Holcim (Australia) Pty Ltd

Greenhouse Gas and Energy Impact Assessment for Proposed Minor Modification to Holcim Regional Distribution Centre (RDC), Rooty Hill

September 2010

Umwelt
Environmental Consultants

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Prepared by

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on behalf of

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Executive Summary

Umwelt (Australia) Pty Limited (Umwelt) was commissioned by Holcim (Australia) Pty Ltd (Holcim) to conduct a Greenhouse Gas and Energy Impact Assessment (GHGEIA) of the proposed minor modifications to the approved Regional Distribution Centre (RDC), located at Rooty Hill, New South Wales (NSW). Holcim obtained Project Approval (05_0051) under Part 3A the *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2006 to construct and operate the RDC for quarry products to a capacity of 4 million tonne per annum (Mpta). The approved RDC, once constructed, will allow Holcim to receive, store and distribute bulk construction materials (sand/aggregate) to customers in the Sydney region.

Since the approval was granted and building on the recent change in ownership Holcim conducted a review of the approved RDC project and has identified operational, capital and environmental benefits in modifying the approved RDC layout. Accordingly Holcim is seeking to modify the 2006 Project Approval (05_0051) under Section 75W of the EP&A Act to allow these minor modifications to the approved, but yet to be constructed RDC (modified RDC).

Since the preparation of the Environmental Assessment (EA) for the approved RDC in 2005, the process for assessing greenhouse gas impacts has evolved significantly. To build on the original environmental assessment, this GHGEIA considers the potential impacts of constructing and operating the RDC with the proposed minor modifications. To measure the greenhouse gas implications of the modification, the GHGEIA also compares emissions from the approved project with emissions from the modified project (using the original assessment methodology).

The scope of the GHGEIA includes:

- estimating greenhouse gas emissions and energy use associated with constructing the modified RDC;
- estimating greenhouse gas emissions and energy use associated with operating the modified RDC;
- estimating the impact of the modified RDC's emissions on atmospheric concentrations of carbon dioxide;
- estimating the impact of the modified RDC's emissions on achievement of local, state, national and international greenhouse gas emission targets;
- evaluating whether the modified RDC aligns with the principles of Ecologically Sustainable Development (ESD);
- identifying management and mitigation options to reduce greenhouse gas emissions from the modified RDC; and
- comparing the approved RDC greenhouse gas emissions and energy usage as outlined in the 2005 EA with those calculated for the modified RDC.

The GHGEIA found that the modified RDC will generate the following sources of greenhouse gas emissions.

	Construction		**Operation**	
	(T CO_2-e)	(%)	(T CO_2-e p.a.)	(%)
Scope 1	0	0	6,978	4.1%
Scope 2	0	0	6,742	4.0%
Scope 3	14,770	100%	155,218	91.9%
TOTAL	14,770	100%	168,938	100%

The construction of the modified RDC is estimated to generate 14,770 tonnes of carbon dioxide equivalents (TCO_2-e). It has been assumed that the construction of the modified RDC will be outsourced and only generate Scope 3 emissions.

The majority of the modified RDC's emissions will be generated in its operation phase. When the modified RDC is operating at full capacity, it will produce approximately 6,978 TCO2-e Scope 1 emissions per annum. The majority of Scope 1 emissions are generated by the Holcim owned/leased fleet consuming diesel while delivering quarry products to customers. Holcim has a direct influence over Scope 1 emissions and these emissions will be subject to management and mitigation plans.

At full capacity the modified RDC is forecast to consume 7,576 MWh p.a. of electricity, which will generate approximately 6,742 TCO_2-e Scope 2 emissions per annum. Holcim can reduce Scope 2 emissions by driving electricity reduction and efficiency initiatives, however, Holcim have no direct influence over the greenhouse gas efficiency of electricity utilities.

The modified RDC's potential to generate Scope 3 emissions is highly uncertain, as activity data is difficult to estimate and some emission factors have not been verified in the circumstances they are being applied. Holcim also has no control over Scope 3 emissions as they relate to the activities of other organisations. At full capacity approximately 155,218 TCO_2-e Scope 3 emissions per annum can be attributed to the modified RDC. Scope 3 emissions are predominately generated upstream via transporting quarry products to the RDC and purchasing cement. The GHGEIA has assumed that cement purchased has a GHG intensity of 0.67 TCO2-e/T. Sourcing a cement product with lower emissions intensity will significantly reduce the modified RDC's Scope 3 emissions.

Scope 2 and 3 emissions have been included in the GHGEIA to demonstrate the potential upstream and downstream impacts of the modified RDC. It is important to note that the modified RDC's Scope 2 and Scope 3 emissions should not be viewed as emissions that are 'over and above' national and global projections. The majority of the Scope 2 and 3 emissions identified in the GHGEIA are also attributable, and will be reported, by other sectors.

The GHGEIA found that the modified RDC will consume approximately 127,246 GJ of energy per annum.

Holcim will seek to maximise energy efficiency via productivity measures as part of the construction, design and operation of the RDC. Holcim will also implement feasible greenhouse gas mitigation initiatives during the design, construction and operational stages of the modified RDC. Further discussion of these measures is contained in the assessment report.

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1.0 Introduction

Holcim (Australia) Pty Ltd (Holcim) obtained a Project Approval under Part 3A the *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2006 to construct and operate the Regional Distribution Centre (RDC) for quarry products to a capacity of 4 million tonnes per annum (Mpta). The approved RDC will allow Holcim to receive, store and distribute bulk construction materials (sand/aggregate) to customers in the Sydney region. Umwelt (Australia) Pty Limited (Umwelt) was commissioned by Holcim to conduct a Greenhouse Gas and Energy Impact Assessment (GHGEIA) of the proposed modifications to the RDC, to be located at Rooty Hill, New South Wales (NSW) (refer to **Figure 1.1**).

Since the approval was granted and building on the recent change in ownership Holcim conducted a review of the approved RDC project and has identified operational, capital and environmental benefits in modifying the approved RDC layout. Accordingly Holcim is seeking to modify the 2006 Project Approval (05_0051) to allow these minor modifications to the approved but yet to be constructed RDC. Holcim has consulted with the Department of Planning (DoP) regarding this modification and the DoP have confirmed that the modification of the Project Approval may be sought under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Assessing the greenhouse gas impacts of major developments is now an established part of the environmental assessment and approvals process. The following GHGEIA evaluates the greenhouse gas impacts and energy use of the proposed modified RDC.

1.1 Approved RDC

Holcim currently supplies the Sydney market with quarry products from the company's Penrith Lakes Development Corporation (PLDC) operations. However, this resource is nearly depleted and the facility is approaching closure. Consequently Holcim has had to locate alternative sources of quarry products to meet the needs of its Sydney market. These quarry materials will come from quarries outside the Sydney region, including the new Lynwood Quarry near Marulan in the Southern Tablelands region of NSW. The approved RDC will allow Holcim to receive, store and distribute construction materials to meet customer requirements in the Sydney region.

The RDC is approved to handle up to 4 Mtpa of quarry product. Construction materials such as sand and aggregate will be transported by rail to the RDC from quarries. These materials will be blended by equipment at the RDC as required and distributed by road to the Sydney market.

The approved RDC includes the following:

- a regional office building and materials testing laboratory;
- a rail siding and rail unloading facility;
- elevated steel storage bins and truck load out facilities;
- ground storage and reclaim facilities;
- blending Plant/Pug Mill;
- a conveyor system linking the unloading station to the storage and truck load out facilities;

- workshop, stores, site offices and amenities facilities, truck washdown facilities, truck refuelling, weighbridges, truck and car parking;
- concrete Batching Plant (CBP);
- bridges at two locations over Angus Creek; and
- realignment of the existing North Parade and creation of New North Parade.

The approved RDC will operate 24 hours per day, seven days a week. The RDC will take approximately two years to build and will employ approximately 220 people during construction. During operation of the approved RDC, approximately 250 people will be employed on-site. At 4 Mtpa the approved RDC will dispatch approximately 400 heavy vehicles from the site on an average day. All traffic to the RDC will access the site via Kellogg Road, with the exception of some minor laboratory traffic. Those vehicles accessing Kellogg Road to/from the south will do so via Woodstock Avenue direct from the M7. Heavy vehicles accessing Kellogg Road to/from the north would do so via Glendenning Road and Power Street direct from the M7

1.2 Description of the Proposed Minor Modifications to the RDC

The RDC site is located off Kellogg Road, Rooty Hill within the Blacktown Local Government Area (LGA). The RDC site is located to the north of the Main Western Railway Line, Nurragingy Reserve is located to the east, and an industrial area is located to the west and to the north of the RDC site.

Holcim is seeking a modification to the 2006 Project Approval to allow minor modifications to the approved but yet to be constructed RDC. Construction of the RDC is planned to begin in 2011 and the RDC is expected to commence operations in 2013.

The proposed minor modifications include:

- changing from elevated steel storage bins to on-ground concrete storage bins, this will reduce the height of the storage facility by approximately 10 metres;
- changing the configuration and location of the rail unloader and rail sidings to accommodate shorter trains, for the initial phase of the development;
- reducing the payload capacity of trains, for the initial phase of the development;
- the removal of the ground storage bins that were originally sited west of the steel storage bins;
- closure of North Parade by Blacktown City Council rather than relocation of the road;
- an increased ground storage area at the radial stacker; and
- minor changes to the locations of the office, workshop and other internal facilities to improve operating efficiencies and in response to the layout changes outlined above.

The proposed minor changes to the RDC will not result in changes to overall RDC components or to the approved RDC capacity of 4 Mtpa. The RDC will operate in much the same way as is currently approved. There will be no change to the number, size or tonnages of heavy vehicles accessing the facility during construction or operation of the RDC. Traffic arrangements and volumes will not change from the currently approved RDC design.

1.3 Minimising Upstream Greenhouse Gas Emissions

Holcim currently services the Sydney region from its operations at Penrith Lakes. The Penrith Lakes Resource is nearly depleted and the facility is approaching closure.

Holcim plans to continue to service the Sydney region using quarry products extracted from quarries outside the Sydney region including, the new Lynwood Quarry near Marulan. Compared to existing operations, sourcing quarry products from Lynwood will increase upstream transport emissions due to the additional fuel required to haul longer road distances. To minimise the greenhouse gas impacts of the additional road transport distance, Holcim will transport quarry products to the RDC via rail. Rail transport is significantly more fuel efficient than road transport and integrating rail into the design of the modified RDC will mitigate new upstream emissions as construction materials for the Sydney market will increasingly need to be sourced outside the Sydney region due to development patterns. **Table 1.1** demonstrates how rail will mitigate upstream transport emissions.

Table 1.1 – Fuel savings using rail

Transport mode	Materials (T)	Payload (T)	Route (Km)	Vehicle Kilometres Travelled (Million Km)	Fuel consumption (L/Km)	Fuel use (kL)
Road	4,000,000	40	380	38.0	0.521	19,798
Rail	4,000,000	2,790	380	0.54	12.0	6,538
Annual Savings						13,260

Table 1.1 demonstrates that the switch from road to rail has the potential to save 13,260 kL or 38,444 TCO_2-e p.a.

2.0 Assessment Framework

2.1 Objectives

The objective of this assessment is to evaluate the environmental impacts of the modified RDC's greenhouse gas emissions and energy use and compare these to the approved RDC.

2.2 Scope

The scope of the GHGEIA includes:

- estimating greenhouse gas emissions and energy use associated with constructing the modified RDC;
- estimating greenhouse gas emissions and energy use associated with operating the modified RDC;
- estimating the impact of the modified RDC's emissions on atmospheric concentrations of carbon dioxide;
- estimating the impact of the modified RDC's emissions on achievement of local, state, national and international greenhouse gas emission targets;
- evaluating whether the modified RDC aligns with the principles of Ecologically Sustainable Development (ESD);
- identifying management and mitigation options to reduce greenhouse gas emissions from the modified RDC; and
- comparing the approved RDC greenhouse gas emissions and energy usage as outlined in the 2005 EA with those calculated for the modified RDC.

2.3 Definitions and Sources

The GHGEIA assessment framework is based on the *National Greenhouse Accounts (NGA) Factors (2009)* and also incorporates the principles of *The Greenhouse Gas Protocol*. The GHGEIA has not used the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (the Determination) as a framework as the scope of the GHGEIA includes emission sources and data constraints that are outside the reporting requirements specified in the Determination. The NGA Factors draw on the Determination, however, the NGA Factors have a general application to the estimation of a broader range of greenhouse gas inventories (DCC, 2009) that are more suited to environmental impact assessment.

The Greenhouse Gas Protocol (World Resources Institute/World Business Council Sustainable Development, 2004) (The Protocol) provides an internationally accepted approach to greenhouse gas accounting. The Protocol provides guidance on setting reporting boundaries, defining emission sources and dealing with issues such as data quality and materiality. **Table 2.1** contains concepts and definitions relevant to the GHGEIA.

Table 2.1 - Glossary of Terms (The Protocol, 2004)

Concept	Definition
Greenhouse gases	The greenhouse gases covered by the Kyoto Protocol include; • Carbon dioxide • Methane • Nitrous oxide • Hydrofluorcarbons • Perfluorcarbons • Sulphur dioxide
Scope 1 emissions	Direct emissions occur from sources that are owned or controlled by the reporting entity (e.g. fuel use, fugitive emissions). Scope 1 emissions are emissions over which entities have a high level of control.
Scope 2 emissions	Emissions from the generation of purchased electricity consumed by the reporting entity. Scope 2 emissions can be measured easily and can be significantly influenced through energy efficiency measures.
Scope 3 emissions	Indirect emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another reporting entity (e.g. outsourced services). Scope 3 emissions are only estimates and may have a relatively high level of uncertainty, unreliability and variability.

2.4 Assumptions and Exclusions

The calculations in this report rely directly on data provided by Holcim. The report has been written with the assumption that the energy consumption and operational data is complete and accurate. Umwelt has not undertaken physical testing and/or auditing to verify the accuracy of the data provided by Holcim.

All methodologies and calculations have been made assuming that construction and operations will continue as described by the modified RDC EA.

The activities and emission sources listed in **Table 2.2** have been excluded from the GHGEIA as they were considered variable, immaterial and incidental for the purposes of this report.

Table 2.2 – Data Exclusions

Emissions source	Scope	Description
Combustion of fuel for energy	Scope 1	• Small qualities of fuels such as petrol and LPG
Industrial processes	Scope 1	• Sulphur hexafluoride (high voltage switch gear) • Hydrofluorcarbon (commercial and industrial refrigeration)
Consumption of electricity	Scope 3	• Electricity use by contractors in the construction phase of the modified RDC
Combustion of fuel for energy	Scope 3	• Employee business travel • Employees commuting to and from work
Waste water handling (industrial)	Scope 3	• Waste water management

3.0 Impact Assessment Methodology

Scope 1, 2 and 3 emissions were calculated based on the methodologies and emission factors contained in the National Greenhouse Accounts (NGA) Factors (DCC, 2009).

Activity data was either provided by Holcim, or estimated based on data derived from industry. **Table 3.1** contains the source of activity data.

Table 3.1 - Source of activity data used for the assessment

Activity data	Source
On-site fuel consumption	Holcim
Electricity consumption	Holcim
Construction materials	Holcim
Waste landfill	Industry
Product transport	Holcim

Energy consumption was included in the GHGEIA as it is strongly associated with greenhouse gas emissions and is an important component of the NGER Act 2007.

A detailed description of the calculations used for the GHGEIA are provided in **Appendix A** and **Appendix B**.

4.0 Impact Assessment Results

Greenhouse gas mitigation and management options can be developed and implemented during the design, construction, operational and closure stages of the modified RDC. The GHGEIA results have been separated into construction and operation stages to help identify mitigation options for the modified RDC.

4.1 Construction Phase

The construction calculations made the following assumptions:

- construction materials would be delivered to the RDC by contractors, travelling an average round trip of 50 kilometres using trucks with a 33T payload;
- construction would take 2 years; and
- all construction activities would be outsourced.

The construction calculations do not include electricity use or some minor construction materials. It is unrealistic to estimate the quantity of some construction materials at a pre-detailed design phase of the project. Emissions associated with the major construction materials (steel and concrete) were included in the calculations, as these are expected to be the major contributors to overall greenhouse gas emissions.

4.1.1 Greenhouse Gas Emissions

The modified RDC's construction emissions are summarised in **Table 4.1**.

The modified RDC's construction will only generate Scope 3 emissions as all construction related activity will be under the operational control of a construction company.

The potential of the modified RDC to generate Scope 3 emissions during construction is highly uncertain, as activity data is difficult to estimate and some emission factors have not been verified in the circumstances they are being applied. This circumstance is not limited to the RDC and applies to all construction projects. Approximately 14,770 TCO_2-e Scope 3 emissions can be attributed to the construction phase of the project. Scope 3 emissions are predominately generated upstream via purchasing steel and concrete.

4.2 Operation Phase

The following results assume that the modified RDC is operating at full capacity i.e. 4Mtpa. The operational calculations also made the following assumptions:

- 75% of all products would be delivered to customers by company owned/leased trucks, travelling an average round trip of 66 kilometres with a 32T payload;
- 25% of all products would be delivered to customers by contractors, travelling an average round trip of 66 kilometres using trucks with a 32T payload;
- quarry products would be delivered to the RDC by contractors, travelling an average round trip of 380 kilometres using trains with a 2,790 T payload; and

- cement would be delivered to the RDC by contractors, travelling an average round trip of 40 kilometres using trucks with a 33T payload.

The operational calculations do not include minor fuel sources (petrol and LPG) and inconsequential Scope 3 sources such as business travel and employee commuting. These are not expected to be major contributors to emissions.

4.2.1 Greenhouse Gas Emissions

The modified RDC's annual operating emissions are summarised in **Table 4.1**.

The modified RDC will produce approximately 6,978 TCO_2-e Scope 1 emissions per annum from burning diesel. The majority of Scope 1 emissions will be generated by fleet trucks delivering products to customers.

The modified RDC is forecast to consume 7,576 MWh p.a. of electricity, which will generate approximately 6,742 TCO_2-e Scope 2 emissions per annum.

The modified RDC's operational Scope 3 emissions are highly uncertain, as activity data is difficult to estimate and some emission factors have not been verified in the circumstances they are being applied. This situation is not limited to the RDC with uncertainties regarding Scope 3 emissions applying to all products. Based on the assessment outcomes, approximately 155,218 TCO_2-e Scope 3 emissions per annum can be attributed to the project. Scope 3 emissions are predominately generated upstream via transporting quarry products to the RDC and purchasing cement (cement contributes 86% of Scope 3 emissions).

4.2.2 Energy Consumption

The modified RDC will consume approximately 127,246 GJ per annum at full capacity. The majority of energy will be sourced from diesel oil and offsite electricity.

Table 4.1 – Total GHG emission summary for the proposed modified RDC (See Appendix A and B for further detail)

Stage	Scope	Source	Source totals (TCO_2-e)	Scope totals (TCO_2-e)
Construction (Over 2 years)	Scope 1 (Direct)	Stationary fuel use	N/A	
		Transport fuel use	N/A	
		Fugitive emissions	N/A	
		Waste	N/A	0
	Scope 2 (Indirect)	Electricity	N/A	0
	Scope 3 (Indirect)	Steel and concrete	13,434	
		Associated energy use	1,288	
		Outsourced transport	38	
		Waste	10	14,770
			Total construction	14,770

Stage	Scope	Source	Source totals (TCO_2-e)	Scope totals (TCO_2-e)
Annual operation	Scope 1 (Direct)	Stationary fuel use	309	
		Transport fuel use	6,669	
		Fugitive emissions	0	
		Waste	0	6,978
	Scope 2 (Indirect)	Electricity	6,742	6,742
	Scope 3 (Indirect)	Cement	134,000	
		Associated energy use	1,893	
		Outsourced transport	19,318	
		Waste	6	155,218
			Total annual operation	168,938

4.3 Comparison between the Approved RDC and the Modified RDC

The proposed minor modifications to the RDC will not alter the operational demands for diesel and/or electricity use compared to the approved project. If the greenhouse gas assessment for the modified project uses the same assessment methodology as the approved project, then the overall greenhouse gas emissions associated with the approved and modified project should be identical. Given greenhouse gas assessment methodologies have changed since the approved project assessment there is a strong case to complete the modified project assessment using an up to date assessment methodology.

To allow a direct comparison of greenhouse gas emissions associated with the approved and modified RDC, the modified RDC's greenhouse gas assessment was completed using the same reporting boundary and emission factors as the assessment for the approved RDC (see **Table 4.2**). **Table 4.2** demonstrates that the modified RDC has the same total greenhouse gas emissions as the approved RDC, when the assessment is completed using a common assessment methodology.

To acknowledge the change in greenhouse gas emission factors, **Table 4.2** includes the results of a hybrid assessment that is based on the approved RDC reporting boundaries, but includes the latest emission factors. The hybrid assessment also assumes that contractors will deliver 25% of building products to customers (a change in operational assumption since the approved RDC assessment). The hybrid assessment estimates that the modified RDC will produce 1,244 T/CO_2-e per annum more than the approved RDC (refer **to Table 4.2**). The increase in emissions is due to small increases in the emission factors for diesel and electricity.

Table 4.2 – A comparison between the greenhouse gas impacts of operating the approved RDC and the modified RDC

Emission Source	Approved RDC Assessment[1]	Modified RDC using the approved project assessment methodology	Modified RDC using a hybrid methodology[2]
	T/CO_2-e per annum	T/CO_2-e per annum	T/CO_2-e per annum
Transport Fuel	23,942	23,942	24,413
Electricity	7,333	7,333	8,106
Total	**31,275**	**31,275**	**32,519**

Contemporary assessment methodology requires a comprehensive assessment of Scope 3 emissions. In developing a more comprehensive assessment, the GHGEIA identified a number of additional emission sources that should be included in the assessment. The additional emission sources included:

- On-site fuel use (i.e. non transport fuel) (Scope 1);
- Embedded emissions in purchasing cement (Scope 3);
- Waste management (Scope 3).

[1] Holmes Air Sciences, (2005) *Air Quality Impact Assessment: Readymix Regional Distribution Centre at Rooty Hill*
[2] Utilises revised emission factors but retains the approved project reporting boundaries

The three additional emission sources formed part of the approved RDC and are not proposed to be modified, however, these were not included in the original greenhouse gas assessment.

This assessment also reviewed the fuel use estimates for the approved RDC. Fuel use modelling found that both the approved and modified RDC would require approximately 9.64 million litres of diesel per annum to operate (an increase on the 8.86 million litres p.a. used for the approved RDC assessment).

The inclusion of the additional emission sources and the updated fuel use estimates increases the total emissions of the modified RDC to 138,978 T/CO_2-e per annum (see **Table** 4.3).

Table 4.3 – The comprehensive modified RDC assessment

Emission scope	**Comprehensive modified RDC Assessment**[3]
	T/CO_2-e per annum
Scope 1	6,978
Scope 2	6,742
Scope 3	155,218
Total	**168,938**

The total emissions calculated by the comprehensive assessment are significantly higher than the approved RDC assessment. The majority of emissions captured by the comprehensive assessment are attributable to Scope 3 emissions, primarily purchasing of cement (134,000 TCO_2-e). As the volume of cement used is consistent with the approved RDC, the greenhouse gas emissions from the modified RDC are expected to be comparable if the emissions associated with the use of cement were included in the initial assessment.

Scope 1 emissions for the modified RDC assessment have declined due to assumptions made about the use of contract transport services. The approved RDC assessment assumed that all road transport would utilise company vehicles and generate Scope 1 emissions. The modified RDC assessment assumes (based on discussions with Holcim) that 25% of transport services will be outsourced and therefore generate Scope 3 emissions. Scope 2 emissions have increased due to a change in emission factors.

Scope 3 emissions for the modified RDC have increased due to the inclusion of a number of upstream and downstream emission sources. Approximately 96% of the increase is due to the inclusion of cement usage in the CBP which contributes an extra 134,000 TCO_2-e. The remaining 4% is due to the use of revised emission factors and the inclusion of emissions associated with waste management.

[3] Utilises a contemporary GHGEIA methodology

5.0 Impact Assessment Summary

The greenhouse gas emissions generated by the modified RDC have the potential to impact the physical environment and the greenhouse gas reduction objectives of local, state, national and international governing bodies. The following section makes the distinction between environment impacts and policy impacts.

5.1 Environmental Impact

The modified RDC's greenhouse gas emissions will have a disperse impact as they are highly mobile and are generated up and down the supply chain (i.e. a nonpoint source of pollution). Greenhouse gas emissions primarily alter the atmospheric concentration of carbon dioxide and methane. The secondary impacts of greenhouse gas emissions include; global warming, ocean acidification and carbon fertilisation of flora. The secondary impacts of greenhouse gas emissions may have many ramifications for the natural and built environment.

The modified RDC's direct emissions are forecast to be approximately 13,720 TCO_2 –e per annum.

Approximately 40-50% of the modified RDC's CO_2 emissions will impact the atmosphere and become a 'greenhouse gas' (i.e. causing radiative forcing). The remaining 50-60% of the modified RDC's CO_2 emissions will be absorbed by the ocean and cycled through land biota (Knorr, 2009, Raupach *et al*, 2008). The airborne fraction (i.e. the proportion of CO_2 that remains in the atmosphere) of the CO_2 emitted from the modified RDC is likely to remain in the atmosphere for a long period. The 2007 IPCC policy makers' summary report states that 'about half of a CO_2 pulse to the atmosphere is removed over a timescale of 30 years; a further 30% is removed within a few centuries; and the remaining 20% will stay in the atmosphere for many thousands of years' (Archer *et al*, 2009).

To put the modified RDC's emissions into perspective, it needs to be noted that global Scope 1 emissions are forecast to be 46,000,000,000 TCO_2-e by 2020 (Sheehan *et al,* 2008). During operation the modified RDC will contribute approximately 0.00002 per cent to the global emissions per annum (approximately 0.00037 per cent when Scope 2 and 3 emissions are included).

5.2 Impact on Local Objectives

To identify whether the modified RDC will impact the policies of local government agencies, the GHDEIA reviewed relevant greenhouse gas policies of the Blacktown City Council and the Sydney Metropolitan Catchment Management Authority (CMA).

Blacktown City Council is currently developing greenhouse gas reduction targets for its Local Government Area. Blacktown City Council was not able to provide specific targets for this report.

A review of the Sydney Metropolitan CMA Catchment Action Plan found that the CMA does not have specific greenhouse gas emission objectives.

5.3 Impact on State Policy Objectives

The modified RDC is located within the jurisdiction of the NSW State Government and therefore the modified RDC should consider the State's greenhouse gas emission objectives contained in the NSW State Plan. The State Plan states:

> Achieve a 60% cut in greenhouse gas emissions by 2050 in line with the Federal Government targets.

Assuming the State adopts the federal Government's short term targets (to meet the shared 2050 target), the State will be seeking to cap Scope 1 greenhouse gas emissions at approximately 145,000,000 TCO_2-e of per annum by 2020 (National Greenhouse Gas Inventory, 2010). The modified RDC is forecast to generate approximately 0.005% of the State's annual greenhouse gas production, and it is unlikely to limit the State Government achieving its objectives.

The NSW State government plans to achieve its greenhouse gas emissions target via a number of initiatives that include:

- expanding sustainable transport options; and
- reducing the demand for electricity via energy efficiency programs.

The modified RDC aligns with State based objectives as the modified RDC proposes to utilise more sustainable transport options and improve the energy efficiency associated with the distribution of bulk construction materials (sand/aggregate) throughout the Sydney region.

5.4 Impact on National Policy Objectives

The Federal Government has committed to reduce Australia's greenhouse gas emissions to 25 per cent below 2000 levels by 2020 if the world agrees to an ambitious global deal to stabilise levels of greenhouse gases in the atmosphere at 450 parts per million CO_2 -e or lower (DCCEE, 2010).

If the world is unable to reach agreement on a 450 parts per million target, Australia will still reduce its emissions by between 5 and 15 per cent below 2000 levels by 2020 (DCCEE, 2010).

If Australia is able to meet the 5% reduction target by 2020, the nation will be generating approximately 525 $MTCO_2$-e of Scope 1 greenhouse gas emissions per annum (National Greenhouse Gas Inventory, 2010). The modified RDC is forecast to generate approximately 0.0013% of the nation's annual greenhouse gas production per annum, and it is unlikely to limit the Federal Government achieving its objectives.

5.5 Impact on International Objectives

An international agreement on greenhouse gas reduction targets is yet to be developed. The Kyoto Protocol, however, provides a proxy for international greenhouse gas objectives. International signatories to the Kyoto Protocol have agreed to reduce 2012 greenhouse gas emissions to 95% of 1990 emissions. Under the Kyoto Protocol, Australia has committed to achieving 108% of its 1990 emissions, or 490 MT CO_2-e per annum, by 2012 (DCC 2007).

The majority of the modified RDC's emissions will occur beyond 2012 and are unlikely to impact Australia's ability to meet its commitments under the Kyoto Protocol.

5.6 Alignment with ESD Principals

The EP&A Act aims to encourage ESD within NSW. To justify the modified RDC with regard to the ESD principles, the benefits of the project in an environmental and socio-economic context should outweigh any negative impacts. The ESD principles encompass the following:

- the precautionary principle;
- inter-generational equity;
- conservation of biological diversity; and
- valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

The key ESD principles that apply to the GHGEIA are intergenerational equity and the precautionary principle

5.6.1 Intergenerational Equity

The EP&A Regulation defines intergenerational equity as:

> Intergenerational equity namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, bio-diversity and productivity.

Generating Carbon Dioxide has intergenerational issues. As discussed in **Section 5.1**, CO_2 can remain in the atmosphere for thousands of years. The Carbon Dioxide emissions attributable to the modified RDC have the potential to impact a number of future generations. Given the relatively small contribution the modified RDC will make to atmospheric levels of CO_2, it is unlikely that the modified RDC will compromise the needs and requirements of future generations in terms of health, bio-diversity and productivity.

5.6.2 The Precautionary Principle

Forecasting the modified RDC's future greenhouse gas emissions and associated impacts involves significant scientific uncertainty. The EP&A Regulation defines the precautionary principle as:

> Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

> In the application of the precautionary principle, public and private decisions should be guided by:
>
> (i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
> (ii) an assessment of the risk-weighted consequences of various options.

In the case of this GHGEIA to cater for scientific uncertainty regarding emissions estimation, a conservative approach has been taken so that the potential impact is not underestimated. In particular, the inclusion of Scope 3 emissions is likely to result in significant double counting of impacts as these emissions will also be assessed and reported by other organisations. The GHGEIA has also been prepared in accordance with current assessment methodologies, quantifying the impact as much as possible. This approach is considered to be consistent with the precautionary principle.

Holcim's Safety, Health and Environment (SHE) management system and the commitments they have made in their Corporate Sustainable Development Report (2009) (refer to **Section 6.0**) indicate that Holcim is taking steps to avoid and mitigate environmental degradation caused by greenhouse gas emissions.

6.0 Management and Mitigation

Holcim has a direct influence over Scope 1 emissions and the modified RDC's Scope 1 emissions will be subject to management and mitigation plans. Holcim can reduce Scope 2 emissions by driving electricity reduction and efficiency initiatives, however, Holcim has no direct influence over the greenhouse gas efficiency of electricity utilities.

The Scope 3 calculations in this report have assumed that purchased cement will have a GHG intensity of 0.67 TCO2-e/T. Sourcing a cement product with a lower emissions intensity will significantly reduce the modified RDC's Scope 3 emissions. Holcim has committed to reducing its net emissions from cementitious products by 25% by 2015 (from 1990 levels). Holcim aims to achieve its greenhouse gas target by reducing the clinker (unrefined materials from the kilning process) content in cement production, improving energy efficiency and increasing the use of alternative fuels.

6.1 Environmental Policy

Holcim's environmental performance is driven by its Environmental Policy which states that protecting the environment is integral to sustainable development. The Environmental Policy includes specific commitments which address greenhouse gas emissions. The commitments are:

- Ensure energy efficiency, optimum use of raw materials and the reduction of waste in all operations; and
- Respond to the challenges presented by climate change by identifying opportunities to reduce its carbon footprint.

Holcim designs and manages its operations to achieve these commitments.

6.2 Management Options

6.2.1 Cement Production

Holcim can potentially significantly reduce its Scope 3 greenhouse gas emissions by purchasing cement with a lower greenhouse gas intensity. Holcim will investigate opportunities to achieve this outcome as part of the project.

Substituting clinker in cement with slag, fly ash or pozzolans could also significantly reduce greenhouse gas emissions from cement production. Reducing the clinker content in the cement production process will reduce the modified RDC's Scope 3 emissions associated with purchasing cement.

6.2.2 Energy Efficiency

Holcim's SHE management System requires business units to identify and evaluate opportunities to conserve energy and resources. Initiatives that increase electricity and diesel use efficiency will reduce the modified RDC's Scope 1 emissions.

Holcim will continue to assess and implement energy and greenhouse management initiatives during the design and operation of the Project.

To identify energy efficiency opportunities and assess the effectiveness, Holcim will implement an energy saving management plan, as part of the operational environmental management plan which reviews energy usage, identifies energy savings opportunities, and based on this will implement viable energy saving measures. Diesel usage is the dominant source of Scope 1 emissions and therefore investigations will initially focus on this aspect.

6.2.3 Alternative Fuels

Holcim has identified that it can substitute fossil fuels with biomass residues and waste derived fuels. Holcim have demonstrated that it can utilise the following fuel sources in its cement production process (Holcim, 2010):

- Waste oil
- Tyres
- Plastics
- Solvents
- Impregnated sawdust
- Industrial waste
- Tallow
- Agricultural waste
- Wood

It is unlikely that Holcim could use waste products as an alternative fuel at the modified RDC. Using alternative fuels in the cement production process, however, may reduce the modified RDC's Scope 3 emissions associated with purchasing cement.

Scope 1 emissions could also be reduced by substituting diesel for biodiesel in fleet vehicles and plant.

7.0 Conclusion

To determine whether the proposed modifications to the RDC change the greenhouse gas emissions profile of approved project, the GHGEIA compared the emissions profile of the approved RDC with the modified RDC (using the same methodology). The GHGEIA found that the proposed modification does not change the projected greenhouse gas emissions for the RDC.

The GHGEIA found that the modified RDC has the potential to generate moderate levels of direct greenhouse gas emissions. The GHGEIA also found that the modified RDC inherently avoids significant indirect emissions by transporting the bulk of its quarry products via rail. The modified project can manage its direct emissions by utilising alternative energy sources (e.g. biodiesel) and promoting initiatives that improve energy use efficiency (fuel and electricity).

Given the greenhouse gas assessment process has evolved since the assessment of the approved project, the GHGEIA also completed a greenhouse gas assessment of the modified project using contemporary greenhouse gas assessment methodologies. The contemporary assessment included a broader scope of greenhouse gas emission sources and found that the majority of the modified project's greenhouse gas emissions are generated indirectly through outsourcing transport services and purchasing cement. The ongoing development of cementitious products will continue to reduce the modified RDC's indirect greenhouse gas emissions over time. Holcim will investigate opportunities to reduce Scope 3 emissions by seeking to use sources of cement or alternatives with lower greenhouse gas emissions intensities.

The GHGEIA found that the modified RDC is unlikely to impact on state and national greenhouse gas policy objectives due to the relatively small contribution the modified RDC will make to state and national emissions.

8.0 References

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APPENDIX A

Modified RDC Construction Emission Calculations

Appendix A - Modified RDC Construction Emission Calculations

Construction Transport

Construction	Truck transport of construction materials by external contractors							
	Materials	Av Fuel consumption	Fuel use	Fuel use	Scope 1 EF	Scope 1 GHG Emissions	Scope 3 EF	Scope 3 GHG Emissions
	T	l/Km	kL	GJ	Kg CO2-e / GJ	T CO2-e	Kg CO2-e / GJ	T CO2-e
Steel	1,807	0.55	1.20	46.50	N/A	N/A	69.81	3.25
Concrete	19,420	0.55	12.95	499.74	N/A	N/A	69.81	34.89
Belting	95	0.55	0.06	2.44	N/A	N/A	69.81	0.17
					Total	N/A	**Total**	38.30

Construction Materials

Materials	Quantity	EF	Scope 3 GHG emissions
	T	**T CO2-e / T**	T CO2-e
Steel	2,206	**2.65**	5,845.90
Concrete	28,516	**0.258**	7,357.13
Cladding	82	**2.82**	231.24
		Total	13,434.27

Construction Fuel Use by Contractors

Construction	External contractors					
Stationary equipment	**Diesel use**	**Diesel use**	**Scope 1 EF**	**Scope 1 GHG Emissions**	**Scope 3 EF**	**Scope 3 GHG Emissions**
	kL	**GJ**	**Kg CO2-e / GJ**	**T CO2-e**	**Kg CO2-e / GJ**	**T CO2-e**
20 Machines	480.00	18,528.00	N/A	N/A	69.50	1,287.70
	480.00		**Total**	N/A	**Total**	1,287.70

Construction Waste

Waste stream	Waste recycled	Waste to landfill	Scope 3 EF	Scope 3 GHG Emissions
	T	**T**	**T CO2-e / T**	**T CO2-e**
Paper	1.55	1.03	2.50	2.58
Food	0.00	2.14	0.90	1.92
Glass	0.00	0.32	0.00	0.00
Recyclable plastic	1.27	2.96	0.00	0.00
Other plastic	0.00	1.76	0.00	0.00
Wood	2.12	2.12	2.70	5.71
Metal	0.00	0.38	0.00	0.00
Other	0.00	5.52	0.00	0.00
			Total	10.21

APPENDIX B

Modified RDC Operating Emission Calculations

Appendix B - Modified RDC Operating Emission Calculations

Stationary Fuel Use

Operation	Company owned/leased fleet					
Stationary equipment	**Diesel use**	**Diesel use**	**Scope 1 EF**	**Scope 1 GHG Emissions**	**Scope 3 EF**	**Scope 3 GHG Emissions**
	kL	**GJ**	**Kg CO2-e / GJ**	**T CO2-e**	**Kg CO2-e / GJ**	**T CO2-e**
Loader	62.50	2,412.50	69.50	167.67	5.30	12.79
FEL	30.00	1,158.00	69.50	80.48	5.30	6.14
Street sweeper	17.00	656.20	69.50	45.61	5.30	3.48
Skid steer	5.50	212.30	69.50	14.75	5.30	1.13
			Total	308.51	**Total**	23.53

Transport Fuel Use to the RDC

Operational	Truck transport of input materials by external contractors							
	Materials	Av Fuel consumption	Fuel use	Fuel use	Scope 1 EF	Scope 1 GHG Emissions	Scope 3 EF	Scope 3 GHG Emissions
	T	l/Km	kL	GJ	Kg CO2-e / GJ	T CO2-e	Kg CO2-e / GJ	T CO2-e
Sand	0	0.55	0.00	0.00	N/A	N/A	69.81	0.00
Aggregate	0	0.55	0.00	0.00	N/A	N/A	69.81	0.00
Cement	200,000	0.55	133.33	5,146.67	N/A	N/A	69.81	359.29
					Total	N/A	**Total**	359.29

Operational	Rail transport of input materials by external contractors							
	Materials	Av Fuel consumption	Fuel use	Fuel use	Scope 1 EF	Scope 1 GHG Emissions	Scope 3 EF	Scope 3 GHG Emissions
	T	l/Km	kL	GJ	Kg CO2-e / GJ	T CO2-e	Kg CO2-e / GJ	T CO2-e
Sand	1,200,000	12.00	1,961.29	75,705.81	N/A	N/A	69.81	5,285.02
Aggregate	2,600,000	12.00	4,249.46	164,029.25	N/A	N/A	69.81	11,450.88
Cement	0	12.00	0.00	0.00	N/A	N/A	69.81	0.00
					Total	N/A	**Total**	16,735.90

Transport fuel use from the RDC

Operational	Truck transport of products by company owned / leased fleet							
	Materials	Av Fuel consumption	Fuel use	Fuel use	Scope 1 EF	Scope 1 GHG Emissions	Scope 3 EF	Scope 3 GHG Emissions
	T	l/100 Km	kL	GJ	Kg CO2-e / GJ	T CO2-e	Kg CO2-e / GJ	T CO2-e
Concrete	0	40.00	0.00	0.00	69.81	0.00	5.30	0.00
Sand	0	40.00	0.00	0.00	69.81	0.00	5.30	0.00
Aggregate	0	40.00	0.00	0.00	69.81	0.00	5.30	0.00
Generic product	3,000,000	40.00	2,475.00	95,535.00	69.81	6,669.30	5.30	506.34
					Total	6,669.30	**Total**	506.34

Operational	Truck transport of products by external contractors							
	Materials	Av Fuel consumption	Fuel use	Fuel use	Scope 1 EF	Scope 1 GHG Emissions	Scope 3 EF	Scope 3 GHG Emissions
	T	l/100 Km	kL	GJ	Kg CO2-e / GJ	T CO2-e	Kg CO2-e / GJ	T CO2-e
Concrete	0	40.00	0.00	0.00	N/A	N/A	69.81	0.00
Sand	0	40.00	0.00	0.00	N/A	N/A	69.81	0.00
Aggregate	0	40.00	0.00	0.00	N/A	N/A	69.81	0.00
Generic product	1,000,000	40.00	825.00	31,845.00	N/A	N/A	69.81	2,223.10
					Total	N/A	**Total**	2,223.10

Electricity

	Electricity consumption				
		Scope 2 EF	Scope 2 GHG Emissions	Scope 3 EF	Scope 3 GHG Emissions
	kWh	Kg CO2-e / kWh	T CO2-e	Kg CO2-e / kWh	T CO2-e
Construction	0.00	0.89	0.0	0.18	0.00
Operation	7,575,600.00	0.89	6742.3	0.18	1,363.61
		Total	6742.3	**Total**	1,363.61

Operating Products – Cement

Product	Quantity	Scope 3 EF	Scope 3 GHG emissions
	T	T CO2-e / T	T CO2-e
Cement	200,000	0.67	134,000.00
		Total	134,000.00

Operating Waste

Waste stream	Waste recycled	Waste to landfill	Scope 3 EF	Scope 3 GHG Emissions
	T	T	T CO2-e / T	T CO2-e
Paper	13.32	1.08	2.50	2.70
Food	0.00	3.62	0.90	3.25
Glass	0.13	0.06	0.00	0.00
Recyclable plastic	0.00	0.51	0.00	0.00
Other plastic	0.00	0.13	0.00	0.00
Wood	0.00	0.06	2.70	0.17
Metal	0.13	0.13	0.00	0.00
Other	0.19	0.82	0.00	0.00
			Total	6.12

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