Beneficial Use of Biosolids in Cement Production
ANZBP Hobart Roadshow - 4 March 2011

karen.campisano@melbournewater.com.au

BORAL

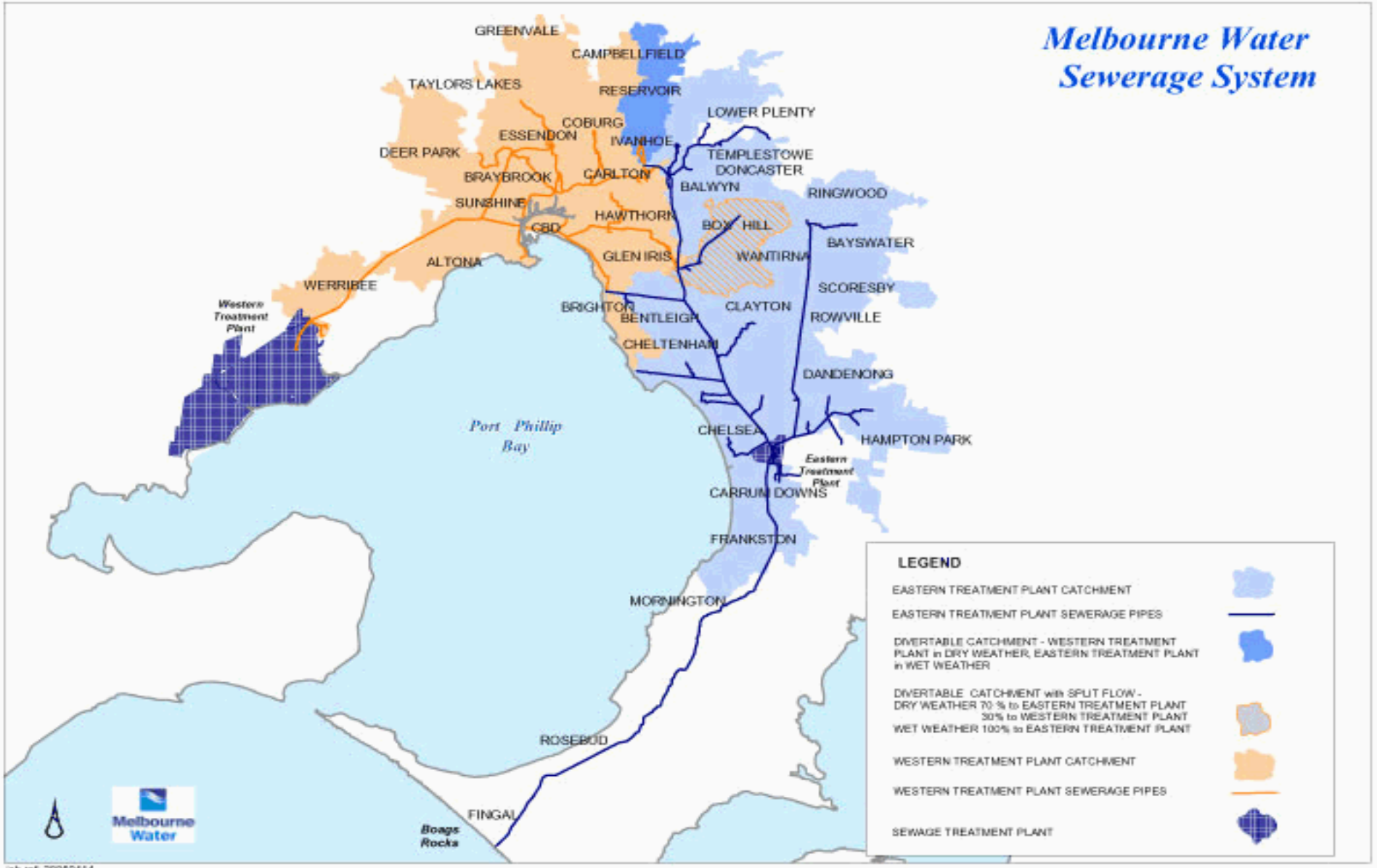
Melbourne Water

Presentation Overview

- Melbourne Water
- Boral Cement
- Feasibility Study
- Pilot Trial


Melbourne Water

Melbourne Water Sewerage System



job ref: 20050614

BORAL

Melbourne Water

The Western Treatment Plant

BORAL

Melbourne Water

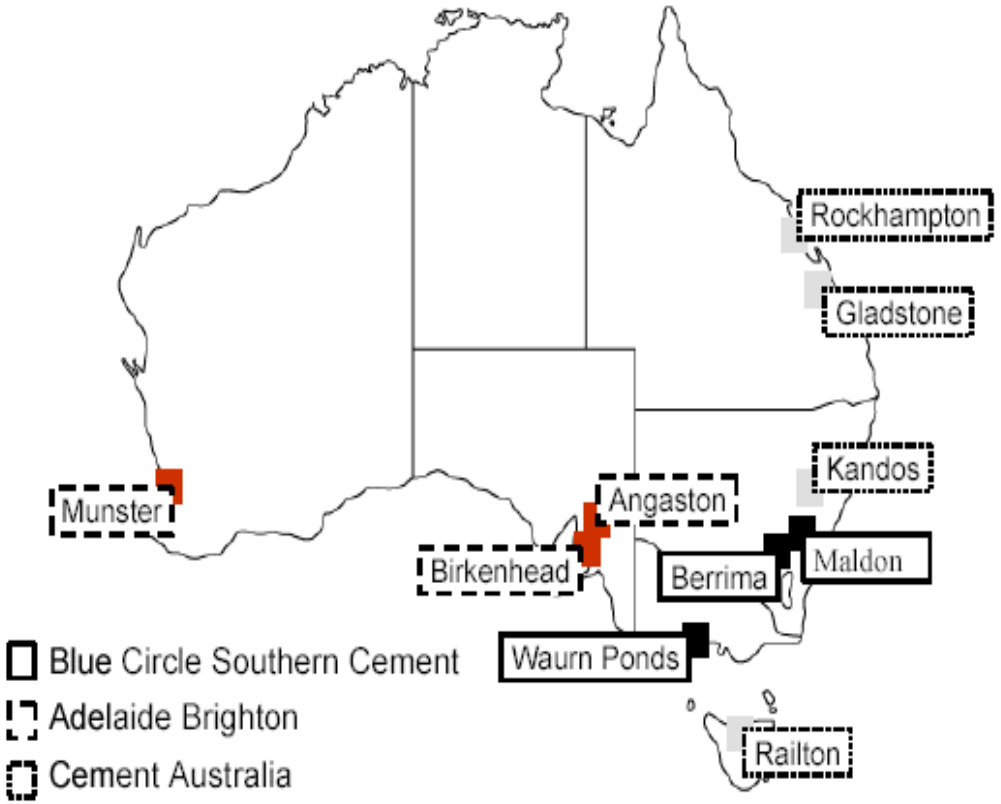
Biosolids

BORAL

Melbourne Water


Boral Cement

Overview of the Australian Cement Industry



BORAL

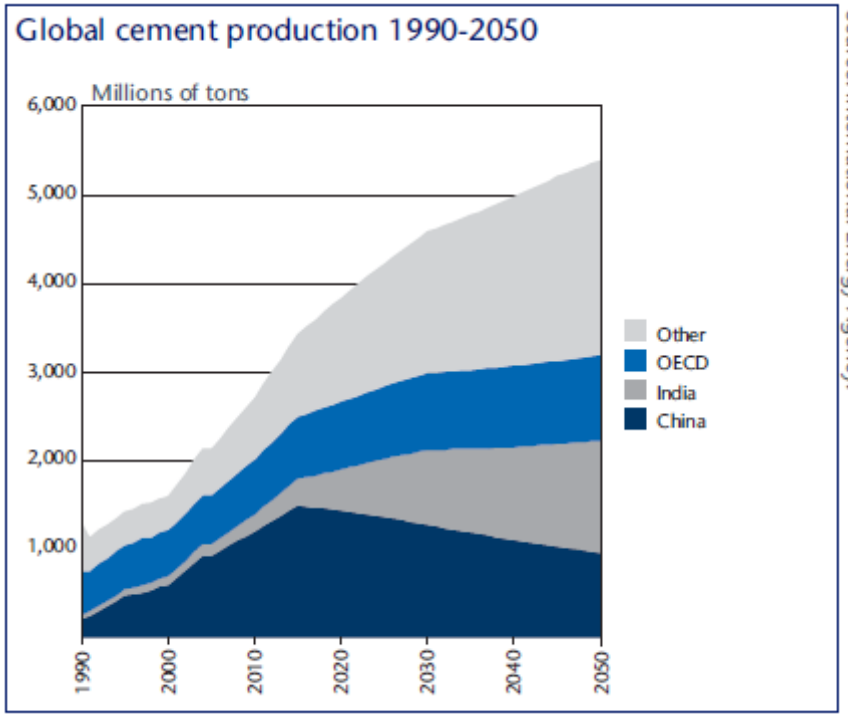
Melbourne Water

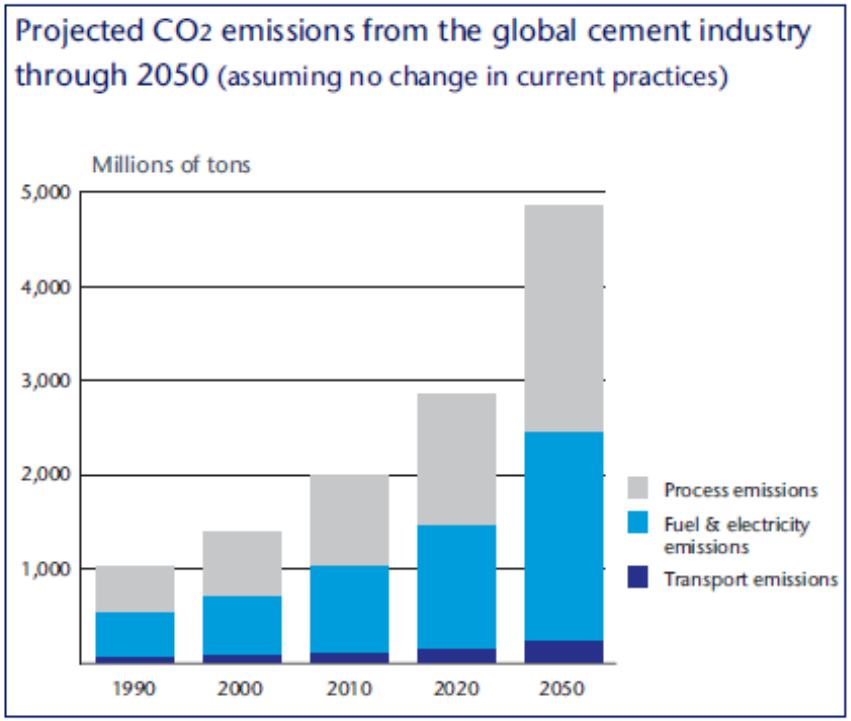
Boral Cement Site

BORAL

Melbourne Water

Global Cement Business

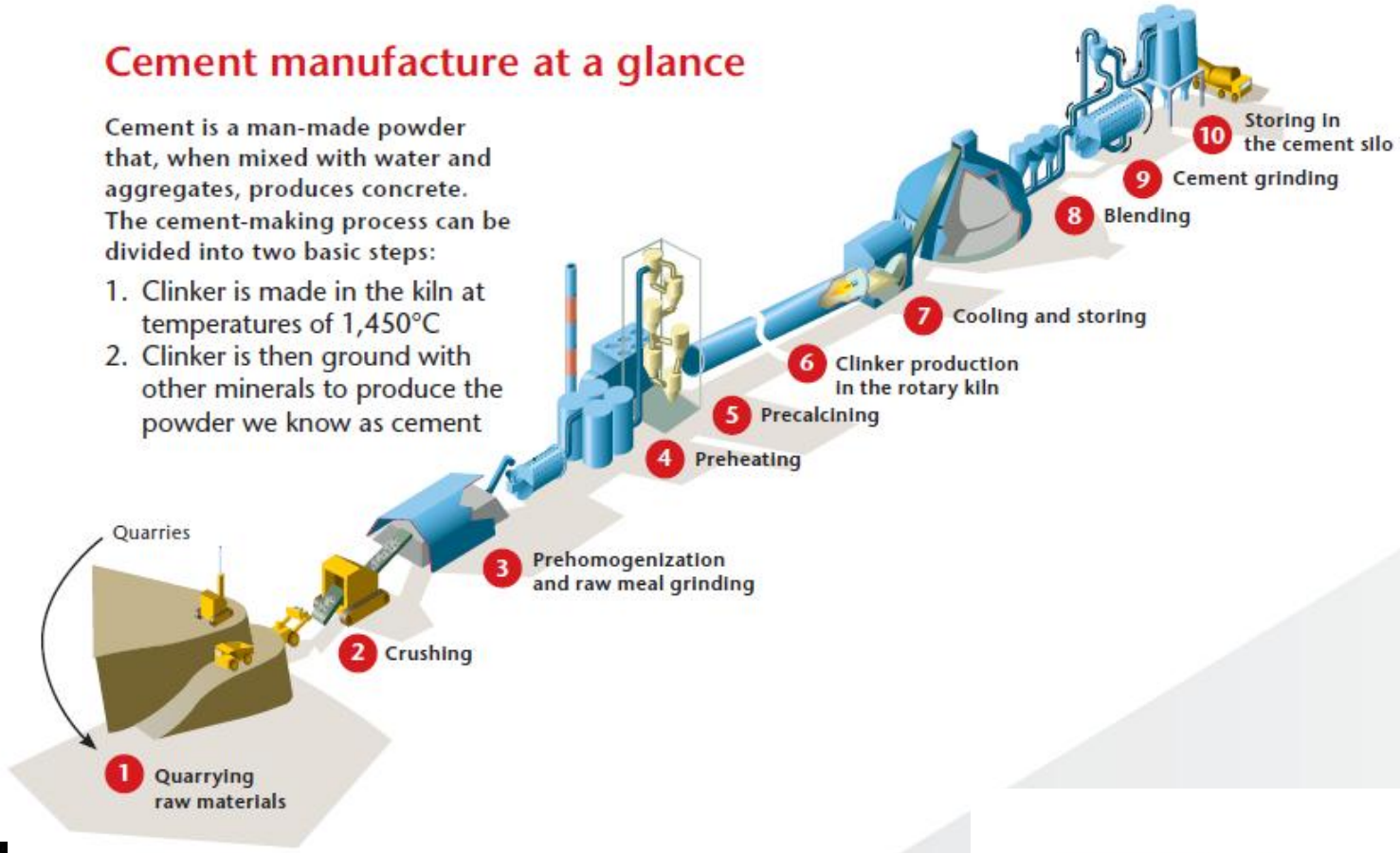




BORAL

Melbourne Water

Cement Manufacture



BORAL

Melbourne Water

Potential Future Alternative Fuels and Raw Materials

BORAL

Melbourne Water

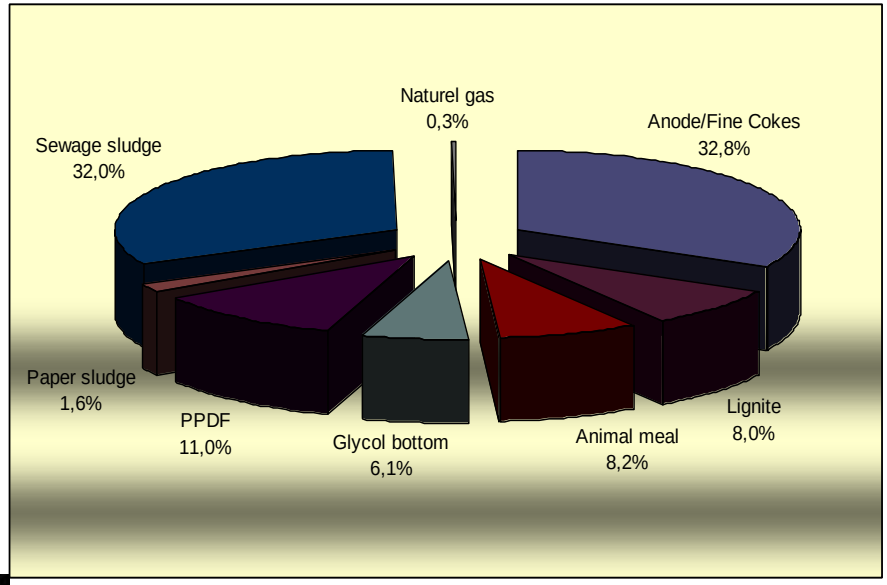
Where Boral are Coming From

BORAL

Melbourne Water

Biosolids Reuse as Cement Kiln Fuel is Established

Fuel mix at ENCI Mastricht Netherlands

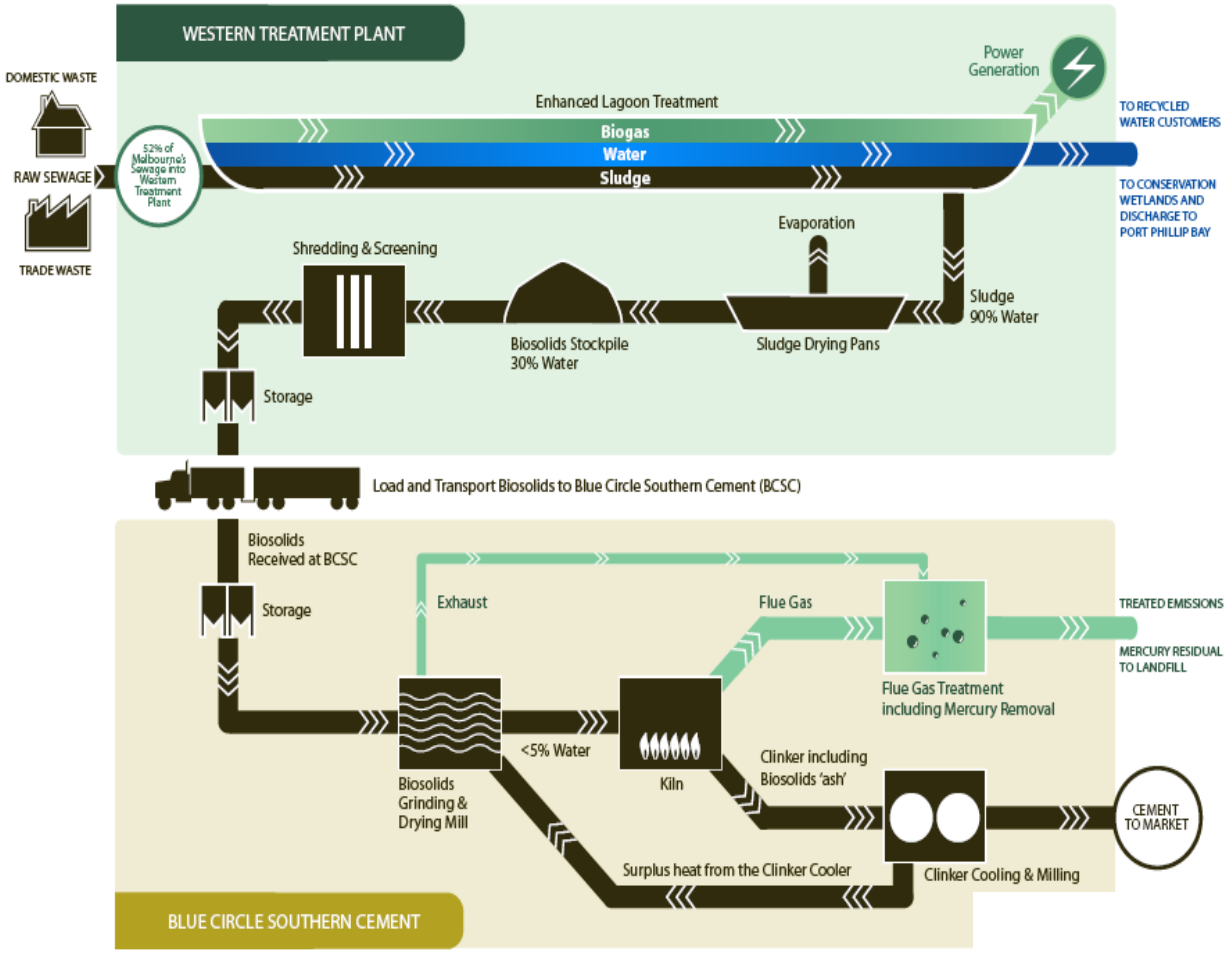


BORAL

Melbourne Water


Feasibility Study

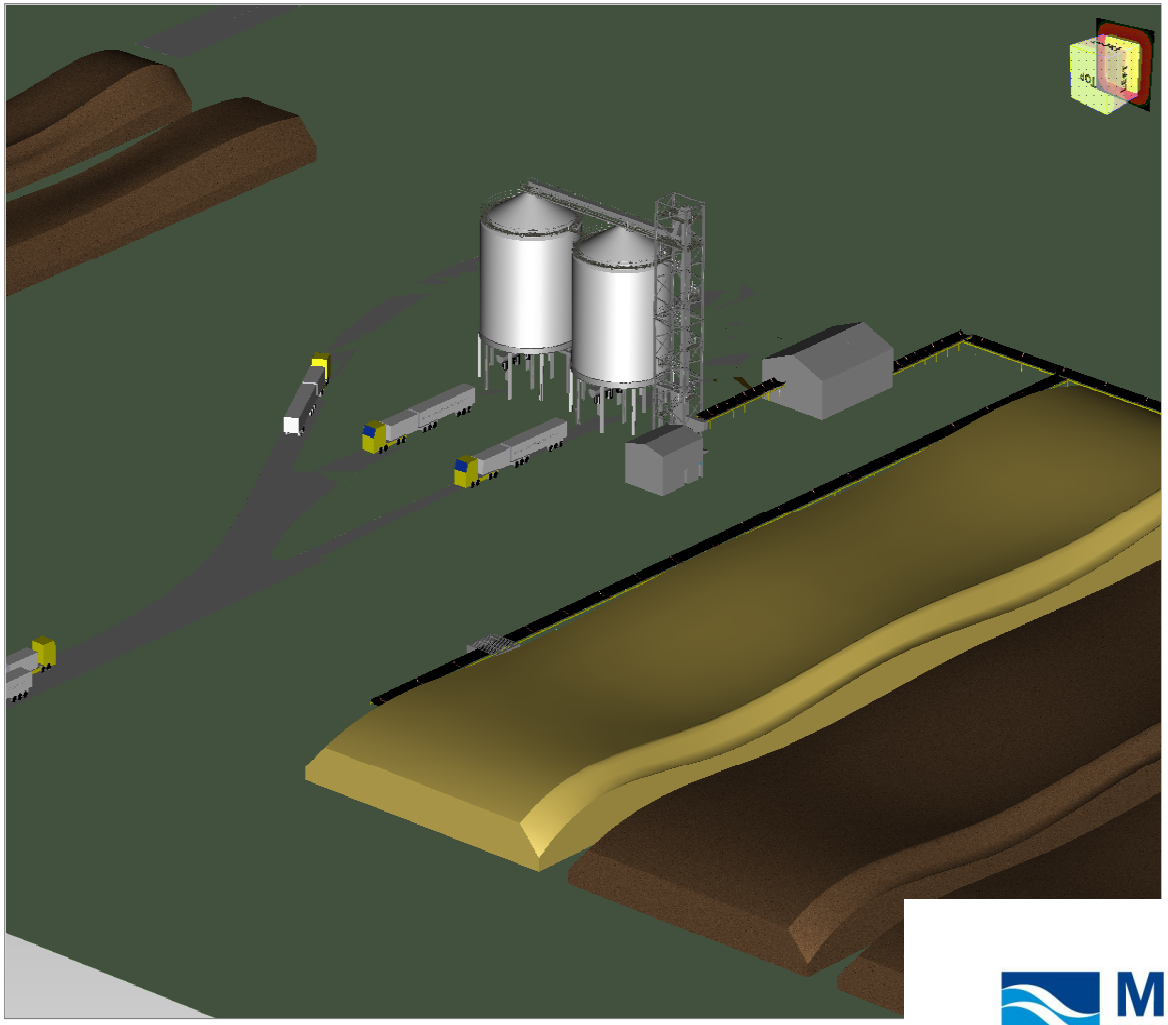
The Design Concept



BORAL

Melbourne Water

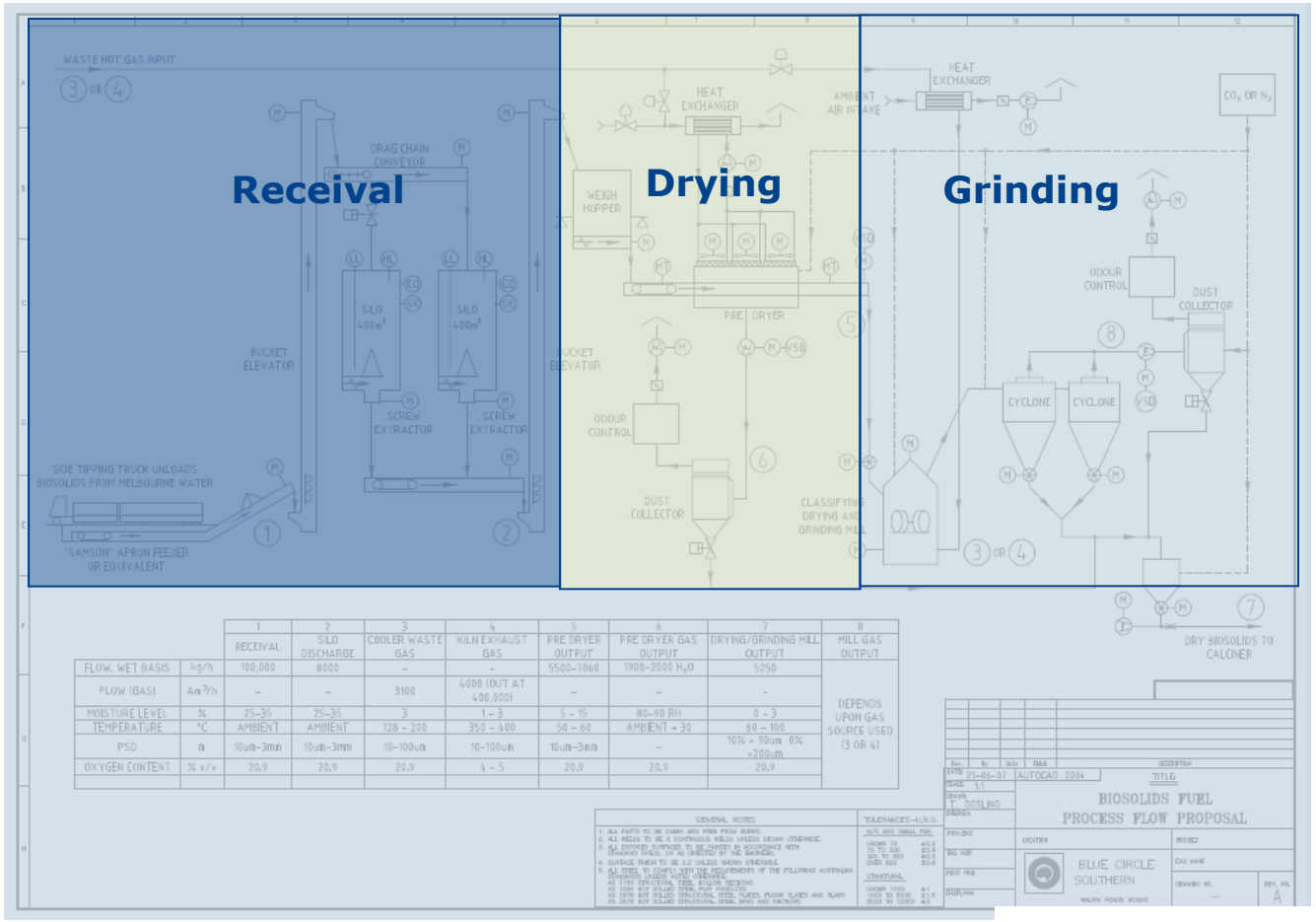
Preparing Biosolids at Western Treatment Plant



BORAL

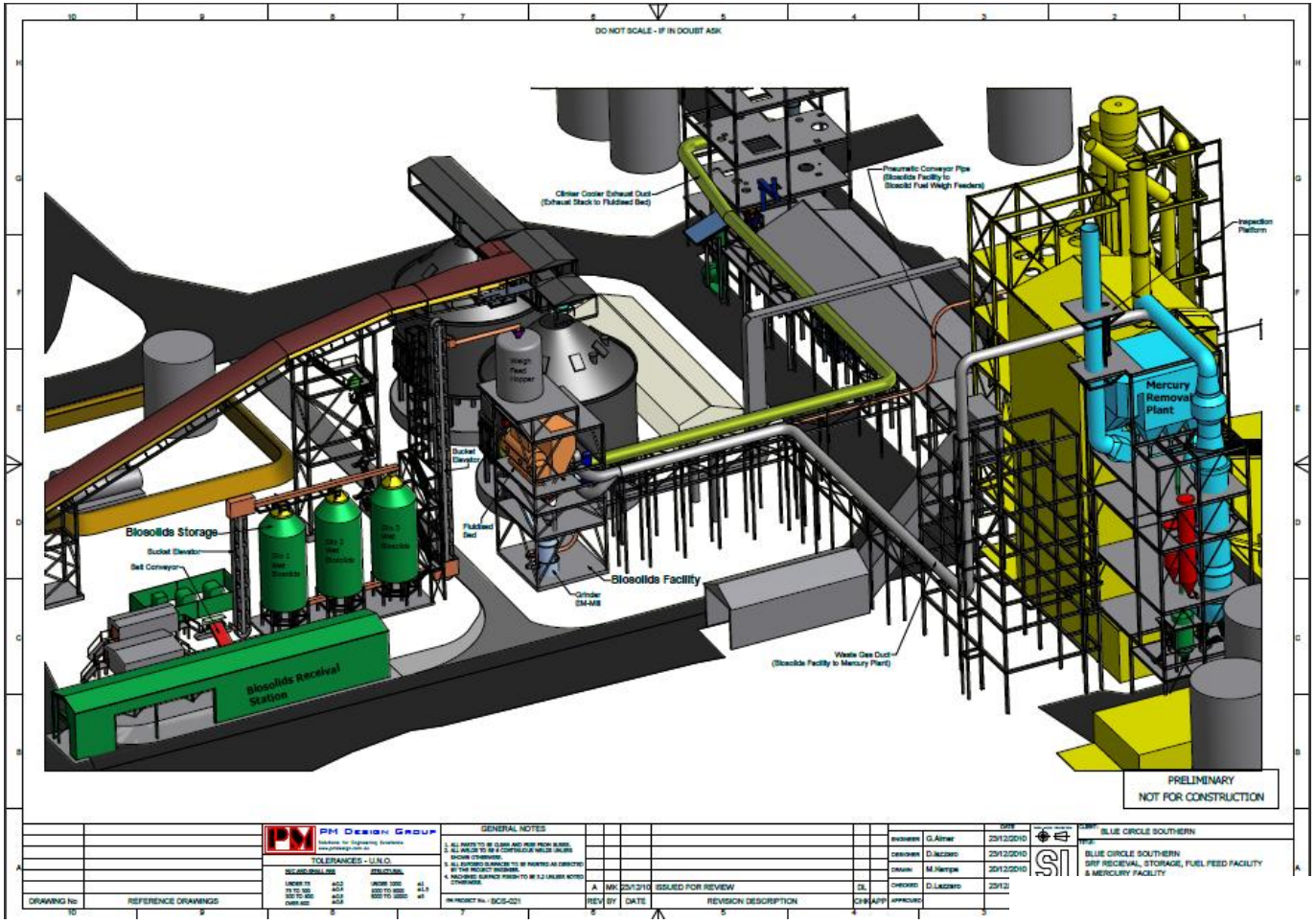
Melbourne Water

Preparing Biosolids at the Cement Plant



		1 RECEIVAL	2 SILO DISCHARGE	3 COOLER WASTE GAS	4 KILN EXHAUST GAS	5 PRE DRYER OUTPUT	6 PRE DRYER GAS OUTPUT	7 DRYING/GRINDING MILL OUTPUT	8 MILL GAS OUTPUT
FLOW, WET BASIS	kg/h	100,000	8000	–	–	5500–7060	1900–2000 H_2O	5250	DEPENDS UPON GAS SOURCE USED (3 OR 4)
FLOW (GAS)	Am^3/h	–	–	3100	4000 (OUT AT 400,000)	–	–	–	
MOISTURE LEVEL	%	25–35	25–35	3	1 – 3	5 – 15	80–90 RH	0 – 3	
TEMPERATURE	°C	AMBIENT	AMBIENT	128 – 200	350 – 400	50 – 60	AMBIENT → 30	60 – 100	
PSD	n	10um–3mm	10um–3mm	10–100um	10–100um	10um–3mm	–	10% × 90um 0% >200um	
OXYGEN CONTENT	% v/v	20.9	20.9	20.9	4 – 5	20.9	20.9	20.9	

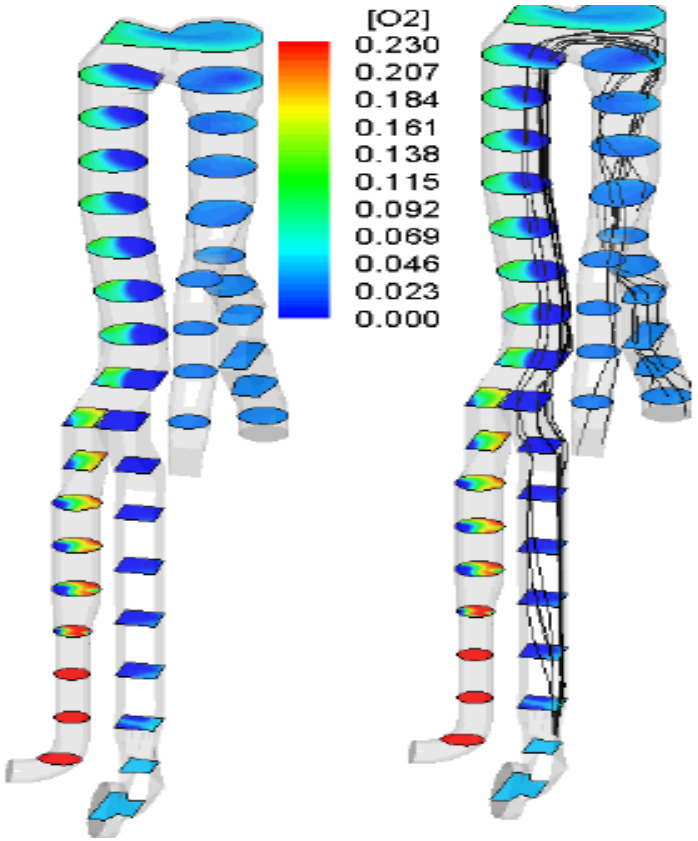
Preparing Biosolids at the Cement Plant

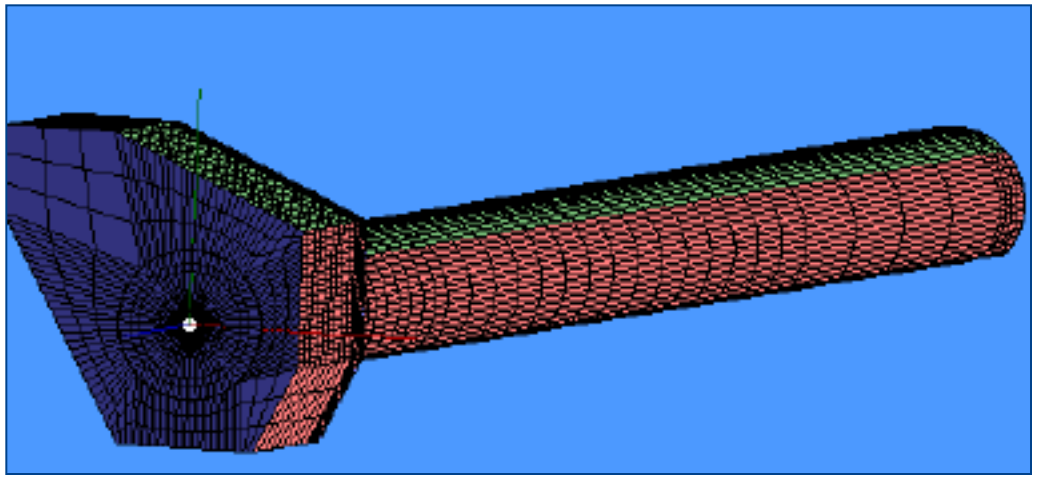


BORAL

Melbourne Water

Biosolids Combustion Modelling





BORAL

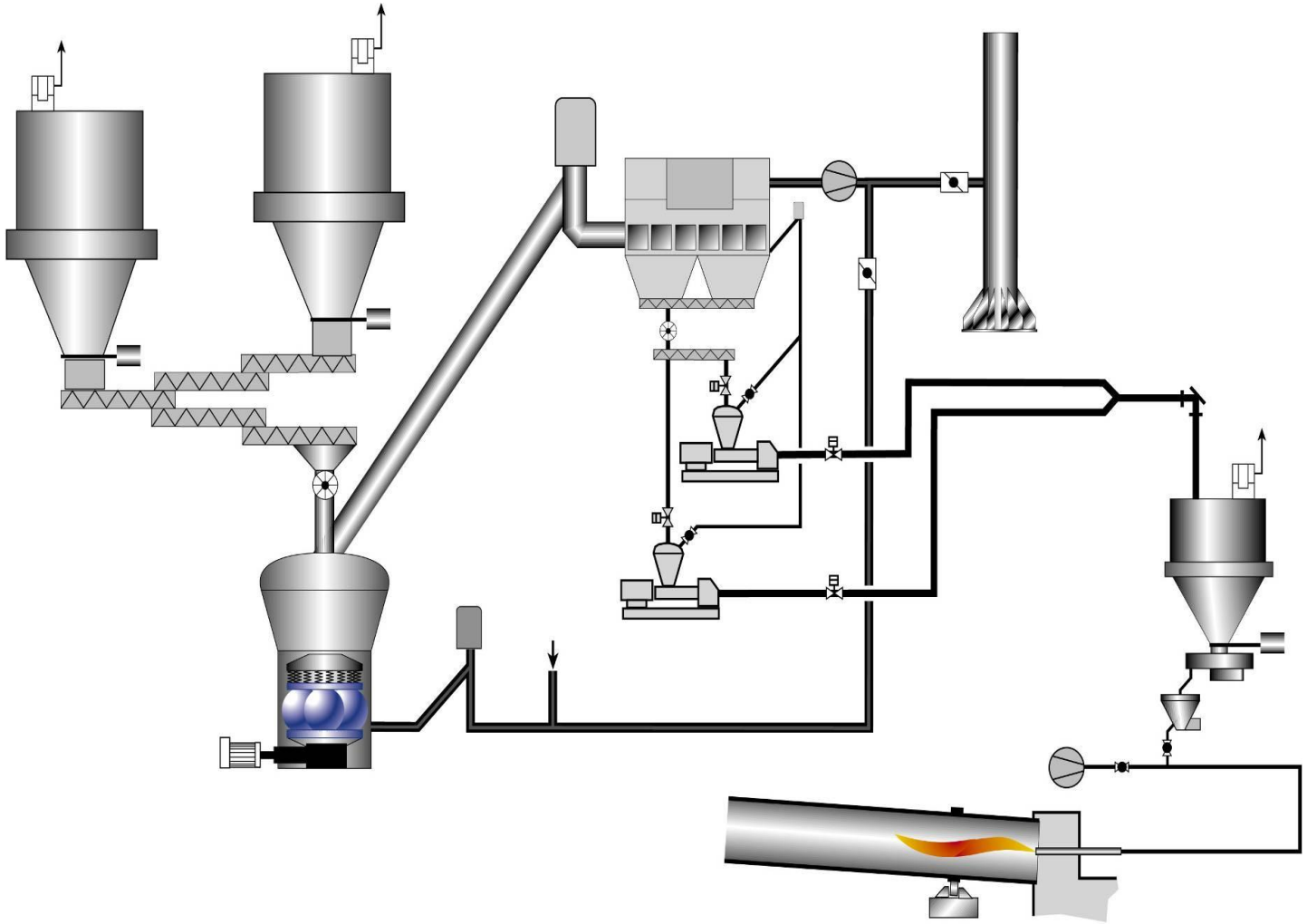
Melbourne Water

Fluid Bed Drying Installation

BORAL

Melbourne Water

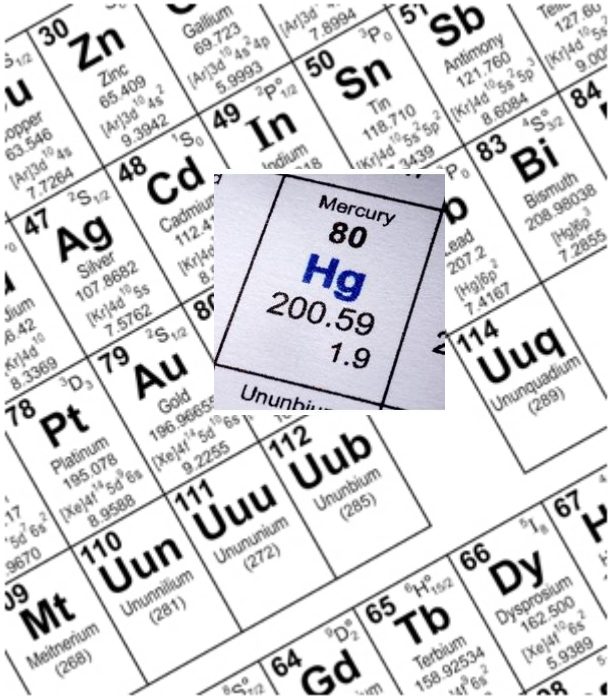
Biosolids Grinding Installation

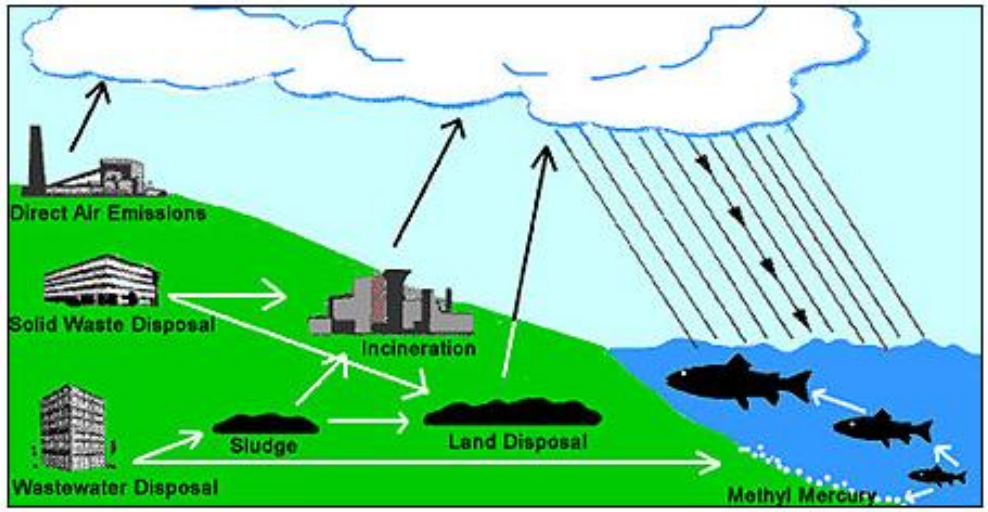


BORAL

Melbourne Water

Mercury





BORAL

Melbourne Water

Managing Mercury Emissions

Hg_o

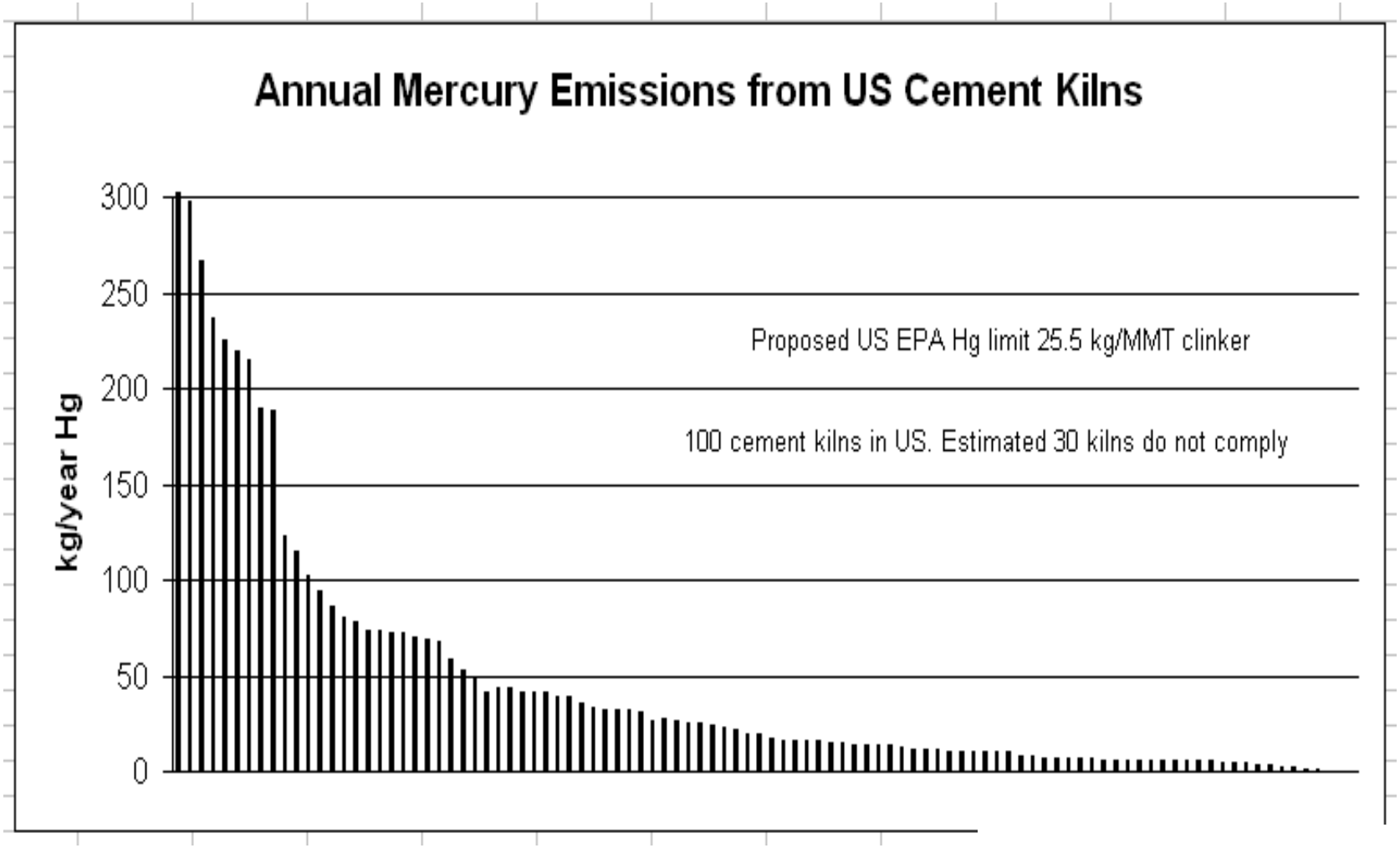
Hg_p

Hg_{2+}

BORAL

Melbourne Water

Changing Regulatory Environment



BORAL

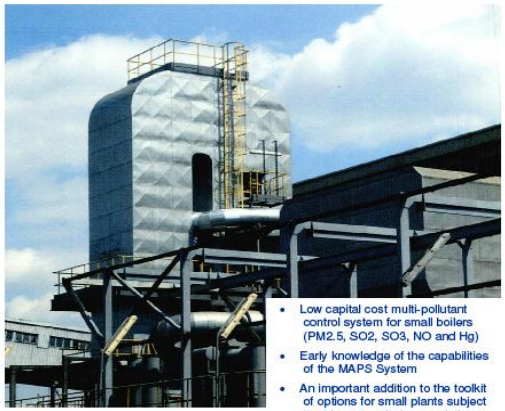
Melbourne Water


Pilot Trial

Indigo Demonstration Plant Operations

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Multi Air Pollutant System (MAPS) Pilot Evaluation



- Low capital cost multi-pollutant control system for small boilers (PM2.5, SO2, SO3, NO and Hg)
- Early knowledge of the capabilities of the MAPS System
- An important addition to the toolkit of options for small plants subject to stringent emission regulations

Full-scale MAPS prototype in Europe

Power producers are constantly being pressed to reduce emissions from their coal fired units. The capital cost of conventional pollution control technologies for large units, 300 megawatts and above, is acceptable in terms of its impact on the cost of generation. However, scaling factors make these costs almost prohibitive for smaller units. Hence, the industry needs a technology with a low capital cost and moderate operating cost if these smaller units are to remain economically viable in the future. This project examines one of the more attractive, low capital cost multi-pollutant control technologies (Multiple Air Pollutant System or MAPS) provided by Indigo Technologies that could meet this need.

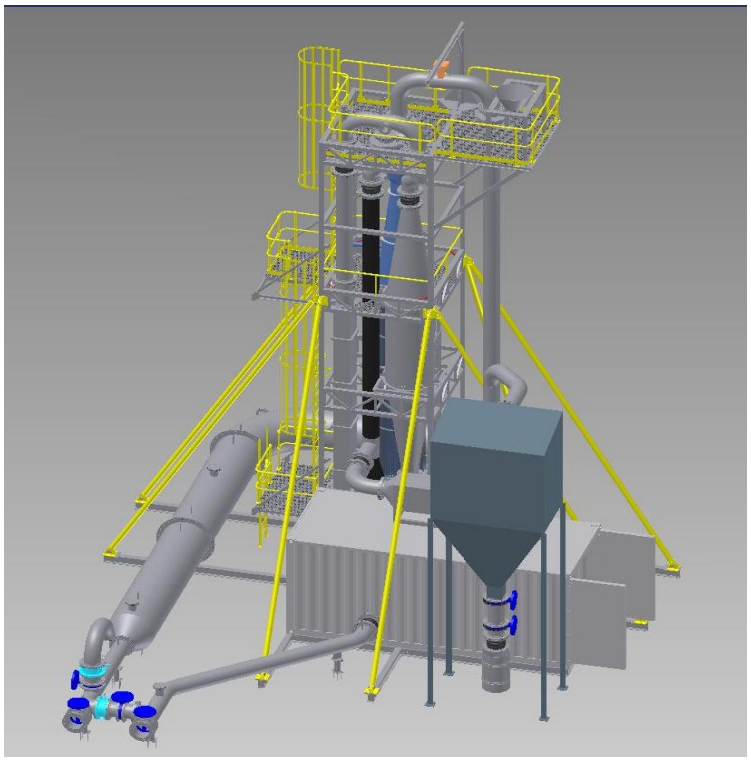
Value

Most power producers have a number of small, coal fired units in their generation mix. These units play an important role in load control and in some instances, matching the generation capacity to the load geographical distribution. However, the economic viability of these units is threatened by increasingly

BORAL

Melbourne Water

Mercury Removal Demonstration Plant

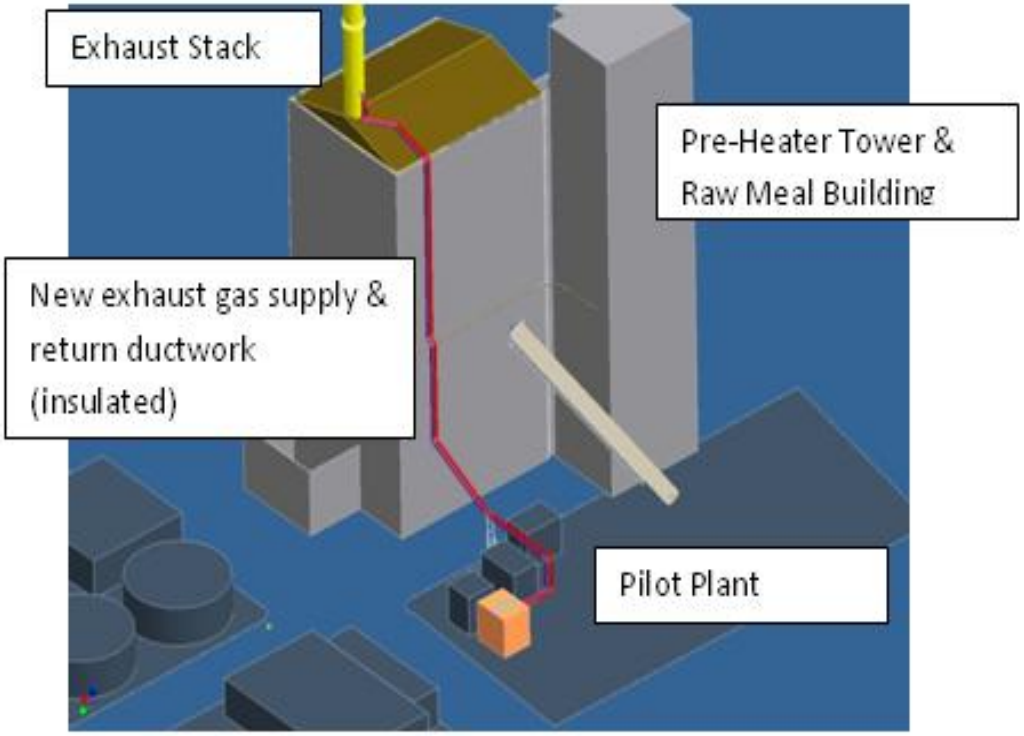


indigo TECHNOLOGIES
creating technology

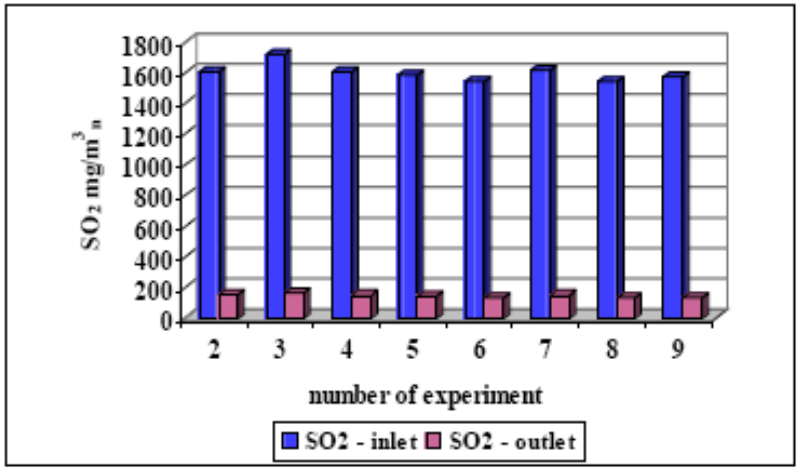
BORAL

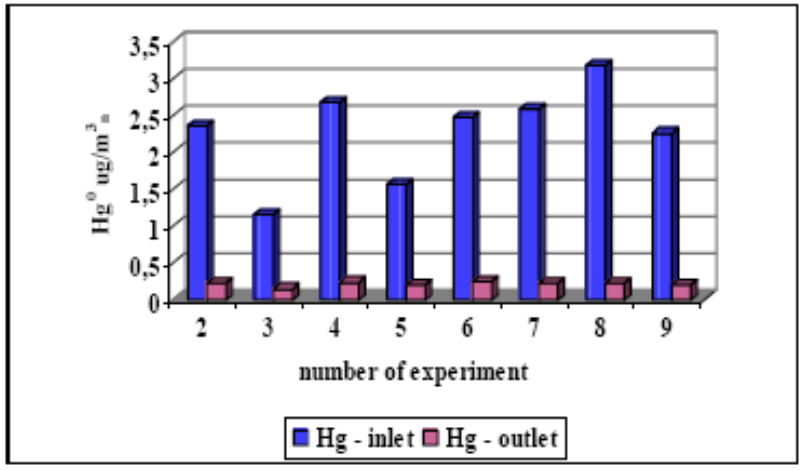
Melbourne Water

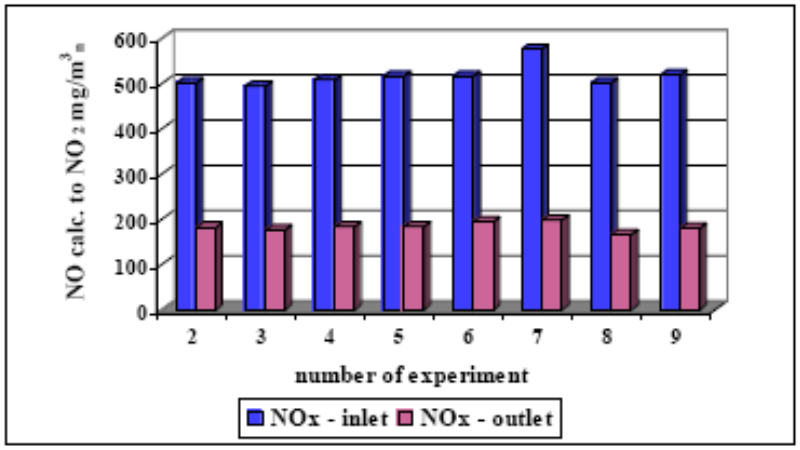
Location of Pilot Plant at Boral



Performance of Indigo Technology MAPS system







average ηSO_2 = 91,0 %
average ηNO = 64,6%
average ηHg^0= 91,0 %

BORAL

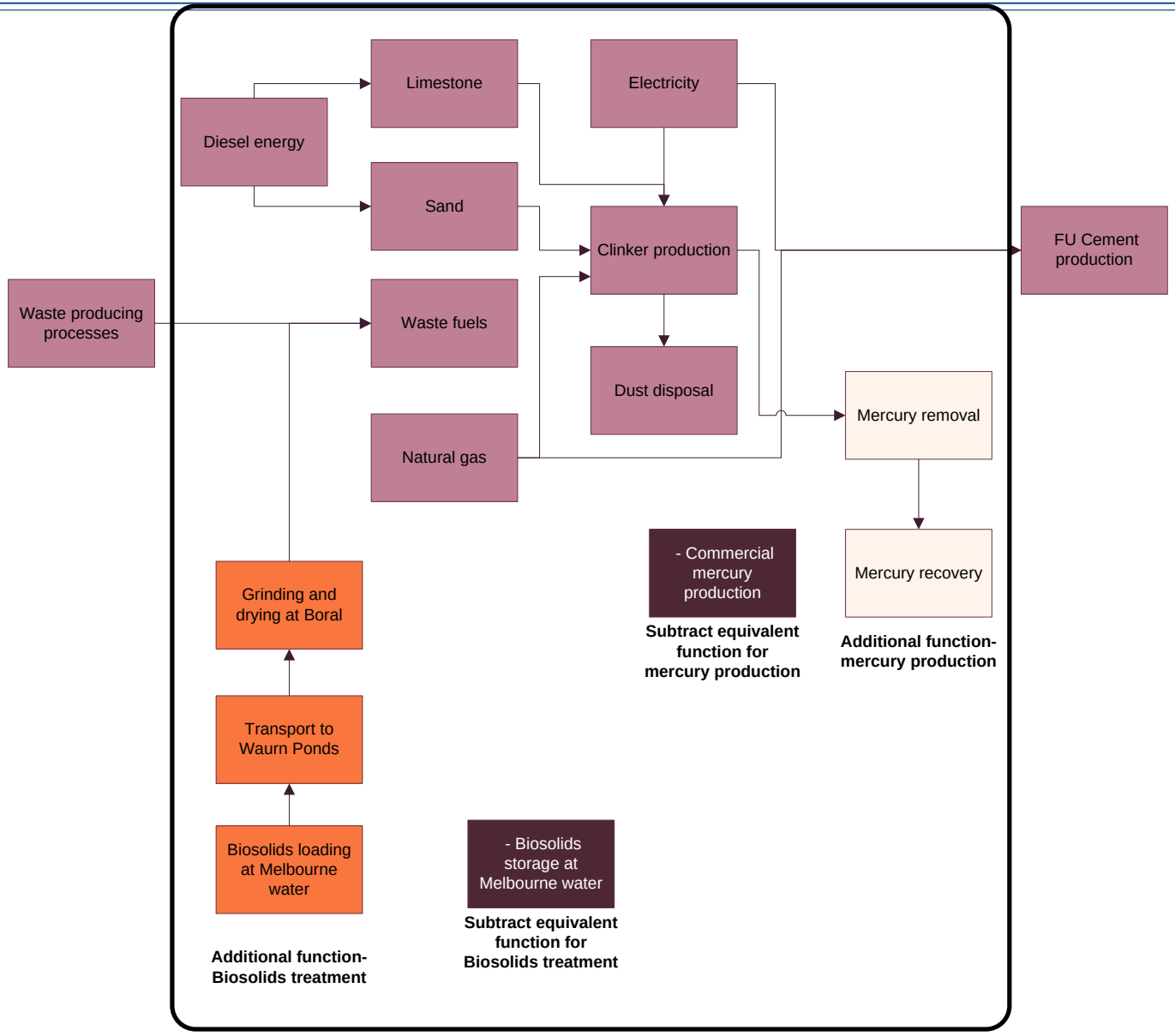
Melbourne Water

Mercury Injection and Measuring Equipment

BORAL

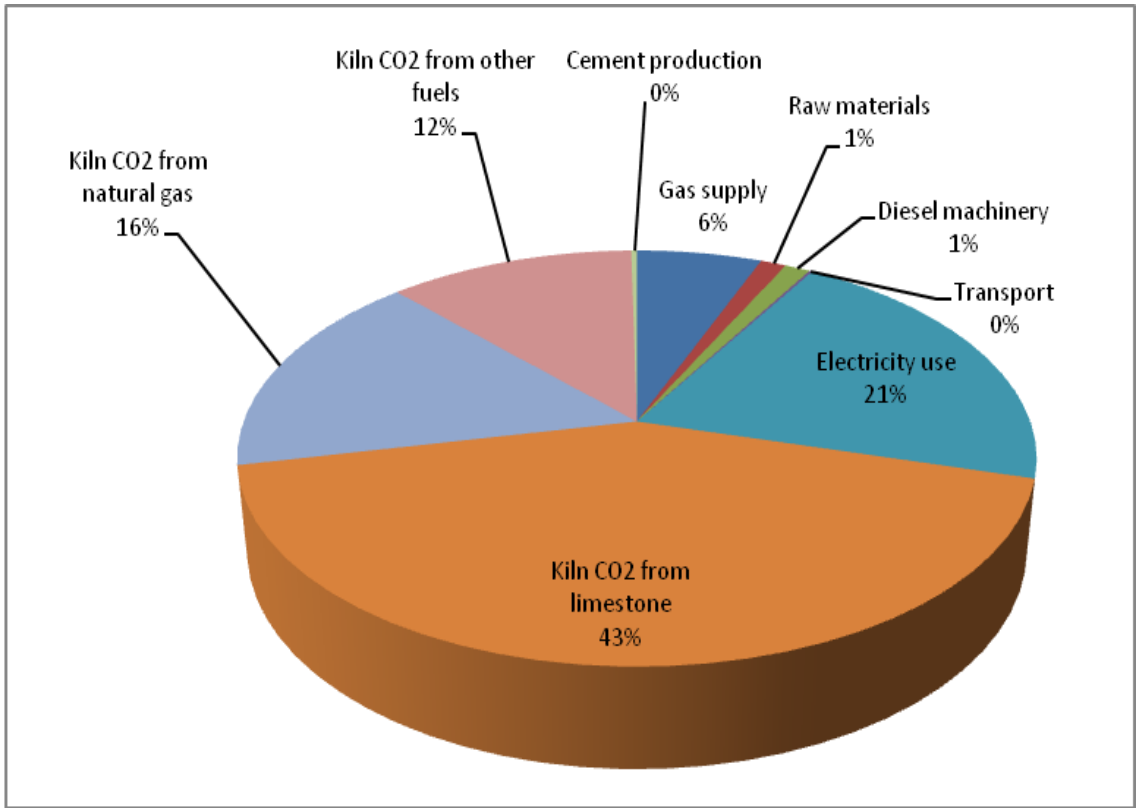
Melbourne Water

Life Cycle Assessment



System Boundary for cement production with biosolids

Greenhouse gas emissions profile of cement production: Business As Usual

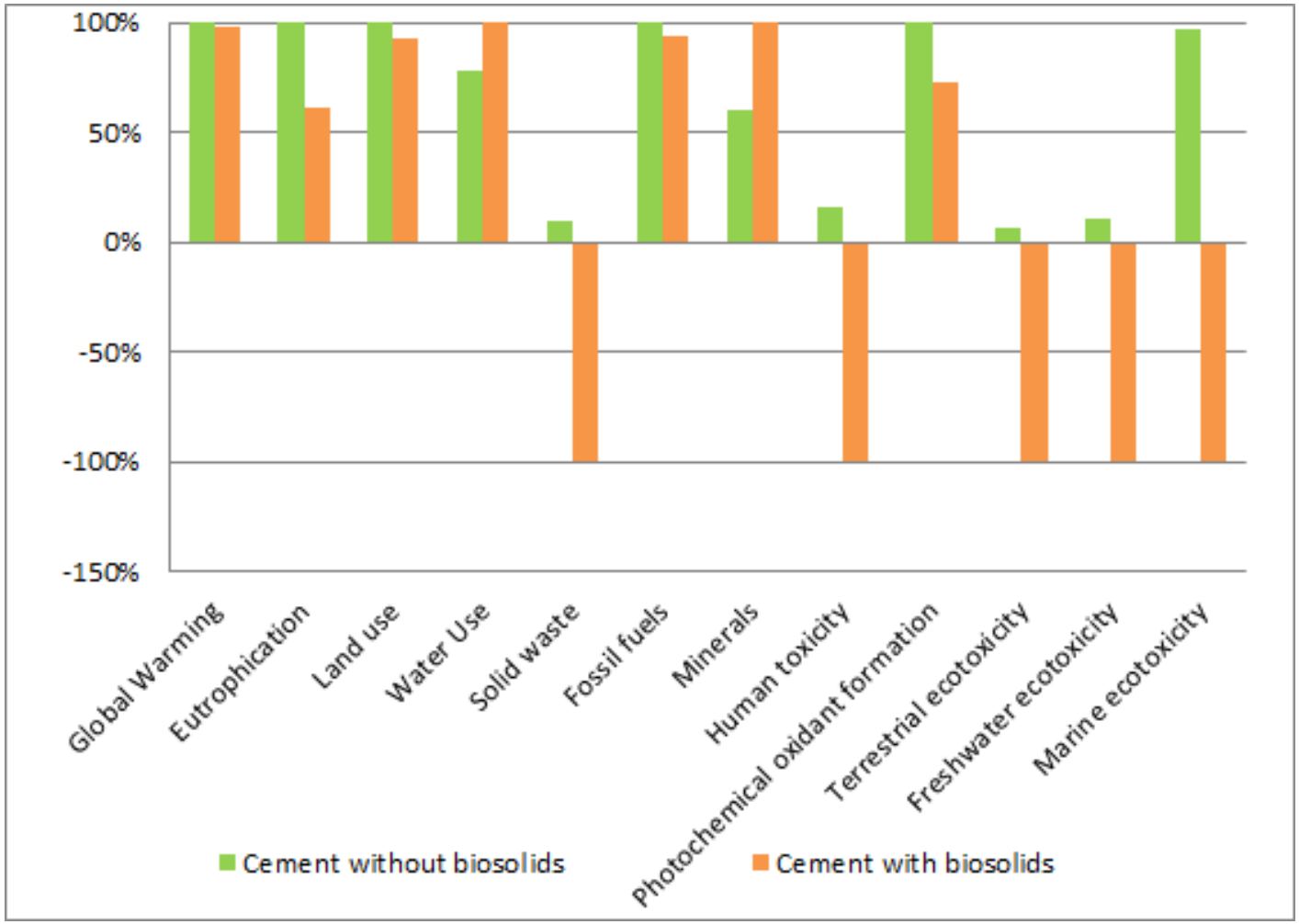


Preliminary Life Cycle Assessment Results

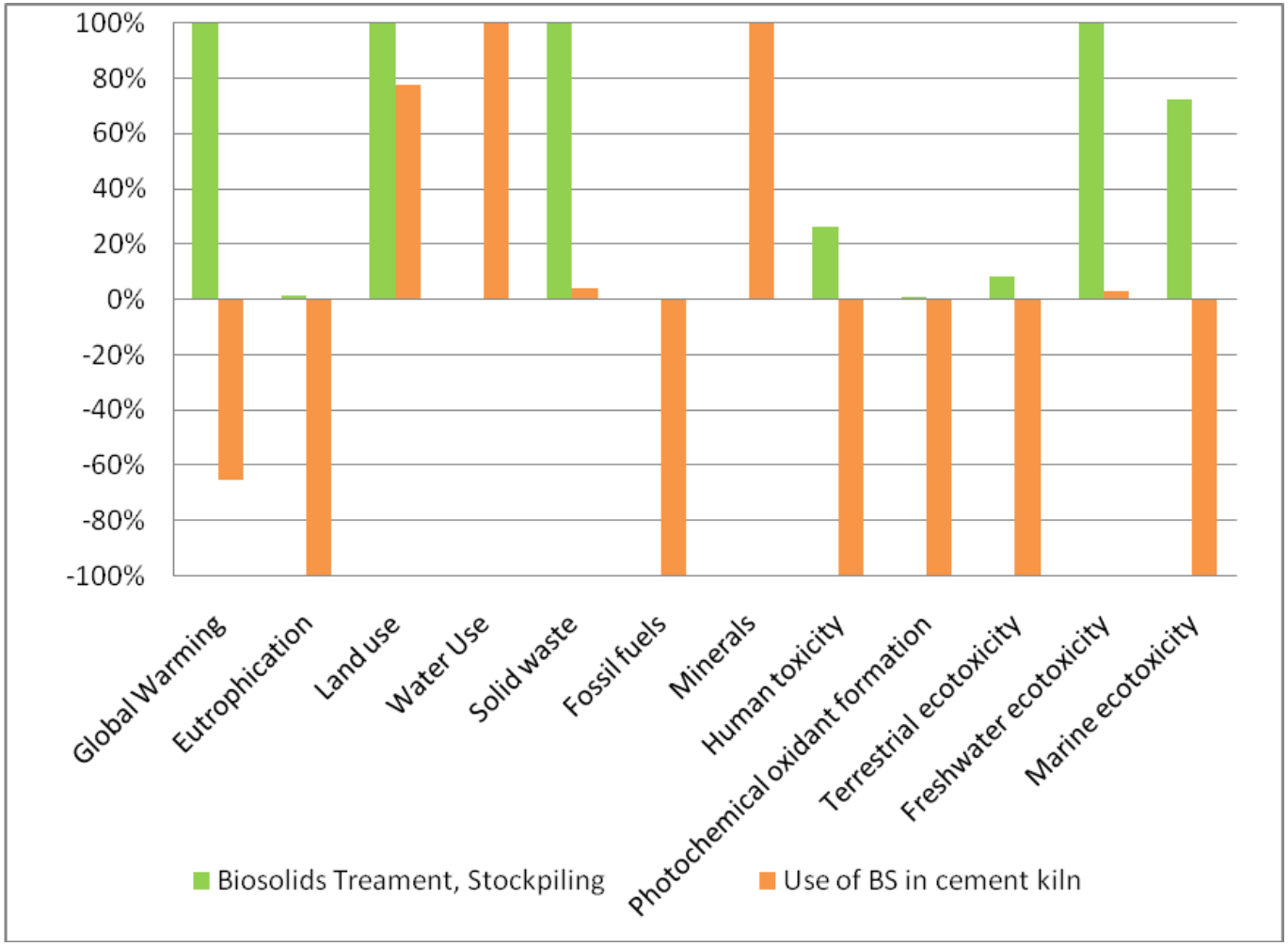
Significant Indicators:

- Global warming
- Resource depletion (fuels)
- Eutrophication
- Photochemical oxidant formation
- Human toxicity
- Eco-toxicity (freshwater)
- Water use
- Land use

Comparison of Cement Production Scenarios



Stockpiling Compared to Cement Production



Preliminary LCA Findings

Small reductions in total fuel use due to substitution of natural gas for biosolids, offset in part by increased in electricity. This will improve as renewable energy targets are met.

Avoided ongoing pollution from biosolids stockpiles, including phosphorus and mercury emissions.

Reduction in particles, NO_x and metal components being emitted to the air from the kiln due to process changes connected with the mercy recovery technology.

Avoided mercury production due to mercury recovery.

Replacing natural gas with biosolids in the production of cement is environmentally beneficial

Key partners

Gossman Consulting

J J C Engineering Pty Ltd

Acknowledgements

Brian McGrath of Boral Cement

Brian prepared the majority of the slides in this presentation and has expended a significant effort in the management of the trial and issues resolution.

Kelly Brooks of Melbourne Water

Kelly prepared the LCA slides in this presentation and is managing the development and completion of the LCA for the trial.