The ENDS REPORT

JULY 2003, Issue No. 342

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World Business Council for Sustainable Development
Building Research Establishment
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(The ENDS Report - May 2002)

Cement firms snub low-carbon eco-cement

An innovative cement developed in Australia could offer significant cost-effective reductions in the cement industry's growing emissions of carbon dioxide. Despite evidence of its potential, cement companies appear to have set their faces against the technology.

The cement sector is highly exposed on the issue of climate change. It is currently responsible for some 5-10% of global CO_2 emissions, and growing demand - principally from developing countries - is likely to see its emissions quadruple by 2050.

Last year, the World Business Council for Sustainable Development issued a major report on the sustainability challenges facing the industry. The two-year project, supported by major cement producers including Lafarge and RMC, was led by the US-based Batelle Foundation (ENDS Report 328, pp 19-22).

The report focused on conventional options for reducing emissions, such as improved process efficiency and greater use of waste fuels and raw materials. It also backed increased development of low-carbon products and processes, but skated over the potential of alternative products such as low-carbon cements.

Traditional Portland cement is made by mixing limestone with clay and heating it in a kiln at 1,450°C to form a cement clinker. The process produces large amounts CO_2 - 60% coming from the calcination process and 40% from the fuel used to heat the kiln.

Australian firm TecEco has developed a new type of "eco-cement" in which some 50-90% of the Portland cement is replaced with reactive magnesia. According to TecEco's managing director John Harrison, the formulation has "enormous potential to revolutionise the building industry because it needs less energy, is cheaper to manufacture and will sequester CO_2 into concrete structures."

The first advantage is that reactive magnesia is made at much lower temperatures of around 650°C - so that less fuel is needed to heat the kiln, reducing both CO_2 emissions and energy costs.

Secondly, TecEco says that although the calcination process still produces CO_2, when the magnesium-based eco-cement is mixed with water and aggregate to make concretes used in porous materials such as bricks, blocks, mortars and paving, it reabsorbs much more CO_2 than Portland cement.

Mr Harrison says that, tonne for tonne, CO_2 emissions from the manufacture of eco-cement are almost 20% lower than from Portland cement production. This reduction increases to over 50% less CO_2 per tonne of eco-cement when its potential to sequester CO_2 is included.

Mr Harrison calculates that if eco-cement replaced Portland cement in some 80% of current applications, the global cement industry would reduce CO_2 emissions by some two billion tonnes per year - more than halving its emissions.

Other claimed advantages include the potential to add greater quantities of wastes such as fly ash to bulk up eco-cement, and possible improvements in durability - including reduced corrosion of reinforcement - and improved fire ratings because eco-cement concretes give off CO_2, cooling or putting out fires. Magnesium-based cement concretes are also less alkaline than Portland.

The potential of eco-cement has been evaluated by an independent expert in cement technology, Professor Fred Glasser of the University of Aberdeen, who also advised Batelle on the cement sector's sustainability report.

Professor Glasser says that magnesium-based cements could have a "substantial economic

benefit" for the sector as a result of reduced energy costs. He believes that eco-cement is "ecologically more satisfactory" than Portland cement and is "suitable for large volume production".

Professor Glasser adds that a number of questions need to be answered about eco-cement's long-term stability under load, its durability and other performance issues. Even so, he sees no reason why it should not be used initially in non-structural applications such as paving slabs, kerbstones and low walls in order to develop practical experience.

The Building Research Establishment is about to commence a three-year research project into magnesium-based cement. The project is funded by the Department of Trade and Industry, the British Cement Association, Rugby Cement and Castle Cement. However, it appears quite limited, with a small budget of £165,000 and no actual construction work planned.

Other major companies may be getting in on the act. Oil giant Shell has revealed that it is conducting research into carbon sequestration in building materials, but refused to provide any details.

In contrast, the cement industry appears wedded to existing technology. Michel Picard, Lafarge's vice president for environmental issues, said that the company had dismissed the eco-cement concept on the basis of a literature review. He added that he does not believe TecEco's claims about the potential CO_2 reductions from eco-cement.

Mr Picard said that Lafarge was "very much interested" in alternatives to Portland cement and was conducting research. However, he declined to give details on grounds of commercial confidentiality.

Noel Morrin, international environment director of RMC, the majority shareholder of Australia's largest cement company Adelaide Brighton, said that his company had no plans to evaluate the benefits of eco-cement.

The BCA's technical director, Pal Chana, said that one problem is that magnesite - the mineral from which magnesium carbonate comes - is common in Australia but is not found in the UK.

According to the British Geological Society, some 20 million tonnes of magnesite is mined annually around the world for use in the steel and chemical industries. The main sources are Turkey, Slovakia, Austria, Spain, Greece, China and Russia.

TecEco's John Harrison accepts that eco-cement needs further development, but is growing frustrated by limited resources and the cement industry's lack of interest. "Cement companies are just standing on the side lines watching," he says. "They need to get in the game."

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1 Further information at www.tececo.com