Presentation Overview

Melbourne Water
Boral Cement
Feasibility Study
Pilot Trial
Biosolids
Overview of the Australian Cement Industry
Global Cement Business

![Global cement production 1990-2050](source)

![Projected CO2 emissions from the global cement industry through 2050](source)
Cement manufacture at a glance

Cement is a man-made powder that, when mixed with water and aggregates, produces concrete. The cement-making process can be divided into two basic steps:

1. Clinker is made in the kiln at temperatures of 1,450°C
2. Clinker is then ground with other minerals to produce the powder we know as cement
Potential Future Alternative Fuels and Raw Materials

- Solid Recovered Fuel
- Fibre Shot
- Bio Solids
- Fresh FCC Catalyst
- Spent FCC Catalyst
- Recovered Mineral

(Boral and Melbourne Water logos)
Where Boral are Coming From

- TALLOW RESIDUE
- FOUNDRY SAND
- CARBON DUST
- USED TYRES
- WASTE OIL
Biosolids Reuse as Cement Kiln Fuel is Established

Fuel mix at ENCI Mastricht Netherlands

- Lignite: 8.0%
- Animal meal: 8.2%
- Glycol bottom: 6.1%
- PPDF: 11.0%
- Paper sludge: 1.6%
- Natural gas: 0.3%
- Sewage sludge: 32.0%
- Anode/Fine Cokes: 32.8%
- Lignite: 8.0%
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Feasibility Study
Preparing Biosolids at the Cement Plant

Receival

Drying

Grinding
Preparing Biosolids at the Cement Plant
Biosolids Combustion Modelling
Fluid Bed Drying Installation
Mercury
Managing Mercury Emissions

$\text{Hg}_0$

$\text{Hg}_p$

$\text{Hg}_{2+}$
Changing Regulatory Environment

Annual Mercury Emissions from US Cement Kilns

Proposed US EPA Hg limit 25.5 kg/MMT clinker

100 cement kilns in US. Estimated 30 kilns do not comply
Pilot Trial
Indigo Demonstration Plant Operations

Multi Air Pollutant System (MAPS) Pilot Evaluation

Power producers are constantly being pressured to reduce emissions from their coal fired units. The capital cost of conventional pollution control technologies for large units, over 500 megawatts and above, is acceptable in terms of its impact on the cost of generation. However, pricing 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, meeting the generation capacity to the load geographical distribution. However, the economic viability of these units is threatened by increasing
Location of Pilot Plant at Boral

Exhaust Stack

Pre-Heater Tower & Raw Meal Building

New exhaust gas supply & return ductwork (insulated)

Pilot Plant
Performance of Indigo Technology MAPS system

average $\eta_{SO_2} = 91.0\%$
average $\eta_{NO} = 64.6\%$
average $\eta_{Hg^0} = 91.0\%$
Mercury Injection and Measuring Equipment
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

Legend:
- Cement without biosolids
- Cement with biosolids
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
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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.