-sensitive periods, where possible;
- avoid the coincidence of noisy plant working simultaneously;
- briefing of the work team in order to create awareness of the locality of sensitive receivers and the importance of minimising noise emissions;
- use of less noise intensive equipment, where reasonable and feasible;
- use of non-tonal reversing alarms fitted to all construction vehicles;
- conducting loading and unloading away from sensitive receivers, where practical;
- liaising with affected residents and informing them when noisy works would occur and what is being done to minimise the noise; and
- use of localised acoustic hoarding around all significantly noise generating items of plant. This would be expected to provide between 5 dB and 10 dB of additional noise attenuation as long as the line-of-sight between the receivers and construction equipment is broken. Barriers are most affective when located either close to the noise source or the receiver.

Road traffic noise management

As the overall noise level is expected to increase by less than 2 dB, no management or mitigation measures are deemed necessary.

Operational noise management

As the predicted noise levels at the surrounding receiver locations are expected to achieve the noise targets established, no management or mitigation measures are deemed necessary.

7.5 Traffic and Access

7.5.1 Existing Environment

Traffic travelling to and from the Cement Works use the following roads (refer to **Figure 12**):

- Taylor Avenue – a local road that runs in an east-west direction and which connects Berrima Road in the east to Old Hume Highway in the west. It carries approximately 2,795 vehicles per day and provides a key link for the Cement Works with the majority of heavy vehicles using it to access the Hume Highway (M31 Motorway) to the west;

- Berrima Road – a RMS Main Road (MR372) that runs in a north-south direction and which connects Berrima in the north with Moss Vale in the south. It carries approximately 3,700 vehicles per day; and

- Hume Highway (M31 Motorway) – a national highway that runs in a generally north east-south west direction which connects the Sydney and Melbourne metropolitan area. It carries approximately 9,850 vehicles per day.

Existing site characteristics

The Cement Works operates 24 hours a day and seven days a week, however, a typical transport day occurs mainly for a 12-hour period during weekdays (4.00am to 4.00pm), and on Saturdays for a 6 hour period (7.00am to 1.00pm). Limited heavy traffic volumes are generated outside of these periods.

Access to the site is via (refer to **Figure 13**):

- Gate 1: On Argyle Street, used for access to administration, reception and stores; and

- Gate 2: On Perth Street, used for all truck deliveries and dispatches.

A private railway line also operates through the site which enters the site at Berrima Road.

Existing traffic generation

An average total of 207 loads are required to be transported to and from the Cement Works daily. Due to the efficiency benefits of backloading trucks, whereby a truck arrives carrying a load of material (i.e. aggregate) and departs carrying a load of another material (i.e. clinker product), these 207 individual loads translates to only approximately 297 truck movements (arrival trips and departure trips) per weekday. It is also worth noting that raw materials, clinker and cement products are also delivered and dispatched via the privately operated railway line.

The 297 truck movements generally occur uniformly throughout an average 12-hour weekday, therefore, on average the works site generates 24.8 movements (trips) per hour. There are 90 truck movements on Saturdays translating into an average of 15.0 movements (trips) per hour over the 6-hour operating period.

Deliveries and dispatches of materials by road to and from the Cement Works can be broken down as follows:

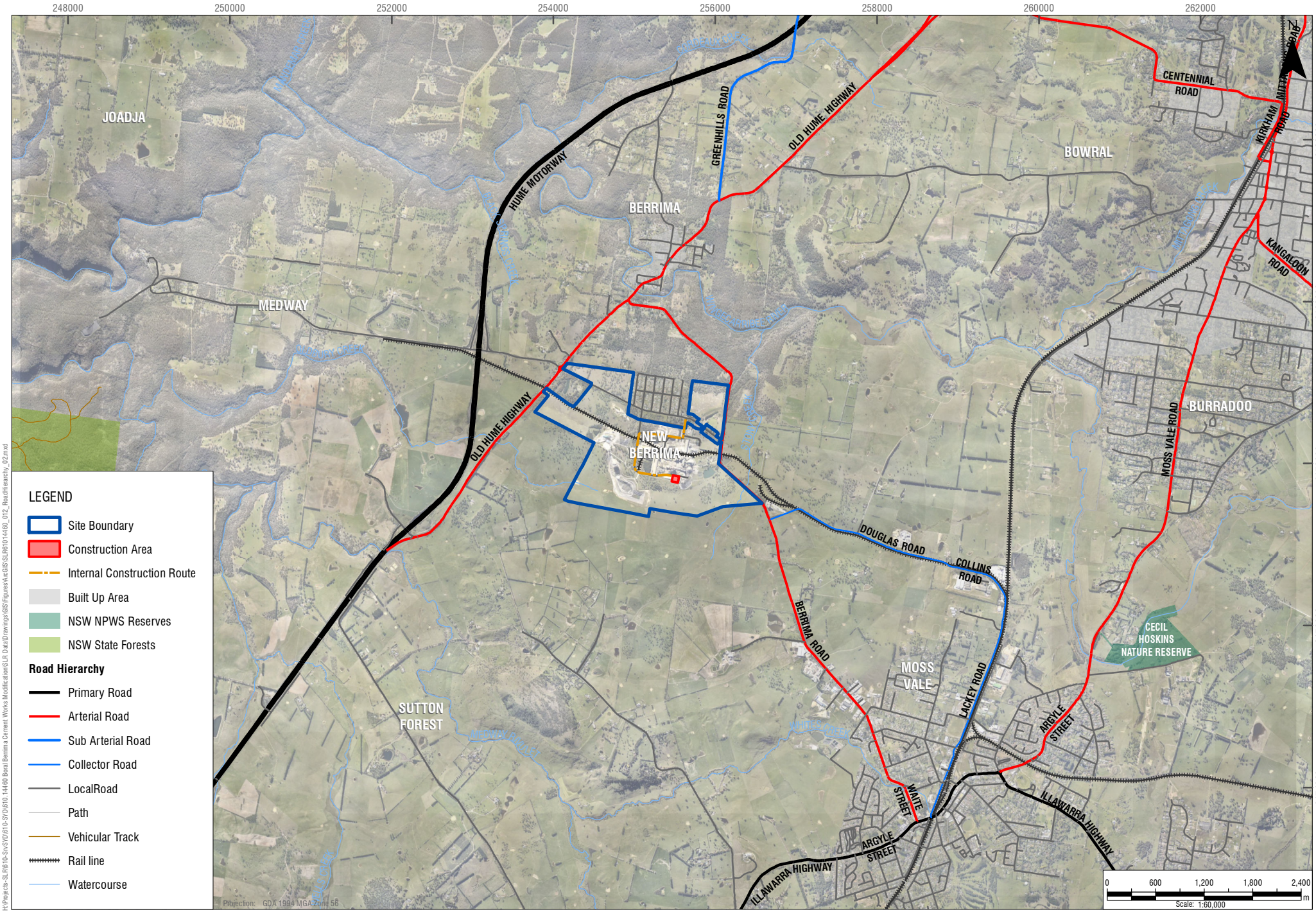
- deliveries of raw materials used for production of clinker and cement: 375,000 tonnes/year;

- deliveries of fuels for energy to operate the Kiln: 220,000 tonnes/year;

- dispatch of manufactured clinker: 300,000 tonnes/year; and

- dispatch of manufactured cement: 550,000 tonnes/year.

The majority of Cement Works truck traffic accesses the New Berrima area via the Hume Highway (M31 Motorway) to the west of the site. The remainder travel east along Berrima Road to the Concrete Plant in Moss Vale. To access the Hume Highway, trucks depart via Gate 2 and travel west through New Berrima along Taylor Avenue to the roundabout intersection at its western termination. From this roundabout, trucks travel either west along Medway Road or south west along the Old Hume Highway.



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Road Hierarchy in the Vicinity of Berrima Cement Works

FIGURE 12

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Site Access Points for Construction

FIGURE 13

7.5.2 Environment Assessment

For the full Traffic Impact Assessment refer to Appendix H.

Construction Traffic

Construction of the proposed development would generate limited additional traffic and heavy vehicle movements and would be managed in accordance with the construction and traffic management procedures. Construction traffic would access the site via the Hume Highway, Medway Road and Taylor Avenue from the west and Berrima Road from the east.

Construction traffic will enter the site via the Perth Street entrance, turning right (west) before turning left (south) to cross the railway line, continuing south and following the round around to the left (east) to reach the construction site. All construction traffic movements will be on existing internal site roads as shown in **Figure 13.**

Operation Traffic

The proposal seeks to use solid waste fuel to supplement and partially replace the existing use of coal to generate energy for the operation of Kiln 6. Provision of up to 100,000 tonnes of solid waste fuel is proposed to be sourced per year, which would reduce the reliance on coal from 220,000 tonnes consumed per year to 170,000 tonnes. Due to the lower caloric value of the solid waste fuel compared to coal, an extra 50,000 tonnes of solid waste fuel would be required to service the existing energy needs of the site. The solid waste-derived fuels intended for Berrima would also have lower bulk density, translating into more trucks for the same tonnage. As a result there would be minor additional truck loads and movements to the site as a result of the proposed modification.

The changes to the existing truck movements as a result of the shift to waste derived fuel would be:

- coal and coke breeze: the reduction in coal required would result in five (5) fewer truck loads to 18 truckloads per day with 36 associated truck movements per day, a reduction from the 46 trips per typical weekday. On Saturdays, there would be approximately 18 trips; and

- waste derived fuel: the waste fuel is to be delivered by either truck and dog trailer vehicles or B-Double trucks with 24 tonne payload capacity. Based on this, 15 truckloads would need to be transported daily, resulting in 30 truck movements per day now needed. On Saturdays, there would be approximately 15 trips.

As staffing levels remain unchanged, no additional parking is required.

All heavy vehicle traffic, include deliveries of solid waste derived fuel, would be weighed upon site entry and exit.

Details of the existing operational traffic for the Berrima Cement Works and future operation traffic anticipated for the Cement Works following the proposed modification are summarised in **Table 33** along with the net increase in traffic volumes.

Table 33: Existing and proposed operational truck traffic

Scenario	12-hour weekday		6-hour Saturday	
	Daily	Hourly	Daily	Hourly
Existing (trucks)	297	24.8	90	15.0
Future (trucks)	317	26.4	100	16.7
Net increase (trucks)	20	1.6	10	1.7
Net increase (%)	6.7%	6.5%	11.1%	11.3%

The assessment indicates that the net increase in traffic generation as a result of the proposed modification would be:

- weekday: 20 additional trips on an average 12-hour working weekday, equivalent to 1.6 additional trucks per hour or an increase in truck trips of approximately 6.5%; and
- Saturday: 10 additional trips on an average 6-hour working Saturday, equivalent to 1.7 additional trucks per hour or an increase in truck trips of approximately 11.3%.

This demonstrates that the forecast increase in traffic generation as a result of the proposed modification would be minor.

As all additional waste fuel delivery truck traffic would use the same local truck routes as existing Cement Works trucks, the proposed modification would not lead to truck movements on roads that do not already support Cement Works trucks.

Details of the existing traffic flow volumes on Taylor Avenue (recorded by tube count survey) and the anticipated net increase in traffic as a result of the proposed modification are summarised in **Table 34.**

Table 34: Traffic implications for Taylor Avenue

Scenario	Weekday		Saturday	
	Daily	12-hour day,	Daily	6-hour day
Existing (vehicles)	2,795	2,025	1,866	698
Net increase (vehicles)	20	20	10	10
Net increase (%)	0.7%	1.0%	0.5%	1.4%

The assessment indicates that the impacts to Taylor Avenue traffic as a result of the proposed modification would be:

- weekday: An increase of just 1% in Taylor Avenue traffic volumes during the typical 12-hour working weekday and just 0.7% across all 24-hours on an average weekday; and
- Saturday: An increase of just 1.4% in Taylor Avenue traffic volumes during the typical 6-hour working Saturday and just 0.5% across all 24-hours of an average Saturday.

The increases in traffic on the local road network as a result of the proposed modification are of such a low order that they would have no material impact on the performance or safety of the local road network and therefore no external infrastructure upgrades are required.

7.5.3 Environmental Management

As the impact of traffic generation on the local road network as a result of the proposed modification is predicted to be minor, no specific mitigation measures are warranted. However, Boral has committed to pay a road maintenance levy to Council of 4 cents/tonne/km for the transport of SWDF the subject of this application. In addition, Boral proposes to surrender the consent for the coal stockpiling for sale (Modification 6) that was approved on 20 June 2012.

7.6 Landscape and Visual

7.6.1 Existing Environment

Works associated with the proposed modification would be wholly located within the existing Berrima Cement Works site boundary and in general proximity to the pre-heater tower. The north of the project area is defined by existing industrial infrastructure including the pre-heater tower and Kiln 6. An existing storage shed is located to the west of the project area with areas of grass and scattered tree cover extending to the south and east.

The objective of the visual impact assessment is to determine the likely visual significance of the proposed modification on people living and working in, or travelling through the landscape within and surrounding the project area.

7.6.2 Environment Assessment

For the full Landscape and Visual Impact Assessment refer to Appendix I.

Methodology

The approach to the visual impact assessment included the following activities:

- desktop study to address the visual character and identify view locations within the surrounding area;
- fieldwork and photography;
- assessment and determination of visual significance; and
- determination of potential mitigation measures.

Environmental Assessment

The proposed enclosed conveyor would extend north for around 110 m from the SWDF reception shed and connect to the pre-heater tower approximately 65m above existing ground level at the tower base. The enclosed conveyor would be supported by a number of regularly spaced trestle structures along its alignment. It would have a relatively small profile against the existing pre-heater tower and approximately 1.5 to 2m in diameter.

A series of individual and panorama photographs were taken during the course of the fieldwork to illustrate existing views in the vicinity of a number of view locations inspected as part of this study. The panorama photographs are reproduced in **Error! Not a valid bookmark self-reference. to Figure 19** as they provide the broadest representation of view locations.

Photomontages have been prepared from two view locations to illustrate how the proposed enclosed conveyor and SWDF reception shed would appear in relation to the existing infrastructure **(Figure 20 and Figure 21**).

The magnitude and significance of visual impact resulting from the construction and operation of the proposed modification would primarily result from a combination of the following factors:

- distance between the view location and elements within the proposed modification;
- duration of the view from view location toward elements within the proposed modification;
- predicted impact of the proposed modification on existing visual amenity;

- nature of predicted impacts; and
- receptor sensitivity of locations from which views towards elements within the proposed modification exist.

These factors were applied in an assessment framework to 10 view-points chosen to represent the range of possible views from the surrounding landscape to the proposed modification.

The majority of view locations surrounding the existing Berrima Cement Works, including private residential dwellings, road corridors and public spaces, within and beyond the Project Area have been determined to have an overall negligible significance with regard to the proposed modification and its associated infrastructure.

The negligible to low visual significance results from a combination of factors which include:

- screening provided by existing industrial infrastructure within the Cement Works;
- gently undulating and ridgeline landforms that extend beyond the Cement Works and project area; and
- moderate to dense tree cover within and surrounding the Berrima Cement Works and residential dwellings.

While construction activities would tend to be more visible than the operational stage of the proposed modification, the construction activities would be temporary and transient in nature. Views toward construction activities would be largely restricted by existing tree cover surrounding the project area.

Key components associated with the project would include some additional low level intensity night lighting around some constructed elements. Night lighting would include individual and direction spot lighting and would avoid broad area or floodlighting where possible. The majority of infrastructure areas associated with the proposed modification would be unlikely to require additional lighting, or lighting that would be directly visible from surrounding view locations.

Figure 14: Panorama view south toward the pre-heater tower from Taylor Avenue, New Berrima (distance approx. 665 m)

Figure 15: Panorama view south west toward the pre-heater tower from Taylor Avenue (distance approx. 634 m)

Figure 16: Panorama view south west toward the pre-heater tower from Berrima Road (distance approx. 587 m)

Figure 17: Panorama view west toward the pre-heater tower from Berrima Road (distance approx. 1,332 m)

Figure 18: Panorama view north toward the pre-heater tower from Oldbury Road (distance approx. 3,244 m)

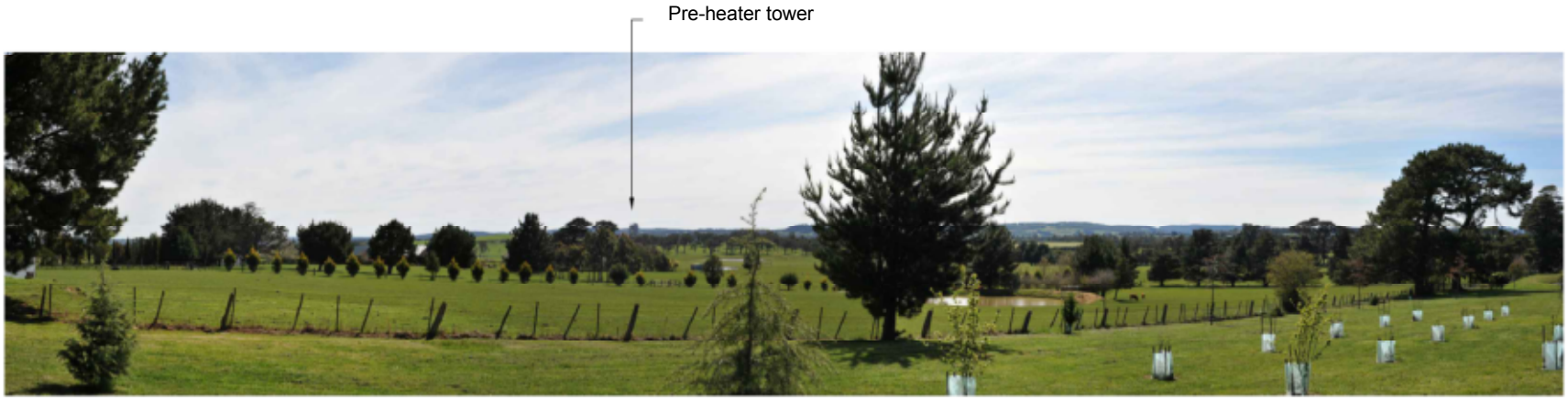

Figure 19: Panorama view north toward the pre-heater tower from Oldbury Road (distance approx. 2,944 m)

Figure 20: Photomontage P1 view west toward the existing pre-heater tower, proposed enclosed conveyor and support trestles from Berrima Road

Photomontage P2 (from photo location 11) view north east toward the pre-heater tower and proposed enclosed conveyor from Oldbury Road

Figure 21: Photomontage P2 view north east toward the pre-heater tower and proposed conveyor enclosed from Oldbury Road

7.6.3 Environmental Management

While the overall significance of the proposed modification's visual impact has been determined as negligible, the following mitigation measures would potentially help to minimise the level of residual visual impacts. The mitigation measures generally involve reducing the extent of visual contrast between the visible portions of the proposed modification and structures and the surrounding landscape.

The colour and texture of any new structures should be dark in tone and utilise non-reflective materials where possible. This would potentially minimise the visual contrast between the structures and surrounding background to a small number of receptor locations surrounding the site. Colour selections should incorporate a palette similar to those selected for existing infrastructure at the Cement Works. The darker colour tones would tend to exhibit less contrast with tree cover across hillside areas to the north of the Berrima Cement Works.

While the majority of proposed light sources would tend to be contained by both landform and tree cover for the majority of receptor locations, it is noted that:

- any additional lighting requirements for the proposed modification would be designed and installed to avoid direct line of sight from areas surrounding the site where possible;
- the proposed modification would not require aviation obstacle lighting;
- large floodlights would typically not be used. It is possible that some lights may be required for emergency lighting or to allow for emergency maintenance; and
- low intensity security lighting would be designed to minimise light spill.

7.7 Waste Management

7.7.1 Introduction

The SEARs identify seven requirements under the heading of Waste Management to be assessed. Six of these are related to the specific issue of waste derived fuel; the response to these is addressed elsewhere in the document.

One of the requirements is to address the 'procedures for the management of other solid, liquid and gaseous waste streams'. There are no other liquid and gaseous waste streams other than those already identified and assessed elsewhere in this document. Minor volumes of solid waste arise during the construction and operation of the proposed modification, and are described and assessed here.

7.7.2 Environmental Assessment

Construction

Site preparation activities will involve a minimal amount of earthworks with any surplus spoil being re-used on site. The existing shed on the construction site will be demounted and re-used elsewhere on site.

The main construction activities involves the installation of a number of prefabricated items including receival and storage building, moving floor system and assembly and installation of modularised material handling and storage system. The focus on offsite prefabrication and modularised systems minimises the amount of construction activity and related construction waste on site.

Operation

As the tyre chips and wood waste would be delivered in bulk to the storage shed and fully used as a fuel in the kiln, there would be no associated residual waste.

The RDF would be delivered in $1m^3$ bales to the designated indoor or outdoor storage area. The baled RDF would be shredded and consumed in the kiln with the RDF, with no residual waste stream.

7.7.3 Environmental Management

Construction waste will be minimal and will be managed in accordance with the contractor's construction management plan with a requirement to minimize waste generation through avoidance, reuse and recycling, with appropriate segregation, and disposal of residual waste to appropriate off-site licenced facilities.

8 MANAGEMENT AND MITIGATION MEASURES

Table 35 sets out the measures to manage and mitigate potential impacts from the proposed modification.

Table 35: Management and mitigation measures

Reference	Description	Construction or Operation
General		
G1	A Construction Environmental Management Plan would be prepared prior to the commence of construction and would address: • Dust management; • Measures to minimise soil erosion; • Protocol to deal with identification of contaminated soil; • Protocol to deal with identification of groundwater; • Safe access to/from the construction site; and • If required, noise management through temporary hoarding. The specific measures to manage erosion and sedimentation during construction include: • Development of an Erosion and Sediment Control (ESC) Plan in accordance with the Blue Book Guidelines (The Blue Book – Managing Urban Stormwater: Soils and Conservation, Landcom, 2008); • Conserve top soil for late site rehabilitation/revegetation; • Installation of sedimentation fencing downslope of areas of ground disturbance; • Construction of a sediment basin and associated water conveyance structures in accordance with Blue Book Guidelines if the site is estimated to produce greater than 150m3/yr of soil loss on the site (to be confirmed prior to construction); • Upslope diversion of clean water runoff around disturbed land; • Routine Monitoring and Maintenance of the ESC measures implemented on site during construction; and • Rehabilitation of disturbed area immediately after disturbance activities are completed.	Construction

Air Quality		
AQ1	Additional campaign testing on discharges from No.6 Kiln stack to test emissions from burning of Non-Standard Fuel	Operation
AQ2	Continuous measurement in No.6 Kiln stack of nitric oxide (NO), nitrogen dioxide (NO_2), VOCs, and other chemical species to monitor emissions from burning of Non-Standard Fuels	Operation
AQ3	Continuous monitoring would be undertaken of specified operational parameters, including temperature in the combustion chamber and stack, oxygen concentration and water content	Operation
AQ4	Monitoring data would be made publicly available	Operation
AQ5	Operate an ambient monitoring station beyond the site boundary which records meteorological data continuously and TSP, PM_{10} and other compounds on a one-day-in-six basis	Operation
AQ6	Gas from the process is raised to a minimum temperature of 850°C for at least 2 seconds to ensure a high capture of efficiency of contaminants in the kiln	Operation
Noise and Vibration		
NV1	Where required, use of localised acoustic hoarding around all significantly noise generating items of plant.	Construction
Traffic		
T1	Boral has committed to pay a road maintenance levy to Council of 4 cents/tonne/km for the transport of waste derived fuels the subject of this application.	Operation
T2	Boral proposes to surrender the consent for the coal stockpiling for sale (Modification 6) that was approved on 20 June 2012.	Operation
Visual		
V1	Where possible, the colour and texture of any new structures should be dark in tone and utilise non-reflective materials to minimise visual impact.	Operation
Waste		
W1	Construction waste will be minimal and will be managed in accordance with the contractor's construction management plan with a requirement to minimize waste generation through avoidance, reuse and recycling, with appropriate segregation, and disposal of residual waste to appropriate off-site licenced facilities.	Construction
W2	The baled RDF would be shredded and consumed in the kiln with the RDF, with no residual waste stream.	Operation

9 CONCLUSION

Boral Cement Limited seeks approval to modify the existing development consent for the New Berrima Cement Works to:

- use Solid Waste Derived Fuel (SWDF) as an energy source;
- change air emission limits of particulate matter (PM), nitrous oxides (NOx) and volatile organic compounds (VOC); and
- construct a fuel storage and kiln feeding system.

In addition, Boral wishes to surrender Modification No. 6 (June 2012) relating to the stockpiling of coal for sale and transport to Port Kembla.

Secretary's Environmental Assessment Requirements (SEARs) were provided by the Department of Planning and Environment (DPE).

An environmental assessment was undertaken, taking into account the SEARs, to assess the potential impacts of the proposed modification and appropriate management and mitigation measures. The assessment focussed on potential impacts to air quality, greenhouse gases, hazardous materials, noise and vibration, traffic and visual as well as the alignment of the proposed modification with waste management and environmental policies and legislation.

The potential impacts identified by the assessment were considered to be minor and within established pollution limits when environmental management and mitigation measures were considered. The benefits of the project include a reduction in greenhouse gas emissions associated with the operation of the Cement Works and the diversion of waste from landfill to be used as a Waste Derived Fuel in line with the EPA's *NSW Energy from Waste Policy (2014).*

Based on this environmental assessment and the implementation of proposed management and mitigation measures, it is recommended that the proposed modifications be approved as it will not have a significant impact on the environment.

REFERENCES

Application Notes to Industrial Noise Policy, Environmental Protection Authority (2010)

Applying SEPP 33: Hazardous and Offensive Development Application Guidelines, Department of Urban Affairs and Planning (1994)

Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, NSW Department of Environment and Conservation (2011)

Assessing Vibration: a technical guideline, Department of Environment and Conservation (2006)

Australian Standard AS 2187: Part 2-2006 *Explosives - Storage and Use - Part 2: Use of Explosives,* Council of Standards of Australia (1998)

British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2*, British Standards Institute (1993)

Draft NSW Waste Avoidance and Resource Recovery Strategy 2013 – 2021, NSW Environmental Protection Authority (2013)

The Environment Protection (Waste to Resources) Policy 2010 (W2R EPP), South Australia Environmental Protection Authority (2010)

The *Greenhouse Gas Protocol (GHG Protocol)*,World Business Council for Sustainable Development (2004)

Guidance Note on the Assessment of Non-Standard Fuels, NSW Department of Environment and Conservation(2005)

Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change, 2009)

National Greenhouse Accounts Factors" Workbook (NGA Factors) Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (2014))

NSW Waste Avoidance and Resource Recovery Strategy 2007, NSW Environmental Protection Authority (2007)

NSW Energy from Waste Policy (2014), NSW Environmental Protection Authority (2014)

Road Noise Policy (RNP,) NSW Department of Environment, Climate Change and Water (2011)

State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33), Department of Planning and Environment (1992)

Wingecarribee Local Environment Plan 2010, Wingecaribee Shire Council (2010)

APPENDIX A

Design and Process Drawings

APPENDIX B

Solid Waste Derived Fuels Technical Specification

APPENDIX C

Conditions of Approval

<table>
<tr><th>No.</th><th>Condition</th><th>Change</th></tr>
<tr><td>1.4A</td><td>Subject to meeting the requirements of this consent, and the requirements of a licence issued under the Protection of the Environment Operations Act 1997 for the site, the following fuels are permitted to be received at the site for use at the upgraded Kiln 6 development at the quantities, firing rates and proportions specified in Table 1.
Permitted Fuels for use in upgraded Kiln 6
<table>
<tr><th>Fuel</th><th>Category</th><th>Tonnes per annum</th><th>Tonne per hour</th><th>Percent of total fuel (by mass)</th></tr>
<tr><td>Natural Gas, Fuel Oil, Diesel</td><td>Standard Fuel</td><td colspan="3">No limits</td></tr>
<tr><td>Coal</td><td>Standard Fuel</td><td>No Limit</td><td>No Limit</td><td>≥ 60.0</td></tr>
<tr><td>Coke Fines</td><td>Standard Fuel</td><td>No Limit</td><td>≤ 10.0</td><td>≤ 300</td></tr>
<tr><td>Hi Cal 50</td><td>Non-Standard Fuel</td><td>10,000</td><td>≤ 1.0</td><td>≤ 6.0</td></tr>
<tr><td>AKF1</td><td>Non-Standard Fuel</td><td>20,000</td><td>≤ 1.3</td><td>≤ 4.7</td></tr>
<tr><td>AKF5</td><td>Non-Standard Fuel</td><td>30,000</td><td>≤ 4.5</td><td>≤ 21.0</td></tr>
</table></td><td>Modification as detailed in Section 4.5.1 of this report</td></tr>
<tr><td>1.4B</td><td>AKF5 is approved for use at the development under this consent subject to the necessary approvals under the Act being obtained for storage facilities and kiln feeding infrastructure. No AKF5 is permitted to be received at the site until the necessary storage facilities and kiln feeding infrastructure have been constructed in accordance with any such approvals. Storage of AKF5 must be in accordance with the New South Wales Fire Brigades' (Fire Safety Division) Guidelines For Bulk Storage Of Rubber Tyres</td><td>Storage of waste tyres has been considered in the design illustrated in Appendix A and is in accordance with NSW Fire Brigades relevant guidelines.

The first two sentences of this condition should be deleted in a modified consent.</td></tr>
<tr><td>1.4C</td><td>Hi Cal 50 and AKF1 are approved for use at the development under this consent subject to the detailed design for any necessary storage facilities and kiln feeding infrastructure being approved to the Director-General. In particular, the detailed design shall:
a) demonstrate that the storage facilities would be appropriately bunded in accordance with the relevant Australian Standards, especially Australian Standard AS1940-2004 (for AKF1, this would include having a minimum capacity sufficient to accommodate catastrophic failure of the tank and that adequate measures are in place to ensure a catastrophic failure of a tanker during transfer was adequately contained to ensure no off-site discharge;
b) include appropriate measures to ensure liquids draining from the bund (and other containment areas) are kept separate and adequately treated prior to discharge to the on-site stormwater management system, and demonstrate that these measures were developed in consultation with the Sydney Catchment Authority and Wingecarribee Shire Council; and
c) include a Fire Safety Study prepared in accordance with the Department's guideline Hazardous Industry Planning Advisory Paper No. 2: Fire Safety Study and in consultation with the NSW Fire Brigades.
A construction certificate must not be issued in relation to any necessary storage facilities and kiln feeding infrastructure until the Director-General has approved the detailed design parameters. No Hi Cal 50 or AKF1</td><td>No changes sought to this condition.</td></tr>
</table>

No.	Condition	Change
	is permitted to be received at the site under this consent until any necessary storage facilities and kiln feeding infrastructure have been constructed in accordance with the detailed design parameters approved by the Director-General.	
1.4D	Only Standard Fuels are permitted to be used at the development during start-up and shut-down.	This would continue to be part of the cement works operating procedures The following wording to be inserted into Schedule 2 definitions in consent to bring clarity to start-up and shut-down: *"Kiln start-up"* *Start-up is defined as the time until the raw meal feed rate to the kiln has reached 250 t/h. Emission limits do not apply during start-ups due to inherent inaccuracy of monitoring equipment in non-steady state conditions.* *"Kiln shutdown"* *Shutdown is defined as the time when the plant is being returned to a non-operational state. Emission limits do not apply during shutdowns due to inherent inaccuracy of monitoring equipment in non-steady state conditions.*
1.4E	Non-Standard Fuels are not permitted to be stored at the site for longer than 3 months, except with the written permission of the Director-General.	This would be part of the cement works operating procedures

<table>
<tr><th>No.</th><th>Condition</th><th>Change</th></tr>
<tr><td>1.4F</td><td>No Non-Standard Fuel is permitted to be received at, or used at the development, unless it complies with:
a) the handling, transporting, sampling, analysis and quality control requirements of this consent;
b) any requirements of a licence issued under the Protection of the Environment Operations Act 1997 for the site; and
c) the fuel specification for that specific fuel.</td><td>This would be part of the cement works operating procedures.
Fuel specification has been attached at Appendix B.</td></tr>
<tr><td>1.4 G</td><td>Prior to the receipt of the first batch of a Non-Standard Fuel from a particular supplier, the Applicant shall certify in writing to the Director-General that the supplier has implemented appropriate quality control and quality assurance procedures to ensure that the Applicant's responsibilities under this consent can be met. At the request of the Director-General, the Applicant shall forward a copy of the supplier's quality control and quality assurance procedures to the Department demonstrating how those procedures cause the Applicant to meet the requirements of this consent.</td><td>No changes sought to this condition.</td></tr>
<tr><td>3.10</td><td>The Applicant shall design, construct, operate and maintain the cement works upgrade to ensure that for each discharge point listed in Table 3 (Standard Fuels Only) and Table 4 (Non-Standard Fuels) below, the concentration of each pollutant listed for that discharge point does not exceed the maximum allowable discharge concentration limit for that pollutant at the discharge point specified. All concentration limits specified in the table are based on 101.3 kPa, 273 K, dry reference conditions (unless otherwise agreed with the EPA) and shall be determined in accordance with the monitoring requirements described under condition 4.1.

Table 3 - Maximum Allowable Discharge Concentration Limits (Air) When Kiln 6 is using only Standard Fuels
<table>
<tr><th>EPA Identification Point</th><th>Pollutant</th><th>Units of Measure</th><th>Concentration Limit</th></tr>
<tr><td rowspan="5">2 – Main Exhaust Stack on Kiln No. 6 a</td><td>Cadmium</td><td>mgm^{-3}</td><td>0.1</td></tr>
<tr><td>Mercury</td><td>mgm^{-3}</td><td>0.1</td></tr>
<tr><td>Hazardous substances</td><td>mgm^{-3}</td><td>1.0</td></tr>
<tr><td>Nitrogen oxides</td><td>mgm^{-3}</td><td>1000</td></tr>
<tr><td>Solid particles</td><td>mgm^{-3}</td><td>95</td></tr>
</table>
a. the location of this point is the same as that described in EPL No. 1698

Table 4 - Maximum Allowable Discharge Concentration Limits (Air) When Kiln 6 is using Non-Standard Fuels
<table>
<tr><th>EPA Identification Point</th><th>Pollutant</th><th>Units of Measure</th><th>Concentration Limit</th></tr>
<tr><td rowspan="13">2 – Main Exhaust Stack on Kiln No. 6 a</td><td>Cadmium and Thallium</td><td>mg/m^3</td><td>0.05</td></tr>
<tr><td>Chlorine</td><td>mg/m^3</td><td>200</td></tr>
<tr><td>Dioxins & Furans</td><td>ng/m^3</td><td>0.1</td></tr>
<tr><td>Hazardous substances b</td><td>mg/m^3</td><td>0.5</td></tr>
<tr><td>Hydrogen chloride</td><td>mg/m^3</td><td>10</td></tr>
<tr><td>Hydrogen fluoride</td><td>mg/m^3</td><td>1</td></tr>
<tr><td>Mercury</td><td>mg/m^3</td><td>0.05</td></tr>
<tr><td>Nitrogen Oxides</td><td>mg/m^3</td><td>800</td></tr>
<tr><td>Solid Particles</td><td>mg/m^3</td><td>30</td></tr>
<tr><td>Sulfur Dioxide</td><td>mg/m^3</td><td>50</td></tr>
<tr><td>Sulfuric acid mist and/or sulfur trioxide</td><td>mg/m^3</td><td>100</td></tr>
<tr><td>Volatile Organic Compounds c</td><td>ppm c</td><td>20 c</td></tr>
</table>
a. The location of this point is the same as that described in EPL No. 1698.
b. Aggregate of Sb, As, Be, Cd, Cr, Co, Pb, Mn, Hg, Ni, Se, Sn and V.
c. Or Total Organic Carbon or other equivalent(s) as agreed to by EPA.</td><td>Modification as detailed in Section 4.1.2 of this report</td></tr>
</table>

<table>
<tr><th>No.</th><th>Condition</th><th>Change</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>3.10 A</td><td>For the purposes of compliance with condition 3.10, for each pollutant specified in Table 4 in condition 3.10, the reference conditions and averaging period of a pollutant discharged must be reported according to the reference conditions and averaging period specified for that pollutant in Table 5, or as otherwise agreed to by EPA.
Table 5 - Reporting Reference Conditions and Averaging Periods
<table>
<tr><th>EPA Identification Point</th><th>Pollutant</th><th>Units of Measure</th><th>Concentration Limit</th></tr>
<tr><td rowspan="6">2 – Main Exhaust Stack on Kiln No. 6 a</td><td>Solid particles</td><td>Dry, 273K, 101.3 kPA, 10%O2</td><td>As per test method (for campaign monitoring)</td></tr>
<tr><td>Solid particles</td><td>Dry, 273K, 101.3 kPA, 10%O2</td><td>24-hour average per method agreed to by EPA (for continuous monitoring)</td></tr>
<tr><td>Nitrogen Oxides</td><td>Dry, 273K, 101.3 kPA, 10%O2</td><td>1-hour average per method agreed to by EPA (for continuous monitoring)</td></tr>
<tr><td>Dioxins and Furans</td><td>Dry, 273K, 101.3 kPA, 10%O2, I-TEQ</td><td>As per test method</td></tr>
<tr><td>All other air pollutants</td><td>Dry, 273K, 101.3 kPA, 10%O2</td><td>As per test method</td></tr>
<tr><td>All other air pollutants</td><td>As agreed to by EPA (for continuous monitoring)</td><td>As agreed to by EPA (for continuous monitoring)</td></tr>
</table></td><td>Change to 24hr averaging of NOx as per Section 4.1.2</td></tr>
<tr><td>3.20</td><td>For each Non-Standard Fuel approved for use at the development the Applicant shall provide a fuel specification, to be approved by the Director-General and the EPA prior to the use of that Non-Standard Fuel at the development under this consent. The Non-Standard Fuel specification shall include, but not be limited to, the minimum calorific value and the maximum quantity of all relevant pollutants, particularly the listed pollutants.</td><td>No changes sought to this condition.</td></tr>
<tr><td>3.21</td><td>Based on the Non-Standard Fuel specification specified in condition 3.20 the following fuel specification criteria are required to be met:
a) no greater than 1 mg/kg and a cadmium specification no greater than 10 mg/kg;
b) for AKF1 a mercury specification no greater than 2 mg/kg and a cadmium specification no greater than 5 mg/kg;
c) organohalogen compounds, expressed as chlorine, in any Non-Standard Fuel not to exceed 1% by weight; and
d) the waste materials to be used as Non-Standard Fuels must not be diluted or blended to meet any of the fuel specification requirements.</td><td>No changes sought to this condition.</td></tr>
<tr><td>3.22</td><td>Prior to the use of Non-Standard Fuels at the development in accordance with this consent, the Applicant shall implement a Tracking Program that meets the requirements of the Director-General. The Tracking Program shall include, but not be limited to, the identification and recording of the following information in accordance with the time periods specified in condition 3.23:
a) batch analyses of Non-Standard Fuels received at the development as provided by the suppliers, and the results of any check analyses carried out by the Applicant as part of the quality control management procedures required under condition 6.7 of this consent;
b) a mass inventory of each listed pollutant entering the process in raw materials, conventional fuels and Non-Standard Fuels, with particular attention to, but not limited to chlorine, mercury, cadmium and chromium;
c) emission factors for each listed pollutant calculated from inputs, outputs, and measured air emissions, variance in the emissions factors from period to period and an assessment with regards to the reasons for any such variance; and
d) any adjustments that may be necessary to Non-Standard Fuel specifications arising from the Tracking Program analysis.</td><td>Refer to the four fold approach in 4.1.1.</td></tr>
</table>

No.	Condition	Change
3.23	The Applicant shall submit a Report that details and assesses the results of the Tracking Program prescribed in condition 3.22 of this consent to the Director-General. The Report shall be submitted to the Director-General: a) every three months in the first year of operation using Non-Standard Fuels under this consent, (to be synchronised with stack monitoring); and b) thereafter every six months, or as otherwise agreed to by the Director-General.	No changes sought to this condition.
3.24	To ensure the emissions of air pollutants are minimised, the Applicant shall NOT use Non-Standard Fuels unless: a) the feed rates for Non-Standard Fuels are maintained at a steady controlled rate to provide for combustion in a proper and efficient manner; and b) a temperature of above 850^{o}C is maintained in the zone where Non-Standard Fuels are fired at the main-firing end of Kiln 6; and c) a temperature of above 800^{o}C is maintained in the zone where Non-Standard Fuels are fired at or in the vicinity of the pre-calciner/ de-nox system for Kiln 6; and d) a temperature of above 300^{o}C is maintained at the outlet of pre-heater strings for Kiln 6; and e) a temperature of below 200^{o}C is maintained at the inlet to the electrostatic precipitator and fabric filter for Kiln 6; and f) the continuous measurements required by this consent, show that all maximum allowable discharge concentration limits values prescribed in Table 4 of condition 3.10 are complied with. The Applicant shall cease to use Non-Standard Fuels immediately in Kiln 6 if any maximum allowable discharge concentration limit is exceeded.	The licensee shall cease to burn Non-Standard Fuels in Kiln 6 as soon as is practicable if: - The temperature is below 800°C in the zone where Non-Standard Fuels are fired or in the vicinity of the pre-calciner; or - The temperature is below 300°C at the outlet of the preheater strings; or - Any of the daily averages for continuous measurements required by the Licence/Consent exceed concentration limit values. The termination of feed of Non-Standard Fuels should be completed over a period of a maximum of 4 hours.
3.25	Without prejudice to condition 3.24e), Kiln 6 shall under no circumstances continue to use Non-Standard Fuels for a period of more than four hours uninterrupted where emission limits are exceeded; and the cumulative duration of operation under such conditions over one year shall be less than 60 hours.	To be deleted as above.
4.1	During operation of the upgraded Kiln 6, the Applicant shall determine the pollutant concentrations and emission parameters specified in Table 6 (Standard Fuels Only) and Table 7 (Non-Standard Fuels) below, at the discharge points indicated and employing the sampling and analysis method specified. All pollutant concentrations and emission parameters for each discharge point shall be determined concurrently and at the frequency indicated in the table, unless otherwise agreed with the EPA.	Changes to emissions reporting as outlined in Section 4.1.2.

No.	Condition	Change
4.1A	Continuous monitoring equipment for emissions, temperature and fuel feed rate, as required to meet the conditions of this consent and as agreed to by EPA must be installed prior to receipt at the site of and use of Non-Standard Fuels in the upgraded Kiln 6.	No changes sought to this condition.
4.1B	Prior to the commencement of the use of Non-Standard Fuels in accordance with this consent, the Applicant shall establish an Ambient Air Quality Monitoring Program in consultation with, and to meet the requirements of, the Director-General, the EPA, and the NSW Department of Health. The monitoring program shall be consistent with the EPA's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* and shall be designed to generate sufficient information to meet the requirements of this consent with regards to the First-Year Monitoring and Modelling Assessment Report. The ambient monitoring program shall include: a) an ambient air quality monitoring station which shall: i. be placed at a location near New Berrima, but away from its immediate influence in terms of air pollution; ii. monitor TSP, PM_{10} and listed pollutants with sampling to be undertaken over an appropriate period (to be agreed with the EPA) every six days; and iii. continue to sample for at least one year from the commencement of the use of Non-Standard Fuels, its continuation thereafter to be reviewed after analysis of the First-Year Monitoring and Modelling Assessment Report. b) generation of suitable continuously sampled meteorological data including wind speed, wind direction, temperature, and variability of wind direction (sigma theta) in general accordance with the *Australian Standard AS2923 – 1987.*	No changes sought to this condition.
4.1C	From the time of commencement of the use of Non-Standard Fuels the Applicant shall continuously monitor the following process parameters: a) gas temperature (or some agreed equivalent indication of the temperature): i. in or near the firing zone at the main-firing end of the kiln where Non-Standard Fuels are being fired; ii. in the kiln at the feed end; iii. in the combustion zone or zones where Non-Standard Fuels are being fired in or adjacent to the pre-calciner/de-nox system; iv. at the outlet of the suspension pre-heater strings; and v. at the inlet to the electrostatic precipitator and the fabric filter. b) carbon monoxide and volatile organic compounds (or total organic carbon or equivalents as agreed with the EPA) in the exhaust gases after all combustion is complete; and c) rates of feed for Non-Standard Fuels AKF1 and AKF5 and the derived rate of feed for Hi CAL 50 in the coal feed.	No changes sought to this condition.
4.6	Within 12 months of the receipt of the first load of Non-Standard Fuels under this consent, the Applicant shall arrange for and bear the full cost of an independent and comprehensive audit of the use of Non-Standard Fuels at the development. Further Audits are to be conducted every 12 months, or as otherwise directed by the Director-General. The Audits are to be carried out by a duly qualified and independent person or team to be approved by the Director-General, and submitted directly to the Director-General, the EPA and NSW Health unless otherwise directed by those agencies. The Audits shall be carried out in accordance with *ISO 19011:2002 - Guidelines for Quality and/ or Environmental Management Systems Auditing* and shall cover all aspects of the use of Non-Standard Fuels at the development, including, but not limited to: a) an assessment of compliance with the requirements of this consent, and other licences and approvals that apply to the use of Non-Standard Fuels at the development; b) a review of management practices and operating procedures regarding the proper and efficient operation of Kiln 6 whilst using Non-Standard Fuels, especially with regards to the minimisation of dioxins emissions; c) assessment of quality control and quality assurance measures implemented by the Non-Standard Fuel suppliers, especially with regards to the sampling and analysis undertaken to ensure that	No changes sought to this condition.

No.	Condition	Change
	Non-Standard Fuels comply with the relevant fuel specification; d) a review of the fuel quality control management procedures implemented by the Applicant including assessment of the Applicant's handling, processing, verification and analysis of information generated by the Applicant and received from the Non-Standard Fuel suppliers; and e) suggestion of any recommendations with respect to any of the matters listed above.	
5.4	Prior to the use of Non-Standard Fuels at the development the Applicant shall establish a Community Liaison Group that has access to all environmental management plans and monitoring data, environmental reporting and tracking and audit reports required by this consent. The Group shall: a) Be comprised of the following, whose appointment has been approved by the Director-General: i. 1 or 2 representatives from the Applicant, including the person responsible for environmental management at the development; ii. 1 representative from Council; and iii. 3 or 4 representatives from the local community. b) Be chaired by a representative agreed to by the Group and approved by the Director-General; c) Meet a minimum of once in every 6 month period; and d) Review and provide advice on the environmental performance of the development, including providing comment where necessary on any environmental management plans, monitoring results, audit reports, or complaints.	No changes sought to this condition.
5.5	The Applicant shall at its own expense: a) Ensure that 1 or 2 of its representatives attend the Group's meetings; b) Provide the Group with regular information on the environmental management and performance of the development; c) provide access to independent scientific/technical support to assist member in understanding and interpreting information provided, if requested; d) provide meeting facilities for the Group, where necessary; e) arrange site inspections for the Group, if requested; f) take minutes of the Group's meetings and make these minutes available to the public for inspection within 14 days of the Group meeting, or as agreed to by the Group; g) respond to any advice or recommendations the Group may have in relation to the environmental management or performance of the development; and h) maintain a record and a copy of the minutes of each Group meeting, and any responses to the Group's recommendations, to be provided to the Director-General upon request.	No changes sought to this condition.
6.6	Prior to the use of Non-Standard Fuels under this consent, the Applicant shall update the Operation Environmental Management Plan required under conditions 6.3 and 6.4 of this consent to reflect any modifications required at the development in light of the use of Non-Standard Fuels. Where the Applicant considers that the Operation Environmental Management Plan does not require any amendment then a clear justification of this must be provided. The Applicant shall not receive or use Non-Standard Fuels at the development until the Director-General has approved the amended Operation Environmental Management Plan. Updating of the Plan shall include, but not necessarily be limited to providing additional detailed measures to the Air Quality Management Plan to minimise the emissions of air pollutants (including toxic pollutants and dioxins) to ensure compliance with the process parameters specified in condition 3.24 of this consent and the air emissions limits specified in condition 3.10 of this consent.	No changes sought to this condition.
6.7	Prior to the receipt of Non-Standard Fuels at the development in accordance with this consent, the Applicant shall establish and implement quality control management procedures to ensure Non-Standard Fuels delivered to the development comply with the fuel specifications. The procedures shall, be forwarded to and meet the requirements of the Director-General, and shall, at the request of the Director-General, be updated to reflect the recommendations of the annual Non-Standard Fuels audit required under condition 4.7 of this consent. The procedures shall include: a) assessment of the sampling and laboratory processes used by the Non-Standard Fuel suppliers with a view to ensure these processes are sufficient for the Applicant to meet the requirements of	No changes sought to this condition.

No.	Condition	Change
	this consent; b) carrying out of periodic, random parallel sampling of Non-Standard Fuels with analysis of substances to which limits have been applied in the fuel specifications; and c) measures to ensure handling, processing and analysis of information provided by Non-Standard Fuel suppliers and that generated by the activities under b) is appropriately stored and managed.	
7.2A	Prior to the commencement of the use of Non-Standard Fuels under this consent, the Applicant shall establish an agreed arrangement with the Sydney South West Pubic Health Unit to ensure that NSW Health is advised in a timely manner of the details of any incident with actual or potential significant off-site impacts on human health or amenity.	No changes sought to this condition.
7.3A	In each Annual Environmental Management Report submitted after the First Year Monitoring and Modelling Assessment Report required in accordance with condition 7.6 has been submitted, the Applicant shall include the details of the use of all Non-Standard Fuels at the development, including, but not necessarily limited to: a) the nature, quantity and quality of Non-Standard Fuels used at the development; b) details of any fuels that did not meet the Fuel Specification, including the source of the fuels and how the rejected fuels were managed or disposed of; c) a review of the results of the Non-Standard Fuels Tracking Program and the Non-Standard Fuels Quality Control Management procedures; and d) the results of all monitoring undertaken in accordance the requirements of this consent and an assessment of these monitoring results, including comparison of stack emissions against the concentration limits set in condition 3.10.	No changes sought to this condition.
7.6	One year after the commencement of the use of Non-Standard Fuels in accordance with this consent, the Applicant shall prepare a First-Year Monitoring and Modelling Assessment Report. The Report shall be submitted to the Director-General, the NSW Department of Health and the EPA not more than 15 months after the commencement of the use of Non-Standard Fuels in accordance with this consent, and shall: a) detail the nature, quantity and quality of Non-Standard Fuels used at the development; b) assess the results of the Continuous Emissions Monitoring, the Ambient Air Quality Monitoring Program and the Process Monitoring requirements under conditions 4.1, 4.1B and 4.1C of this consent against the relevant emission limits and process parameters prescribed by this consent and within the context of the predictions made in the documents listed under condition 1.2 i) of this consent; c) assess the results of the Non-Standard Fuels Tracking Program including detailed description and assessment of any trends identified through the Program; d) assess the adequacy of the Non-Standard Fuels Quality Control Management Procedures required under condition 6.7; and e) based on this assessment, review the necessity for continuing or modifying any of the emissions monitoring, reporting or pollutant tracking requirements of this consent.	No changes sought to this condition.

APPENDIX D

Air Quality Impact Assessment

APPENDIX E

Greenhouse Gas Assessment

APPENDIX F

Hazard Assessment – SEPP 33 Preliminary Risk Screening

APPENDIX G

Noise and Vibration Impact Assessment

APPENDIX H

Traffic and Access Impact Assessment

APPENDIX I

Landscape and Visual Impact Assessment

APPENDIX J

Correspondence with EPA May 2014