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Department of  
Industry and Resources

# Proceedings

# Green Processing 2004

“2nd International Conference on the  
Sustainable Processing of Minerals”

**10 – 12 May 2004**

**Fremantle, Western Australia**



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## **2nd International Conference on the Sustainable Processing of Minerals**

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We would like to thank the following technical referees for their contribution towards enhancing the high quality of papers included in this volume.

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# Foreword

This is the second Green Processing conference; the first was held in Cairns on 29 - 31 May 2002. That Conference brought together, for the first time in Australia, many of the people involved in developing an understanding of Sustainable Development and what it means for the minerals industry.

Sustainable Development is usually defined as ‘the ability to meet the needs of the present without jeopardizing the needs of future generations’ and achieving sustainable development is undoubtedly the major challenge facing the world. The minerals industry as the ultimate provider of the material needs of society has an important role in sustainable development. However, as a large consumer of natural resources and energy, and major producer of wastes and emissions, the industry faces huge environmental and social challenges. The dilemma of the increasing global demand for materials and the environmental and social impact of their production is the key issue facing the minerals industry. This is the context for Green Processing 2004.

Leading up to Green Processing 2002 was the Global Mining Initiative, a three year project sponsored by many of the leading minerals companies, that culminated in the publication of the report ‘Breaking New Ground – Mining Minerals and Sustainable Development’. Since then minerals companies, industry associations such as the Minerals Council of Australia and the International Council for Mining and Metals, and researchers have started to implement some of the understanding developed through the GMI and other projects in helping frame their planning, technology and research. One outcome already has been the establishment of the Cooperative Research Centre for Sustainable Resource Processing which commenced in mid-2003. This CRC brings together leading minerals companies and research organisations ‘to find technological solutions for progressively eliminating waste and emissions in the minerals cycle, while at the same time enhancing business performance and meeting community expectations’. The CRC also a broader role – to educate professionals who will have a holistic view and be able to integrate across the social, economic and environmental domains to develop ‘green’ ways of meeting material needs.

The papers in Green Processing 2004 provide an update on these and other developments and point directions to the future. The papers include overviews from industry and government perspectives, discussions of specific challenges and approaches, and descriptions of technological breakthroughs which can potentially transform the industry. As a package they provide a comprehensive account of the state of ‘green processing’ in the minerals industry.

I would like to acknowledge the work and commitment of the Organising Committee in the planning of Green Processing 2004 and the contribution of the Technical Program Committee, chaired by Dr Joe Herbertson, in developing the Conference program. Thanks also to many others who have helped along the way, particularly the referees who volunteered their time to ensure the high quality of the papers and the staff of The AusIMM Events Department for their efforts in preparing this volume and managing the Conference.

**John Rankin**  
**Acting Chief CSIRO Minerals**  
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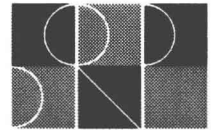


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**S**pearheading the Western Australian Government's drive to increase industrial development, investment and export growth is the Department of Industry and Resources.

Covering activities as diverse as mineral and petroleum development, downstream processing, construction, manufacturing, defence, shipbuilding, bio-industries, and information and communications technology, the new Department is committed to helping companies and individuals to advance their projects.

For mature industries, the Department provides advice and market intelligence, both through locally-based analysts plus a network of overseas trade and investment offices in Europe, the Middle East, India, Indonesia, Japan, Malaysia, China, Taiwan and Thailand.

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Three key business groups are:

- Mineral and Petroleum Services
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# Plenary



# WA Government Strategy for Sustainability and Implications for the Minerals Industry

J Limerick<sup>1</sup>

## ABSTRACT

The WA Government has recognised and embraced the need for a concerted approach to sustainability, and adopted sustainability as the context for tackling the challenges that face the State's future. To this end, a broad cross-agency State Sustainability Strategy was developed during 2002 and 2003 to bring together the State's actions towards sustainability goals under a single framework. The Department of Industry and Resources has a major role in implementing this Strategy.

The Department of Industry and Resources is responsible for the development of Western Australia's industries, encompassing minerals, petroleum, resources processing, manufacturing and information and communications technology. The pursuit of sustainability in this area is as important as any, and the Department has adopted as its vision '*Sustainable prosperity and a better quality of life for Western Australians*'.

The challenges for DoIR's vision lie in the integration of economic, social and environmental goals in a large and diverse State. Actions assigned to DoIR under the State Sustainability Strategy encompass industry development, community consultation, green processing, indigenous engagement, sustainability assessment and various other measures. As part of a process of reorienting the Department's operations to achieve a greater focus on sustainability, including but not limited to the ability to effectively respond to the State Sustainability Strategy, DoIR recently adopted six major sustainability related programs. Two of these, Sustainability Assessment of Major Projects and Sustainable Resources Development, relate directly to the mining industry.

The implications of the State Sustainability Strategy for the Mining sector are likely to be broader and bolder goals for the economic and social spin-offs from the industry, and deeper community engagement throughout the life cycle of projects. Major, complex and strategic projects are likely to be assessed explicitly on economic, social and environmental outcomes.

The goals involved in sustainability are too complex for Government to specify and enforce on its own. To ensure a sustainable outcome, industry will need to recognise where it can make a difference and take the initiative. DoIR recognises and values industry's efforts to define a sustainable path through initiatives such as the International Council on Mining and Metals (ICMM) and its sustainability principles.

DoIR is committed to working with the industry to make the transition to a sustainable future. By working across government and in concert with industry and the community, rapid progress can be achieved in ensuring sustainable prosperity and a better quality of life for Western Australians.

---

1. Director General, WA Department of Industry and Resources (DoIR), 100 Plain Street, East Perth WA 6004.





# The Contribution of Research to Sustainability (With a Minerals Industry Perspective)

R Batterham<sup>1</sup>

## ABSTRACT

Since the 1970s we have seen a marked corporate response in terms of the environment. In part this has come from regulation but it has largely come from stakeholders and the community. We now see a similar trend towards sustainability. The Brundtland (1987) definition of sustainable development provides a direction for advocates: the advance of human prosperity in a way that does not compromise the potential prosperity and quality of life for future generations. In my view its three essential components are: economic, environmental and community.

The Global Mining Initiative and the contributions to the Rio World Summit and the Johannesburg World Summit on Sustainable Development indicate that sustainability is being taken very seriously by the mining industry. But does the minerals industry really embrace sustainability as they claim? There is a view that in reality sustainability is a non-event and that the triple-bottom line approach is only a convenient catch-cry for companies who are actually focussed very strongly on the economics part of the equation.

Chemical engineers are showing a strong trend to more sustainable practices and the chemical industry has shown real commitment to research into developing sustainable processing systems. This requires a framework for thinking and design and the chemical industry is demonstrating true innovation as it moves towards 'no waste' technologies. Whilst there are limits to the rates of change that can occur the minerals industry should also be moving in a much more determined manner towards the notion of processing of products designed for whole-of-life cycle – with minimum/no waste. But is the minerals industry just paying lip service to the importance of research to sustainability?

Several common themes influence the science and innovation agenda in Australia, which will affect the development and adoption of innovations by Australia's minerals sector. First is the well-proven link between peer-reviewed scientific excellence and commercial application. Second is the rise of multi-disciplinary Mode 2 research, which has developed in response to the complexity of problems faced by contemporary researchers, which are best analysed by combining expertise from two or more disciplines.

Successful innovation outcomes, in any field, including minerals processing, is promoted by Mode 2 research which benefits from greater levels of networking and collaboration. Kofi Annan in his Message to the World Social Forum puts it very succinctly '*The way forward lies in finding constructive solutions together*'.

## INTRODUCTION

Since the 1970s there has been an increasing corporate response on environmental matters by the mining industry. We have moved from environmental issues being relevant only to minority groups, through a series of attitudinal changes by the managers of mining companies, brought about mainly by pressure from the wider community. Whilst there has always been examples of excellent environmental performance within the industry and indeed the Australian Conservation Foundation was founded by luminaries from the mining industry, for many spending money on improving the environment beyond some minimal level was seen as a distraction from production or treated in a similar way as donations to the community. The ideas of the Global Mining Initiative (GMI) in reporting environmental performance however engendered proactive attitudes that have now spread through the industry.

There is now a rising expectation on the part of the community that social matters will also be given an increased level of support, bringing them into line with the well-entrenched approaches to health, safety and the environment. This time around it would appear that the mining industry is at the leading-edge of sustainability. The GMI and the contributions to the Rio World Summit and Johannesburg World Summit on Sustainable Development indicate that sustainability is being taken very seriously by the mining industry. But does the minerals industry really embrace sustainability as they claim? There is a view that in reality sustainability is a non-event and that the triple-bottom line approach is only a convenient catch-cry for companies which are actually focussed very strongly on the economics part of the equation.

Of the many possible definitions of 'sustainability' the Brundtland (1987) definition of the goal of sustainable development arising from the Rio World Summit has struck a chord with governments, industry, financial institutions, environmental policy advocates and individuals as a direction against which our activities and plans should be measured.

*Sustainable development means the advance of human prosperity in a way that does not compromise the potential prosperity and quality of life of future generations.*

It is worthwhile to consider carefully its meaning. Prosperity advancement is taken for granted but it is recognised that this advancement must be managed to occur within particular constraints. If it were to be achieved in the manner of those who are already the most prosperous the overwhelming evidence suggests it could be very short lived.

## THE CHALLENGE TO ACTION

There are as many readings into the Brundtland definition, by way of proposed directions, as there are interest groups, but at least its challenge is clear, not least of all for us.

The challenge is one of balance and direction, not one of absolutes. There can be little doubt that many individual activities that we are daily engaged in are not sustainable if continued for enough generations. Some of them are already affecting the health and prosperity of future generations. Yet some of these activities are paradoxically essential to the health and prosperity of future generations, because they provide a platform to that health and prosperity. Advancement requires starting from where we are, with a determination to get to somewhere else.

For example, we are tempted to look at energy intensive processes with a jaundiced eye as unsustainable, contributing to greenhouse emissions. One example is primary aluminium smelting. However, even with close to perfect recycling, which would eventually reduce primary aluminium needs, we may still need to build up the stock of lightweight aluminium in energy efficient vehicles if we are to ultimately achieve energy efficiency in transportation. Now we cannot do that without smelting primary aluminium. Clearly, smelting more aluminium with significantly lower greenhouse gas emissions satisfies the sustainability test.

The challenge of sustainability requires us to think long and hard about this type of decision. The value of attention to sustainability is not so much in what it stops us from doing, but in what it encourages us to do differently. For governments, corporations and entire industries this has become a very public test since the Rio World Summit.

1. FAusIMM, Chief Scientist of Australia.