INTERNATIONAL COUNCIL ON MINING AND METALS

WORKING PAPER[1]

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THE MINING AND METALS INDUSTRIES:

PROGRESS IN

CONTRIBUTING TO SUSTAINABLE DEVELOPMENT

[1] This Working Paper has been prepared to inform others about the mining and metals industries contributions to sustainable development. However it has not been reviewed by the ICMM membership and therefore is not an official organisational report.

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PART 1 INTRODUCTION

1.1 About this Document

In May 2001, the United Nations Environment Programme (UNEP) invited the International Council on Metals and the Environment (ICME) to prepare a report summarising the progress and achievements of the mining and minerals sector in promoting the goals of sustainable development. The aim was to provide a series of reports from various industrial sectors for providing input for the World Summit on Sustainable Development (WSSD) that will be held in Johannesburg, South Africa, from 26 August to 4 September 2002. The WSSD will review progress made by governments and other major groups, including the private sector, in the implementation of Agenda 21, the declaration that emanated from the United Nations Conference on Environment and Develop (UNCED), the "Earth Summit," that was held in Rio de Janeiro in 1992.

While this Working Paper was prepared for submission to UNEP it was decided not to submit it for their sectoral review process, but rather to post it on the ICMM website as a background document. The reason for this decision was that the mining and metals industrial sector's primary contributions to sustainable development are best illustrated by the activities associated with the Global Mining Initiative that was launched in 1998. (see below)

Finally, this Working Paper seeks to provide a brief overview of progress over the past decade of the mining and metals industries' contribution to sustainable development. It cannot include everything but attempts to cover the thematic areas of Agenda 21 as they relate to the industry, and as well as those issues which are important to the industry's stakeholders. Where sectoral data is not available, case studies were used as examples to illustrate practices and performance. While focussing on progress and achievements, this paper also

raises areas of unsatisfactory progress and aims to contribute to discussions about future challenges for the sector and ways forward.

The Global Mining Initiative

The Global Mining Initiative (GMI) is an industry initiative involving 10 major resource companies who are members of the World Business Council for Sustainable Development. The GMI is addressing the challenges confronting the mining and metals industrial sector in the transition to sustainable development, including access to markets and resources, and the need to improve social and environment performance. The project aims to build trust with society and develop business directions that ensure economic viability while contributing to sustainable communities and environmental protection.

With sustainable development a major focus, the GMI is engaging in dialogue with stakeholders about how best to make the tough choices and trade-offs required for successful mineral development.

The work of the GMI got under way in 1998 and focused on three parallel components:

- The MMSD (Mining, Minerals and Sustainable Development project) analysis of the issues facing the industry with pointers for how they could be addressed;
- A multi-stakeholder engagement conference to be held in Toronto (May 12-15, 2002) involving the industry and stakeholders to discuss the way forward; and
- The creation of global mechanisms to carry forward the MMSD project findings and the conference discussions, and to engage in ongoing global sustainable development initiatives.

The MMSD Project

The Mining, Minerals and Sustainable Development Project (MMSD) is the major component promoted by the GMI. However, it has grown far beyond the original group to involve some 28 mining and minerals companies, sponsorship by governments (Canada, Australia, and the UK) labour unions, UN agencies, the World Bank, and some academic and civil society organizations.

Because an industry-managed analysis would have neither the independence nor credibility that was needed, the World Business Council for Sustainable Development was invited to facilitate the execution of the project. In turn it commissioned the London-based International Institute for Environment and Development (IIED) to carry out the work. It was charged with undertaking an independent analysis of the issues facing the sector in the terms of its contribution to the goal of sustainable development. It was asked to do this with as many interest groups and stake holders as it could reach.

While the industry is putting up most of the funds for the MMSD Project, it has no control over what the project chooses to investigate, whom they consult or how their report will be written. Monitoring of these aspects is the responsibility of the project's Assurance Group, which is made up of 25 people drawn from the different interests concerned.

The MMSD project will issue a draft report in March 2002. The final report will be completed in April and published in May 2002.

The GMI Conference

The GMI is organising a landmark multi-stakeholder engagement conference on mining, metals and sustainable development in Toronto Canada from 12–15 May 2002. The pathways and options developed in the MMSD final report will help inform the conference discussions. A wide representation of interests will

be invited to allow engagement between the industry and its stakeholders at the leadership level.

The purpose of the conference is to achieve open and inclusive debate on how the industry should contribute to sustainable development; hear views from outside the industry; develop an industry consensus on sustainable development priorities; and describe and encourage best social and environment practice. The outcomes will go forward as the industry's contribution to the World Summit on Sustainable Development.

Renewed Industry Representation

The third element of the GMI has been to create global mechanisms to carry forward the MMSD project findings and the conference discussions. It was decided to transition an existing body, the International Council on Mining and the Environment (ICME) into a more broadly mandated association, with membership from industry Chairmen/CEOs and leaders of existing industry bodies. This new, London-based organization was named the International Council on Mining and Metals (ICMM).

1.2 About ICMM

ICMM is the successor body to ICME, which was established in 1991 and brought together significant producers of non-ferrous and precious metals with a mandate to promote sustainable policies and practices in the mining and production of primary metals, and to ensure the safe production, use, recycling and disposal of metals. In May 2001, members decided to reorganise ICME into a new body, the International Council on Mining and Metals.

ICMM builds on the platform of ICME and will lead the world's mining and metals industries as they contribute to meeting the opportunities of sustainable development in the 21st Century. Its objective is to assist the mining and metals industries to align their economic, social and environmental goals so as

to maximise their contribution to meeting the challenges of sustainable development. It aims to lead change within the industries, and to determine and promote global best practice performance standards.

The ICMM provides a point of engagement for the mining and metals industries with stakeholders at a global level. It seeks to maintain a high level of dialogue with governmental and non-government organisations and others, and to present authoritative positions on global issues affecting the future of these industries.

Throughout this Working Paper much of the work referred to will have been carried out by ICME and its members over the past ten years and will be referred to as such. However, ICMM is now the inheritor of the legacy of ICME and so the ICMM name also appears throughout this Working Paper as appropriate.

ICMM represents its membership rather than all mining and metals companies located throughout the world. This Working Paper, however, attempts to provide a global perspective by drawing on the approaches of ICMM members to sustainable development issues, as well as describing developments more broadly in the mining and metals industries. ICMM members produce most minerals and operate in all continents (excluding Antartica) and in general are large companies, but ICMM also has a window on the small and medium companies in the sector through its linkages with the national, regional and commodity mining associations.

1.3 About the Mining and Metals Industries

The industry produces a wide range of minerals, metals and alloys. Its products are essential for everyday life. They also provide essential raw materials for nearly every other industrial sector. Assured supplies of minerals and metals will be required to meet the needs of the world's growing

population and to fulfil expectations of improvement of quality of life, notably in developing countries. The global consumption of minerals is forecast to increase substantially. It is estimated that between 2000 and 2050, the world will require five times the amount of minerals and metals that have been utilised in human history up until 2000.

It is estimated that there are over 10,000 mining and metal companies in the world and some 20,000 mines, processing plants and smelters. Nevertheless, the minerals industry is relatively small making up 1.5% of the international share market. It is an international industry with assets employed in six major geographic regions and covering five major commodity groups.

TABLE 1: MINERAL ASSETS

By region			**By commodity grouping**		
	Enterprise Value **US$billion**	*%*		*Enterprise Value* **US$billion**	*%*
North America	67	25%	Precious Metals	60	23%
South America	38	14%			
			Base Metals	50	20%
Asia	19	7%			
Australia	50	19%	Aluminium	60	22%
			Industrial Minerals	40	15%
Africa	41	15%			
Europe	55	20%	Bulk Commodities	60	22%
Totals:	**270**	**100%**		**270**	**100%**

Source: NM Rothschild and ABN Ambro

The industry makes a contribution to GDP, exports, etc. in over 150 countries, and in some economies, including some developing countries; its contribution can be significant. In addition, the mining and metals industries spin off a host of associated service, manufacturing, and technology businesses.

The last thirty years have seen a substantial increase in mineral and metals production and a trend towards larger operations whose size confer economy of scale advantages. There is a trend towards consolidation in the industry, with fewer larger global companies emerging - largely to be able to make the investments required to take advantage of the economics of scale. This economic consolidation is also facilitating and requiring leadership in environmental performance and corporate social responsibility of companies.

In setting the context for the discussions in this Working Paper and the sustainable development challenges facing the mining and metals industry, certain features are important, e.g.

- Mineral deposits have fixed locations and companies need access to land to find and develop minerals.
- Mining and metal processing operations disturb the environment and communities in which they operate and have both positive and negative impacts.
- Mining and smelting technology, knowledge and practice have changed substantially over time, but the legacy of historic practices continues, posing practical and reputational challenges.
- In some quarters, mining and metal processing operations are unpopular because of their potential impacts, past practices and also contemporary accidents that undermine community confidence and the reputation of the industry.
- The industry relies, probably more than many, on community sanction for its political license to operate.
- Technological development has been at the heart of mining and metal processing progress over centuries, and technological development remains a key to improving its sustainability - economically as well as in terms of eco-efficiency, minimising impacts, etc.

- Industry profitability has been low for an extended period, in part reflecting the long term trend of decreasing real prices for metals, as well as structural and other factors. This requires that costs are tightly controlled in the industry, and that productivity gains are constantly pursued.
- While metal products have finite lives, the elemental metal component of such products is potentially infinitely recyclable.
- Some minerals and metals are essential for life, but they can also be toxic in certain forms, concentrations, or exposures.
- Mining and metal processing investments tend to be large, long term, and immobile, and political and regulatory frameworks are important.
- The industry operates within the bounds of advanced legislation and regulation in most areas and phases of its operation. Regulatory restrictions on products are an emerging area of focus by governments with methodologies and approaches still contentious in some respects.

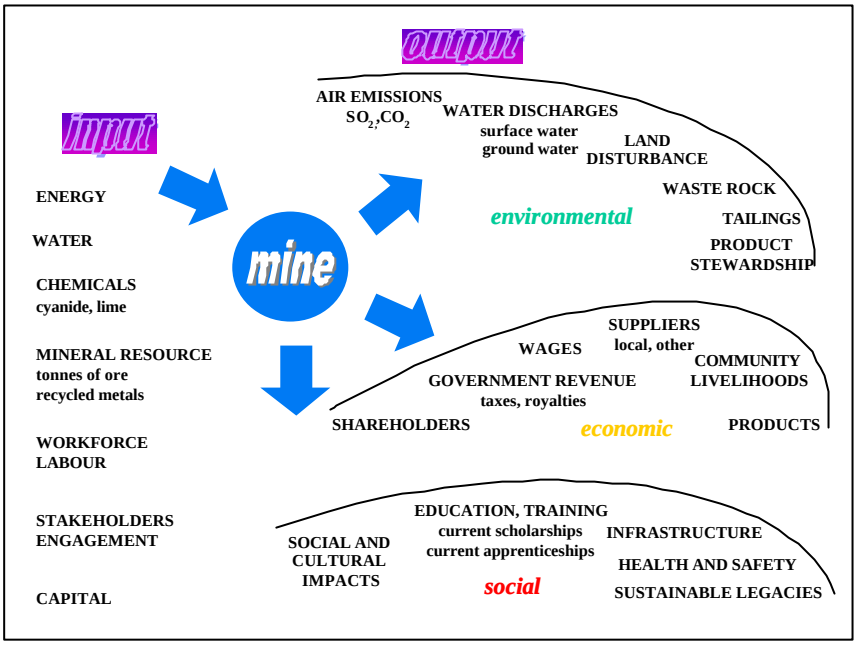
PART 2: IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT AS THE INTEGRATING FRAMEWORK FOR THE MINING AND METALS INDUSTRIES

2.1 Overview

The 1992 United Nations Conference on Environment and Development (UNCED), the "Rio Earth Summit, launched a new global partnership for sustainable development and affirmed the indivisibility of environmental protection and the development process. Agenda 21, the declaration that emanated from that important event, identifies sustainable development as the basis for managing locally, nationally and globally, the effect of human impacts on the environment. The mining and metal industries were not covered in Agenda 21 as a distinct resource sector like oil and gas and forestry.

Over the 1990's, the mining and metals industries have increasingly seen the sustainable development paradigm as the best framework within which to address their issues and challenges. The mining and metals industries had to pay early attention to their environmental performance in line with rising community and societal expectations. Over the last decade, they have strengthened this environmental focus and have become increasingly concerned with other dimensions of sustainable development including social and community impacts, fair distribution of economic benefits, human rights, transparency, sustainable legacies post-mine closure, and the health and environmental risks of its products. The mining and metal industries also had to look more deeply at what is required for them to sustain their material and economic contributions to society and recognised that there was a need to build confidence about mining and metals amongst all stakeholders - communities, governments, employees, and NGO's.

MINERALS SUSTAINABLE DEVELOPMENT MODEL



After: Peter Hancock, Sustainable Development of Mineral Resources, Geology Department, Australian National University.

Sustainable development has become the framework for action in the mining and metals industries, e.g.

- Sustainable development charters and policies have been adopted by companies and industry associations.
- Some 28 companies are involved in the MMSD project which is engaging stakeholders to help the industry define priorities and pathways to improve its environmental and social performance.
- Systems and other tools to embed sustainability in corporate practices and culture are being adopted.
- Companies are increasingly of the view that sustainable development is critical to their long term survival and to the delivery of enhanced shareholder value.

2.2 The ICME/ICMM Sustainable Development Charter

ICME's original Environmental Charter was adopted in 1993 and amended in 1997 to add principles related to Community Responsibility. In 1998, work commenced to transform the charter into a comprehensive Charter on Sustainable Development. The development of the new charter involved a multi-stakeholder process that included representatives of NGO's (environment, development and others), international trade unions, UN agencies, bilateral aid agencies, the World Bank/International Finance Corporation and ICME member companies.

The Charter contains twelve Fundamental Principles of Sustainable Development as well as management principles in four key areas; Environmental Stewardship; Product Stewardship; Community Responsibility and General Corporate Responsibilities.

The restructured organisation - ICMM - has adopted the ICME Sustainable Development Charter as an interim charter.

2.3 Embedding Sustainable Development in Company Practice

As part of the MMSD project, in 2001, PriceWaterhouseCoopers undertook a survey of the perceptions, policies and progress relating to sustainable development of thirty-two of the world's largest mining and minerals organisations[1].

A preliminary review of the findings of the survey by MMSD, says it is clear that the majority of the participating companies have taken the first critical step

[1] Thirty-two organisations representing nearly $US 100 billion in annual sales and over 750,000 employees participated in the survey to provide a baseline assessment of how the mining and minerals industry is responding to the issues of sustainable development. These organisations represent a broad commodity and global geographic distribution. Full survey results are available on the www.mining-survey.com

towards a better understanding of sustainable development, by acknowledging its importance to the industry and its future. The survey also shows that these companies are aware of the importance of their interaction and consultation with local stakeholders, and their economic and environmental impacts on their employees and on the local communities where they operate.

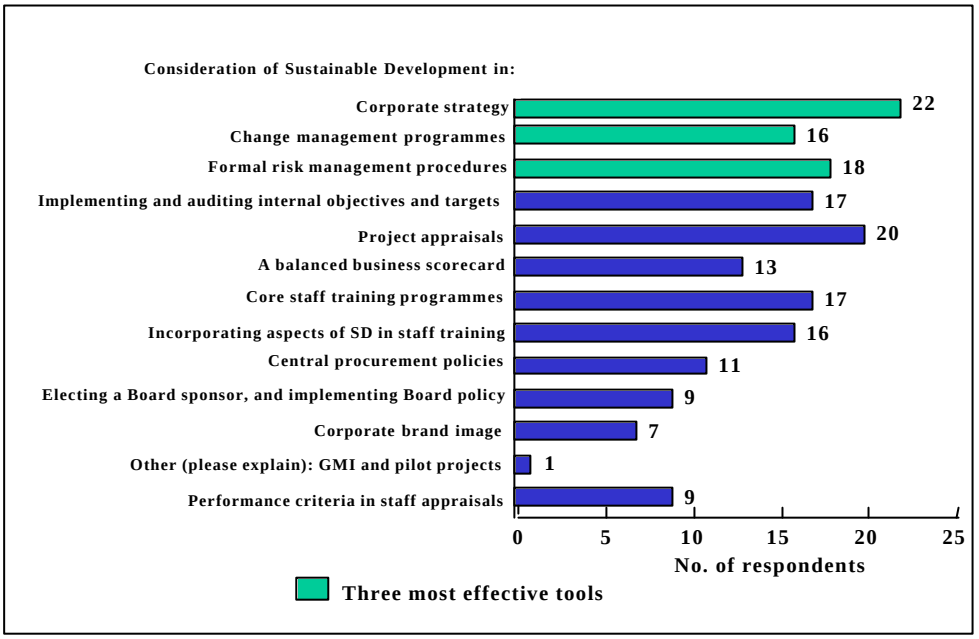
While there is a strong endorsement and recognition of the importance of the ideas of sustainable development to the future of the industry, and the success of individual companies, it appears many companies are wrestling with the concrete steps necessary to make this recognition operational: they have concluded that sustainable development is of over-arching importance, and have begun to take some specific measures to integrate these concepts into corporate practice, but most companies are far from developing a detailed vision of all the steps necessary to adapt to a business environment in which sustainable development is the dominant paradigm.

Findings included:

- The majority of respondents believe that addressing sustainable development is critical to the delivery of enhanced shareholder value, to survival in the long term and to improved management of risk. Improving relationships with communities and with regulators were also drivers.
- Investment decisions are being influenced by the need to consider sustainability related issues such as community attitudes, human rights, and biodiversity.
- Environmental and social issues are generally being managed through the adoption of associated policies, management systems and risk management processes. Implementation of environmental management appears to be more developed than the management of social issues and wider economic impacts.

- The future for the industry is seen as involving greater transparency and accountability, with increased focus on cleaner technologies and more efficient use of resources.

TABLE 2: TOOLS USED FOR ACHIEVING CULTURAL CHANGE AND EMBEDDING SUSTAINABILITY



MMSD - PriceWaterhouse Coopers

Mining and Minerals Sustainability Survey 2001

Table 2 shows progress in embedding sustainable development principles into aspects of strategy, management procedures, project appraisals, training, and implementation and auditing of internal objectives and targets. In other areas, such as procurement policies, and performance criteria in staff appraisals, sustainable development considerations are starting to be incorporated, but are not yet the norm.

South African Mining Summit on Sustainable Development

In February 2000, a tripartite mining summit in South Africa reached consensus on sustainable development in the mining industry. The Summit created a shared vision between government, business, labour, NGO's and community-based civil society, and set up structures to develop sustainable development strategies. There was a particular focus on job creation and poverty alleviation, development of rural areas and reversing urban degradation in sustainable mining areas.

A sector partnership committee was established plus five implementing structures:

- Promotion and Mineral Development
- Beneficiation
- Employment and Human Resources
- Cyclical Volatility and Depletion
- Rural Development.

PART 3: ECONOMIC AND SOCIAL DIMENSIONS OF SUSTAINABLE DEVELOPMENT

Elements in Agenda 21 relevant to the mining and metals industries:

• *Accelerating sustainable development in developing countries* • *Combating poverty* • *Unsustainable patterns of production and consumption* • *Protecting and promoting human health, reducing health risks from environmental pollution and hazards*

3.1 Overview

For the mining and metals industries, the economic and social dimensions of sustainable development can be grouped into three categories, each with their associated issues and challenges.

1. **A supplier of materials which meet society's needs.** The production and availability of a broad range of minerals and metals have played and will continue to play a large role in meeting human and economic needs, including for shelter, infrastructure and mobility. Key issues are:
   - Will the supply of minerals and metals, including recycled metals be adequate to meet the needs of current and future generations?
   - The industry's ability to attract necessary investment capital.

2. **The economic contribution of the industry to countries, and in particular to developing countries.** Poverty alleviation is a fundamental concern of the Rio UNCED agreements and remains central to progress towards sustainable development. The mining and metal industries can play a role in wealth creation for nations. Key issues are:
   - The sound management of mineral wealth by countries.
   - The roles of companies, governments and civil society groups in the development process.

3. **Creating Sustainable Community Legacies.** This includes economic livelihoods and also areas such as health, safety, human rights and ethics, training and institutional development. Key sustainable development issues are:
   - Maximising community benefits and contributing to a sustainable legacy to communities.
   - Minimising negative impacts.

3.2 Metals contribute to meeting society's needs

Assured supplies of metals will be required to meet the needs of the world's growing population and to help fulfil expectations of improvement in the quality of life, notably in developing countries. Given their unique physical and chemical properties, metals are essential for a number of uses in transportation, housing, power generation and transmission and electronics, as well as for a wide range of high technology applications in the telecommunications, computer, aerospace, medical and environmental control industries.

The most widely used metals are aluminium, copper, zinc, nickel, lead and iron. Most metals in use are in the form of alloys, such as steel, brass, and aluminium alloys. Many of the lesser-known metals are used in small quantities in complex machinery and scientific instruments.

The development of new technologies which will enable progress to a more sustainable society will need new and different materials including new and different applications of metals and alloys. For example, every personal computer contains thirty-one different metals. Innovation and research produce new alloys and improve metal specifications. At the same time, some metal uses will disappear or contract with the development of new technologies, substitute materials, or in uses which pose unacceptable risks to health or the environment. Table 3 gives an accurate although static picture of the properties and uses of metals.

TABLE 3: PROPERTIES AND USES OF METALS

Metal	Properties	Some Uses
Aluminium	Lightweight, good conductor	Air, wire and cable, cans, foil
Chromium	Self-healing oxide coating	Stainless steel, refractories
Cobalt	Oxidation resistance	Magnets, superalloys
Copper	High conductivity, corrosion resistance	Wire and cable, pipe and tubing, coinage, bronzes, brasses
Gold	Stable, malleable, ductile	Jewellery, electronics, aerospace, dentistry, foil
Iron	Lustrous, conducts heat and electricity, malleable	Steel making, cast iron, wrought iron
Magnesium	Light weight, high strength to weight ratio	Transportation, steel refining
Lead	Corrosion resistant, soft, dense	Batteries, glass, sound and radiation protection
Manganese	Forms oxides	Steel alloy, fertiliser
Mercury	Liquid, good conductor	Thermometers, amalgams
Molybdenum	High melting point	Steel making, catalyst
Nickel	Corrosion resistance	Stainless steel, coins, superalloys, catalysts
Platinum group	Corrosion resistance, high conductivity, rare	Jewellery, catalysts, electrical circuitry
Rare earth metals	Forms oxides	Magnets, catalysts, ceramics
Silver	Good conductor	Flatware, photography
Tantalum	Corrosion Resistance	Surgical implants, carbide tools
Tin	Low melting point, corrosion resistance	Coatings, solder, pewter, chemicals
Titanium	High melting point, light, strong	Aerospace pigments
Tungsten	Highest melting point, wear resistance	Carbide tools, filaments and electrodes, chemicals
Zinc	High chemical reactivity	Galvanised steel, castings

3.2.1 Sustaining the Supply of Minerals

The consumption of most minerals and metals has escalated over the last century. The pace continues to accelerate so that the world is annually producing and consuming nearly all mineral commodities at record rates. Advances in extraction technology, lower cost of metals, new uses for metals, rising living standards and population growth are underlying drivers.

Club of Rome forecasts in the early 1970s argued that there would be limits to growth based on availability of resources. In the case of mineral resources, it was believed that global depletion of certain resources was imminent within the next few decades. Yet these predictions have been contradicted by the facts, at least as far as the major metals are concerned.

Minerals in the ground are by nature non-renewable, and specific mines have finite lives. However, there are a number of reasons why minerals and metals arguably are in no danger of being depleted in any foreseeable scenario or timeframe. In particular, known mineral resources are very extensive and economic reserves are not static, key reasons being that:

- If metal prices increase lower grade ores can be mined.
- New exploration techniques enable better penetration and discovery.
- New processing technologies enable recovery of metals from lower grade ore-bodies. (The minimum mineable copper grade at the start of the 20th century was about 2.5%, dropping to 1% half way through the century and to about 0.5% toward the end - although there is clearly an asymptotic limit to this trend. Low grade nickel deposits are now being mined by new techniques.)

- Economic and technological factors have enabled re-mining of some old mine wastes.

Plus, the stock of metals available for use and re-use grows as more metal is produced and recycled. Indeed, the largest known and rapidly growing stocks of metals are "metals in use".

Mineral resources are measured in different ways - reserves, economic reserves, resources. Table 4 shows that hundreds of years of resources exist for most major minerals. Reserves - which are known resources which are profitable to exploit with existing technology and prices - are at lower levels. The life expectancy of reserves depends on future economic growth rates - which make a big difference to the consumption of metals. The Table shows that the life expectancy of current reserves of major minerals under different economic growth rates is generally sufficient for some decades - silver and lead being in the shortest supply. It is worth noting that once reserves reach 20 to 30 years of current production, companies have little commercial incentive to invest in developing their reserves further. These resource estimates and reserves can be conservative as a result.

TABLE 4: RESERVES, RESOURCES C.F. PRODUCTION

Life Expectancies of World Reserves, Selected Mineral Commodities

Mineral Commodity	1999 Reserves	1997-1999 average annual production	Life expectancy in years, at three growth rates			Average annual growth in production 1975-1999 (percent)
			0%	2%	5%	
Aluminium	25×10^9	123.7×10^6	202	81	48	2.9
Copper	340×10^6	12.1×10^6	28	22	18	3.4
Iron	74×10^{12}	559.5×10^6	132	65	41	0.5
Lead	64×10^6	3070.0×10^3	21	17	14	-0.5
Nickel	46×10^6	1133.3×10^3	41	30	22	1.6
Silver	280×10^3	16.1×10^3	17	15	13	3.0
Tin	8×10^6	207.7×10^3	37	28	21	-0.5
Zinc	190×10^6	7753.3×10^3	25	20	16	1.9

Life Expectancies of Resource Base, Selected Mineral Commodities

Mineral Commodity	Resource Base (metric tons)	1997-1999 average annual production	Life expectancy in years, at three growth rates			Average annual growth in production 1975-1999 (percent)
			0%	2%	5%	
Aluminium	2.0×10^{18}	22.4×10^6	89.3×10^9	1065	444	2.9
Copper	1.5×10^{15}	12.1×10^6	124.3×10^6	736	313	3.4
Iron	1.4×10^{18}	559.5×10^6	2.5×10^9	886	373	0.5
Lead	290.0×10^{12}	3070.0×10^3	9.4×10^6	607	261	-0.5
Nickel	2.1×10^{12}	1133.3×10^3	1.8×10^6	526	229	1.6
Silver	1.8×10^{12}	16.1×10^3	111.8×10^6	731	311	3.0
Tin	40.8×10^{12}	207.7×10^3	196.5×10^6	759	322	-0.5
Zinc	2.2×10^{15}	7753.3×10^3	283.7×10^6	778	329	1.9

Source: Adopted from Tilton, March 2001

John Tilton, in his manuscript "Depletion and the Long-Run Availability of Mineral Commodities" for the April 2001 workshop on this subject sponsored by the MMSD project and Resources for the Future, notes that the central question about whether or not coming generations face a future of shortage of minerals resources (or resources which are too costly to use) remains unanswered. However, he also states that:

> "…depletion is no longer inevitable. While over time depletion tends to drive the costs and prices of mineral commodities up, new technology tends to mitigate this tendency. Indeed mineral commodities can become more available over time if the cost-reducing effects of new technology more than offset the cost-increasing effects of depletion".
>
> "new technology has over the past 130 years kept the adverse effects of depletion at bay despite an unprecedented surge in both population and the consumption of mineral commodities. Real production costs and prices for many mineral commodities have actually fallen, implying their availability has increased".

The reserves picture, the increasing contribution of recycling, plus an understanding of the dynamic interactions discussed by Tilton should go a long way towards allaying fears about intergenerational equity in terms of supply of minerals and metals.

3.2.2 Recycling

Recycling is an important and growing part of the supply of metals. The elemental nature of metals means that they can be reused and recycled without loss of their properties. This offers opportunities to

extend the use of these materials, conserve resources, reduce energy usage and minimise waste disposal e.g. approximately half of the metals used in Europe are from recycling.

There are practical and economic limits to the efficiency of collection, transportation, recovery and recycling of metals at any time and place. Scrap recovery as a percentage of consumption varies with the metal and location. Recycling rates depend on factors such as the dominance of an end-use market, low-cost collection systems, the life of the structural use of the metal (railways, buildings, electricity systems), difficulty of separation from composite products or applications (zinc as a protective coating on steel). Also, some minerals and metals go into dispersive and other uses which mean that they are unrecoverable (e.g. zinc for cathodic protection, minerals in fertilisers, in paints, etc.)

A major impetus for conservation is that scrap metal processing, in general, requires considerably less energy than is needed to produce primary metal. Typical energy savings for recycled secondary material compared with primary production are estimated as follows: steel 74%, aluminium 95%, copper 85%, lead 65%.

Determining recycling rates is complex because of the varying service lives of metal products and the different pathways by which metal products may be reused, remelted, remanufactured and otherwise recycled. The following are estimates of the extent of recycling of key metals.

Lead - 55% of consumption. 90% of battery lead is recycled in some OECD countries.

Copper - 40% of world's requirements. Excluding wire production which requires high purity copper, 72%

		of copper used by other industries comes from scrap.
Steel	-	40%
Zinc	-	Zinc consumption derived from secondary sources is around 30%.
Aluminium	-	approximately 1/3 of world aluminium demand is met from recycled aluminium alloys. Almost 100% of production scrap is recycled. 40% of aluminium beverage cans are recycled in Europe (92% in Sweden).
Molybdenum	-	10%

The European Commission's "Recycling Forum 1999-2000" found that for ferrous and non-ferrous metals:

- Market forces drive the recycling process and recycling rates are growing.
- Waste shipment legislation restricts the markets for certain recyclable materials.
- The collection system is well established and market driven.
- The sorting of metals is easy because of their intrinsic properties.
- Standards and classifications exist at both national and international levels.
- Wastes generated by the initial and subsequent recycling processes are generally themselves recycled. Final disposal by land-filling is minimal and incineration is only used for non-metallic wastes.

Recycling rates are expected to keep growing, driven by energy conservation, as well as improved product design and material identification to assist recovery. However, despite the intrinsic value contained in discarded metal products, there is a need for policies and

incentives to support the market system's ability to effectively realise this value by promoting recyclability, collection and recovery of metals.

3.2.3 Sustaining the Industry

For the industry to meet growing demand for minerals and metals, it has to be able to attract the investment capital required to explore, to build new mines, refineries and smelters, to invest for higher productivity and to research new technologies. To do this, it has to be profitable enough over the medium to longer term to sustain investor support.

In fact, the profitability of companies in the minerals industry has been unsatisfactory. Over the past 25 years the industry has generated a 5% per annum compound real rate of return. (This analysis covers most of the major international mining companies, and returns are made up of share price appreciation and dividends.)

Over the past 25 years, annual returns have fluctuated dramatically. There is some evidence that industry returns are falling at the same time as volatility is increasing. Also, the average disguises the performance of individual companies. For instance, in a sample of forty international resources companies that have remained listed since 1970, the top quartile performers produced a long term real US$ return of about 10% per annum, while the bottom quartile delivered - 2% per annum.

Management and boards are responding by implementing more exacting cost control measures, capital management programs and through the process of consolidation. The spate of mergers and industry consolidation presently underway in the gold, aluminium and copper sectors will change the industry structure resulting in fewer but larger companies. The continuing government privatisation programs are also

altering the structure of the industry. Size is a factor in attracting capital. The top 150 listed international minerals companies had a combined market capitalisation of US$320 billion at the end of 1999. This global industry market capitalisation is lower than that of a number of individual companies such as Microsoft (US$600 billion) and GE (US$500 billion).

Structural change in the industry is being driven in part by the requirements for companies to be much bigger in order to attract the support of financial markets and fund managers.

The growth in Socially Responsible Investment (SRI) funds is a related issue. This is an emerging business and the methodologies being used by investment funds and ratings agencies are currently still being developed. There is no clear model of what is a socially responsible company. Some funds declare some activities to be unethical on an essentially arbitrary basis. This often includes uranium mining, and sometimes coal mining or mining in general. Other fund managers allow a percentage of uranium mining as acceptable in a mixed portfolio.

Although three major mining/metal companies are listed on the Dow Jones Sustainability Index, approaches currently being taken by SRI funds are generally producing outcomes inimical to the mining industry. As noted, under the "negative screening" approach, mining is often excluded as a whole, or companies are being excluded, e.g. if they mine uranium. Clearly this does not reward well-managed, responsible mining companies. Under the "best of sector" approach, only major companies tend to be rated, thus disadvantaging smaller minerals companies which have strong environmental management credentials.

It is a challenge for the investment funds and ratings agencies to develop meaningful, consistent and transparent approaches to their ratings and to engage with the industry as it does so. Equally the industry will need to work with the ratings agencies to improve screening processes, focussing on relevant information, comparability and transparent methodologies.

The achievement of improved rates of return on capital is related to the mining and metals industries' ability to deal constructively with the challenges of sustainable development. A more profitable industry will clearly be better able to respond to the growing demands of sustainable development. Additionally, an industry which is more focused on the sustainability of its own activities will be better attuned to dealing with the challenges of sustainability on the broader stage. Both are dependent on behaviour which takes due account of the long term, including long term relationships, and both rest on behaviour which seeks to avoid waste and to reward efficiency.

Whether there will be a flow-back from the increasing demands of sustainability to the profitability of the industry is less clear. However, growing social and environmental demands associated with sustainable development will make entry to the mining industry an increasingly costly and complex process. Those without a track record of achievement in social and environmental matters may find it difficult to persuade those controlling access to resources and to the necessary finance to support their undertakings. Such constraints could conceivably have a constructive influence on profitability of the industry to the extent that over-zealousness in the creation of new capacity in the past has been a significant contributor to industry's poor performance.

3.3 Economic Contribution of the Mining and Metals Industries

As noted, poverty alleviation is a fundamental concern of the UNCED agreements and remains central to progress towards sustainable development. The mining and metal processing industries play a direct and indirect role in wealth creation in many countries. Increasingly, much new development is occurring in remote areas in developing countries which poses both opportunities and challenges.

One of the critical areas that must be addressed in relationship to mining activities is the transparent distribution of rents including the elimination of corruption at high levels of some governments. Mining activities often elicit significant demands for economic benefits from the industry. These include, for example, national governments, local governments, local communities, health authorities, education systems, highway departments, and telecommunication providers. It is unrealistic for mining companies to be expected to fund everything that may be demanded of them or to assume those activities they do fund to have a continuing financial liability in perpetuity. The key will be to define at the beginning of the process the responsibilities of all of the principal parties including national government, local government, international aid agencies, local development NGO's and other civil society organisations, and the mining companies. In those cases where some parties can not or do not, fulfil their role the mining companies responsibility should be twofold: (a) to play their role fully and with integrity, and (b) where appropriate form partnerships with others to help them develop the capacity they need to fulfil their respective roles better.

3.3.1 Managing Mineral Wealth

In many countries, the mining and minerals industries provide a significant national and local economic and social contribution, including to GDP, exports, employment, training, infrastructure, business development, community programs, and other benefits such as

technology or mining services spin-offs. The industry can also bring significant economic and social challenges to countries and communities. Sound policy and management is required to ensure that net benefits are derived, and that there is beneficial use of the wealth generated, including in local and regional areas hosting the mine.

In some developing countries mining and metal processing industries are the dominant industry in terms of providing an engine for growth, investment, exports and employment and over the last decade, much of the growth in production has occurred in developing countries, some of them amongst the poorest in the world.

Global exploration expenditure and global investment to develop mines represent significant foreign direct investment flows.
Some US$4 billion is spent on mining exploration globally.

TABLE 5: GLOBAL EXPLORATION EXPENDITURE US$ MILLION

Countries	1997
Latin America	1170
Australia	673
Africa	667
Canada	436
South East Asia	440
US	365
Rest of the World	283
Total	**4034**

Source: London Mining Journal

Mining has played and continues to play, a significant role as the foundation for economic growth in many countries.

In South Africa:

- Mining provided the critical development of infrastructure such as power stations, communications, rail networks.
- Mining was responsible for the development of the Johannesburg Stock Exchange and still constitutes 30% of the market capitalisation of the exchange.
- Mining was behind the development of South Africa's research and development structures and its financial services industry.
- Mining has declined in terms of its direct contribution to GDP, but 59% of South Africa's exports are derived from primary and beneficiated mineral exports.

In Chile:

- Chile's export income is generated mainly from primary industry, the most important of which is mining.
- Investment in the mining industry was estimated at US$1.1 billion in 1999, but is estimated to have been US$600-700 million in 2000, with fewer projects coming on-stream.
- In 1999, Codelco was the world's largest single copper producer, which controls around 20% of the world's known reserves of copper, and estimates that it has seventy years of production at current levels without finding further reserves.
- In 1999, Codelco created the Institute of Innovation in Mining and Metallurgy to focus on more innovative production using fewer resources.

A number of developing countries have mining as the dominant industry. Rod Eggert, Colorado School of Mines, in a paper to an

MMSD Workshop on Managing Mineral Wealth, said that mineral economies can be defined as those in which minerals output is greater than 8-10% of GDP, or those in which minerals exports are greater than 40% of total merchandise exports. Using the GDP measure, in 1998 the developing countries mineral economies (excludes fuel minerals) were:

Botswana	Papua New Guinea
Costa Rica	Sierra Leone
Chile	South Africa
Congo, Democratic Republic (former Zaire)	Sudan
Madagascar	Suriname
Namibia	Togo
Niger	Zambia

Having economic deposits of mineral resources is an asset for countries, but does not of itself guarantee sustainable development. The wealth generated needs to be invested in other capital including physical infrastructure and facilities, human capital, political and social institutions, culture, and technology.

Philip Daniel, (1992) University of Sussex

> "It is possible to turn a mineral windfall to advantage, but it is also possible to create a development pattern that is worse in (terms of welfare) than that which would have been in place without the minerals. The outcomes depend largely on the things governments do and thus on the pressures and interests that form and influence governments".

At the national level the problems of managing mineral wealth are well known - minerals rents are often inappropriately expropriated, there are

regulatory distortions, as well as problematic exchange rate and inflation effects of mining sector development. These problems can be addressed by governance reforms, and by governments, communities (and other civil society) and companies as the key players acting in close partnership in order to ensure that minerals sector investments outcomes are consistent with sustainable development.

It is the governments' role to facilitate the creation and sustainability of mineral wealth; they have the primary responsibility for managing the broader economic and political effects of mineral related development.

Communities and civil society have an indirect role in the process of decision making and creating and sustaining mineral wealth. They have an oversight or watchdog role in managing the economic and political effects.

There is considerable debate about the role of companies in the development process. Companies should concentrate on profit maximisation in a responsible manner from a social and environmental perspective. In addition, they have an evolving but ill-defined role in sustaining economic benefits and in managing broader effects.

Currently some mining companies are taking the lead in developing strategies and tools for sustainable development in their respective areas. These efforts have not been coordinated, and are not directed by any particular policy or guidelines. There is a challenge for governments to use these experiences to help set Sustainable Development policy directions.

3.3.2 Creating Sustainable Community Legacies

At the community level, the mining and metals industries can make an important contribution to sustainable development by providing direct jobs and other livelihoods, training, local business development, compensation payments, health programs, education, agricultural training, providing opportunity for women, etc.

In developing countries in which mining countries operate, considerations of sustainable development bring with them obligations to consider a much wider range of social commitments which, in developed countries, would be shared with a wide range of government and other agencies and contributors. While in many cases, mining and metal processing operations have improved the situation of communities, some problems have been created or exacerbated by mining and metal processing developments.

In particular, a lack of strategy on sustainability issues will cause a major impact on mine closure at both the local and provincial areas. This will not only affect an orderly exit of these mining companies from the area of their operations, but will result in substantial decrease in essential services, and maintenance of public infrastructure contributed by these operations, a significant decline in standard of living (food security, collapse of local businesses, drying up of cash income into the area).

Traditional communities face special difficulties in relation to sustainability, in terms of maintaining traditional lifestyles. Their systems of status and social organisation are often the first victims of change.

How should companies meet the challenge of mineral development in regions where there is poor political will at the national level and weak capacity for communities at the local level? Local authorities need to be capable of formulating and executing plans for the development of social and physical infrastructure. People in the local communities need to be able to identify and use new economic opportunities. Companies need to be prepared and able to provide support. But there is no blue-print on how to build capacities and companies, communities and governments are all learning.

Through the Sustainable Development Charter, ICMM member companies have committed to the following set of community responsibility principles:

- Respect of cultures, customs and values of individuals and groups whose livelihoods may be affected by exploration, mining and processing.
- Recognise local communities and other affected organisations and engage with them in an open, transparent and effective process of consultation and communication from exploration through production to closure.
- Assess the social, cultural, environmental and economic impacts of proposed activities and engage with local communities and other affected organisations in the design of community development strategies.
- Contribute to, and participate in, the social, economic and institutional development of the communities where operations are located and encourage the establishment of sustainable local and regional business activities.
- Reduce to acceptable levels the adverse environmental and social impacts on communities of activities related to exploration, extraction and closure of mining and processing facilities.

- Respect the authority of national and regional governments; take into account their development objectives; contribute information related to mining and metal processing activities; and support the sharing of the economic benefits generated by operations.

Each mine and mining community is different and case studies are required to develop an understanding for approaches being taken.

3.3.3 Case Studies

Richards Bay Minerals (RBM) Community Program

RBM's communities include some of the poorest urban and rural communities in Kwa Zulu - Natal. The company has run ongoing social investment programs over twenty-five years. A formal five year plan developed in 1998 is reviewed and updated annually, with goals being set and performance evaluated, focussing on four main areas:

- education
- health care
- rural development/agriculture
- economic empowerment.

Social uplift projects are implemented in partnership with local communities, relevant government departments, and community based organisations in response to community needs. Projects target thousands of people within a 50km radius of RBM's operations, e.g. more than 30,000 children are at RBM supported schools and crèches; some 4,000 jobs have been created through the Small Business Advice Centre; 600,000 patients have attended RBM supported clinics since 1991, capacity building and skills development/adult education reaching some 30,000 people.

Placer Dome's Western Areas Joint Venture Care Project

Placer purchased 50% of the South Deep Mine in South Africa's Witwaterstrand Basin in April 1999. The Joint Venture will expand and modernise the South Deep Mine over the next several years and aims particularly to improve operating safety and sustainability. However, technological modernisation and other investments in efficiency necessitated a reduction in the workforce and a retrenchment of 2,560 workers occurred from July to October 1999.

Industry wide retrenchment of over 100,000 workers in the South African mining sector in the past decade has taken a severe toll on mine worker communities. The Care Project trained and employed local community development workers to work with the retrenched miners and their extended families to identify viable alternative opportunities, training, seed capital and coaching. The short term goal of the project is for at least 70% of the retrenched employees or their proxies to become economically active. The program's infrastructure also benefits families of those removed from economic productivity as a result of HIV/AIDS.

The Care Project is conducted as a tripartite partnership - government, private, civil society groups. The Canadian International Development Agency has provided guidance and has agreed to invest significant financial support to broaden the project's scope and duration. The World Bank has characterised the Care Project as an innovative pioneering project that could serve as a model for the mining industry throughout the developing world. Care Project management is in discussion with the World Bank about supporting skills training and enterprise development components.

Natural Resources Cluster of Business Partners for Development (BPD-NRC)

The BPD-NRC is one of four such "clusters" initiated by the World Bank to explore how businesses, governments and civil society can work more closely in the form of "Tri-Sector Partnering".

The objective is to explore new ways of managing social issues within the extractive industries. The logic of organisations pooling their complementary resources, knowledge and skills, based on each of their own competencies to jointly address complex social problems is impeccable, but a framework for operationalising the "Tri-Sector Partnering" has not been adequately developed.

BPD-NRC has been in operation for two and half years with the goal of systematising the concept of partnering over a sustained period. As well as a series of guidance and workshop training manuals, BPD-NRC has developed specific mining case studies:

- Rio Tinto's Kelian gold mine in Indonesia, which is focussing on mine closure issues.
- ICML's Sarshatali coal-mining project in India.
- Placer Dome's Las Cristinas gold mine in Venezuela.
- Anglo American's Konkola Copper Mines in Zambia

Artisanal Mining

Artisanal mining, the informal and less mechanised form of small-scale mining has expanded in many Asian and Sub-Sahara African countries, mainly as a result of deteriorating agriculture-based livelihood, formal sector retrenchment, and growing impoverishment. Although artisanal mining contributes to alleviating poverty temporarily by providing subsistence, it hardly qualifies as a poverty reduction activity since it is unsustainable. Economically haphazard, its practices are socially and environmentally destructive unless properly organised. In many countries, the organising of this sector has become an elusive task.

The sheer increase in the number of miners is overwhelming government services, often resulting in land conflicts, clandestine operations and lawlessness. This can create problems also for the formal mining sector, with encroachment on lease areas and operations, or with environmentally damaging practices which can destroy rehabilitation or destabilise mining areas.

The World Bank has established a Consultative Group for Artisanal and Small Scale Mining (CASM). The goal is to establish a forum that would provide a coordinated approach to assessing and addressing some of the problems of this sector.

Improvements may ultimately only occur if government development agencies, etc. can create alternative sustainable livelihood for poverty reduction. Until macro-policies can deliver results, the mining industry should play a part with others in seeking ways to improve the safety, and environmental impacts of artisanal mining.

3.3.4 Community Health Case Studies

Mining companies can be ideally placed to assist in community health programs as they operate (and therefore possess infrastructure) in geographically diverse and sometimes remote communities where local or national governments find it difficult to apply resources.

In Papua New Guinea, Placer Dome has a program to eliminate filariasis as a public health hazard within a district of Milne Bay Province in which its Misima Mine is located. The company employs 750 people from the surrounding community, but the filariasis program will extend to 39,000 people living in over 136 villages scattered amongst the Islands.

In the Tabubil area of Papua New Guinea, public health has improved greatly since the Ok Tedi project started, with infant mortality down from 300 per thousand to less than 15 per thousand, and average life expectancy up from 30 years for men to more than 50 years. The incidence of malaria among villages within a 40 kilometre radius of the mine has decreased from 70% of children to less than 15%, and in adults from 35% to less than 6%.

In Kalimantan, the Rio Tinto Foundation has a five year TB Program based on a Memorandum of Understanding signed in 1997 involving the Ministry of Health, WHO, East Kalimantan Provincial Government and Kutai Regency and the Indonesian Association Against Tuberculosis. The program has consistently surpassed the WHO target cure rate of 85%. It has been extended to cover the whole of West Kutai Regency (approximately 150,000 people over 31,000 square kilometres). AusAID has also supported the program since 1999. Regency.

Anglo American and AIDS

AIDS has recently been identified as the most important cause of adult fatality in South Africa; it is arguably the most important challenge facing the country.

For fifteen years Anglo American has taken a leadership role in seeking to respond to the disease. AIDS is a major threat to the workforce, but the health of the workforce cannot be separated from that of the wider community. As a result, Anglo American has sought to involve the community in its response to AIDS. For most of the period, the emphasis has been on prevention. Interventions have included:

- education programmes and the distribution of free condoms;
- establishing the prevalence of HIV infection through anonymous prevalence surveys;
- community programmes designed to enhance the ability of women to exert more control over their lives through, for example, income creative schemes;
- implementing large scale prevention and treatment campaigns for sexually transmitted infections (cofactors in the transmission of HIV) including through outreach to sex workers in the community;
- implementing a formal system of HIV/AIDS reporting;
- supporting HIV clinical vaccine trials.

Anglo American is changing the emphasis of its programmes to include stress upon voluntary counselling, testing and treatment.

3.3.5 Community Safety

Major mining accidents are not common but they do occur, and can cause severe environmental and community damage. Recent tailings dam failures have generated a lot of concern and follow-up activity within the industry and amongst NGO's, regulators, UNEP etc. Tailings dam spills at Aznalcollar in Spain and Baia Mare in Romania have attracted intense scrutiny and reduced public confidence in the industry's ability to manage its risks. Previous accidents including at Marcopper in the Philippines, and Omai in Guyana also had serious environmental and community impacts. Many companies have strengthened their tailings management auditing and monitoring systems as a result.

ICME has worked with its members and with UNEP to focus on issues concerning tailings dam management and dam failures e.g. two international workshops in Stockholm 1997 and Buenos Aires 1998.

The industry also worked with UNEP on a dedicated Mining Accident Prevention and Emergency Preparedness Project in 2000/2001. The elements of this Project were:

- To improve procedures for cyanide management in mining globally (see cyanide code, in Part 8).
- To improve the on-ground application of sound engineering practices throughout the lives of tailings containment facilities.
- To strengthen the effectiveness of regulation by holding the first international government Workshop on Accident Prevention in Mining.
- To develop an APELL for Mining Handbook (APELL is a UNEP program on Awareness and Preparedness for Emergencies at Local Level) to give companies practical guidance in planning for

emergencies. The Handbook puts particular emphasis on risk reduction, community involvement and preparedness, integrated planning, plus improved communications in the event of an accident.

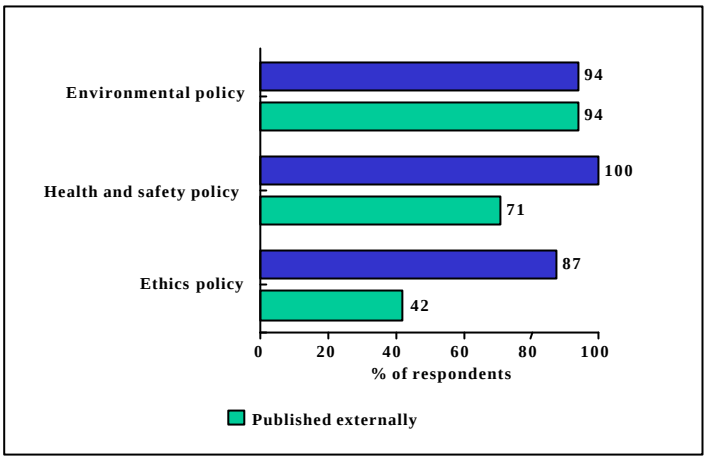
The Project's results will depend on the implementation of its outputs and the industry will continue to work with UNEP and other partners to assist in dissemination and uptake. Arresting accidents is necessary to re-establish community confidence in the industry and is a critical element in the progress being made by the industry towards sustainable development.

3.4 Ethics and Human Rights

In considering the social and economic dimensions of sustainable development, an important element is deepening the commitment to ethical behaviour and respect for human rights. The industry is having to consider its approach to these matters, since it often operates in countries or regions where unethical business practices and human rights abuses are prevalent.

The PWC Mining and Minerals Sustainability Survey found that the majority of respondents have ethics policies in place, although they are not necessarily made public.

TABLE 6: POLICIES FOR KEY SUSTAINABLE DEVELOPMENT RELATED AREAS



Source: PWC Survey

In December 2000, the Governments of the United States and the United Kingdom announced a new set of voluntary principles to guide companies in maintaining the safety and security of their worldwide operations within a framework that ensures respect for human rights and fundamental freedoms. The new principles are the result of a multi-stakeholder dialogue between the governments and companies in the extractive sectors (e.g., Rio Tinto, Freeport McMoRan, major oil companies) and various NGO's (e.g. Amnesty International, Human Rights Watch, the Prince of Wales Business Leaders' Forum) with an interest in human rights and corporate social responsibility. The participants have agreed to keep the principles under review to ensure their continuing relevance and efficiency.

Guiding principles are provided in three areas:

1. Identification and assessment of the risks present in a company's operating environment, including an understanding of the root causes and nature of local conflicts, as well as the standard of adherence to human rights and international humanitarian principles of the key actors.

2. Interactions between companies and public security (regarding security provided by host governments to companies).

3. Interactions between companies and private security (in those circumstances where host governments are unable or unwilling to provide adequate security to protect a company's personnel or assets).

3.5 Worker Health and Safety

The health and welfare of workers in this sector have been a high priority for many years. Significant progress has been made and safety standards such as those advocated by the National Occupational Safety Association have been adopted. However, workplace hazards management often differs dramatically between operations in the developed and developing countries. Poor working conditions in developing countries, particularly among artisanal miners, often place those individuals in situations of substantial risk to their health. Deaths in underground mines in China and FSU countries continue at untenable levels, but reports are patchy. However, deaths also continue to occur in developed countries at unacceptable rates. Table 7 shows that the numbers of deaths have been reducing over the decade, but in terms of fatal injuries per million hours worked, the rate is declining only very slowly if at all.

TABLE 7: MINING FATALITIES

Year	South Africa	USA	Australia	Canada
1990	$675_{0.43}$			**Figures not Available**
1991	$604_{0.40}$	$40_{0.11}$	$40_{0.2}$	
1992	$552_{0.46}$	$34_{0.10}$	$25_{0.13}$	
1993	$481_{0.45}$	$38_{0.12}$	$19_{0.12}$	
1994	$440_{0.40}$	$35_{0.10}$	$20_{0.09}$	
1995	$472_{0.44}$	$43_{0.12}$	$32_{0.15}$	
1996	$390_{0.37}$	$36_{0.10}$	$7_{0.03}$	
1997	$357_{0.35}$	$44_{0.12}$	$33_{0.15}$	
1998	$319_{0.37}$	$39_{0.11}$	$19_{0.09}$	$2_{0.07}$
1999	$309_{0.34}$	$40_{0.13}$	$10_{0.04}$	$2_{0.09}$
2000	$285_{0.33}$	$30_{0.13}$	$18_{0.11}$	$5_{0.21}$

Source: Minerals Council of Australia, Mines and Aggregates Safety and Health Association, Ontario, Canada, Mine Safety and Health Administration, Washington, USA, South African Department of Minerals and Energy

(Sub-script figures are fatal injuries per million hours worked. This is given to assist in comparing countries' data).

Table 6 showed that 100% of the mining and metal processing companies or organisations surveyed by PWC had health and safety policies in place. Management systems needed for safety are being widely adopted. Within companies, most CEO's have safety amongst their highest priorities to provide commitment to push the pace of cultural and systems change in their organisations and across the industry more generally. Nevertheless, safety improvement has been much more difficult to achieve than the companies and professionals working in the minerals industry expected.

There are three basic parts to the fundamental safety management model: safe workplaces; established technical standards and safe practices and procedures; properly skilled, trained and motivated workers.

In relation to workplaces, the mining and metals processing industries must adopt the rigorous engineering based "process safety" approach that other hazardous industries have developed for the engineering, design, and operation of workplaces. Practices as hazard and operability studies (Hazops), risk assessment and risk management planning must be applied universally. For instance, the offshore petroleum industry has applied an ultra-rigorous management Safety Case approach for some years which could have relevance in the mining industry.

There are a number of countries where mines are becoming deeper as they age. Environmental drivers may also lead to a swing from open-pit mines to underground operations in the future. This will have implications for worker safety. The role of technology is important and industry-sponsored research and development work is being directed to enable safe mining in much deeper, hotter conditions.

Occupational Health

There can be large differences in occupational health experience and management between developed and developing countries. In developed countries, in both the 1980's and the 1990's, soft tissue injuries (e.g. sprains, strains) and traumatic injuries (e.g. fractures, lacerations) made up a large proportion of mining industry injuries. Nevertheless dust and respiratory issues also remain of concern.

Research effort is an indicator of the relative importance and intractability of issues. Research efforts internationally have been categorised as follows:

- dust and respiratory issues - 66%
- fire - 15%
- ground, wall or roof support - 14%
- ventilation or air quality - 10%.

ICME has been active in the occupational health area and has produced a training manual for member companies entitled "Infrastructure and Systems for Risk Assessment of Metals and Metal Compounds on Human Health". This manual is a practical guide for companies to develop and implement a data collection system that should improve the assessment of risk in the workplace, particularly of different species of metals and metal compounds.

PART 4: ENVIRONMENTAL DIMENSION OF SUSTAINABLE DEVELOPMENT

Elements in Agenda 21 relevant to the mining and metals industries industry

• Protection of the atmosphere • Managing fragile ecosystems • Land conservation and rehabilitation • Conservation of biological diversity • Protection of the oceans, protection of freshwater resources • Environmentally sound management of toxic chemicals • Environmentally sound management of wastes

Overview

Large mining and metallurgical operations have substantial impacts on the environment. Sustainability requires that the impacts be well managed and not result in unacceptable or irreversible changes to the ecology. The industry's environmental performance is a key determinant of its reputation and expectations and performance are continuously rising. The industry has substantially improved its environmental practice, particularly over the past two decades, although examples of poor management and environmental performance including incidents of chronic and acute environmental damage do still occur.

The environmental impacts of the mining and metals industry continue to be among the most contentious issues confronting the industry. Priority issues include the past legacy of abandoned mines, mine closures, the management of large volume waste, tailing management including submarine disposal, air and water quality, management of toxic chemicals, conserving biodiversity, and energy use. Much of the progress that must be made in the transition to sustainable development will involve environmentally related issues.

Table 8 gives an overview of environmental issues associated with mining and minerals processing and the approaches to minimising impacts.

TABLE 8: OVERVIEW OF ENVIRONMENTAL ISSUES AND ACTIONS

Issues	Actions
Impact on biodiversity	• Minimise land clearing e.g. reduce number of access tracks, minimise erosion, rehabilitate disturbed land. • Properly characterise and document pre-existing (baseline) eco-systems. • Achieve and monitor long-term ecosystem recovery and stability. • Protect significant flora and fauna.
Water conservation	• Set water efficiency targets where appropriate to encourage water conservation. • Monitor and reduce impact of groundwater extraction from underground aquifers.
Surface and groundwater impact	• Reduce discharge to surface and groundwater. • Prevent sediment run-off. • Design and manage processing and tailings retention systems to reduce see page. • Recover contaminated water.
Energy conservation	• Set energy efficiency targets.
Climate Change	• Measure all greenhouse gas emissions. • Develop targets and action plans to reduce emissions per unit of production.
Sulphur dioxide emissions	• Reduce sulphur dioxide emissions with best practice smelter technology taking into account local impacts e.g. use of acid plant, hydrometallurgical technology.
Dust from roads, mines, processing facilities, tailings retention facilities, waste rock piles	• Develop cleaner production processes to reduce dust e.g. cover exposed areas, dust suppression. • Rehabilitate waste rock piles, tailings facilities, used access tracks.

Issues	Actions
Change in existing landform and creation of new landforms from waste rock stock piles, mine voids	• Rehabilitate new landforms to ensure stability, safety and reduced visual impact. • Aim to provide environmental or social benefit. • Monitor water quality in voids.
Toxicity from certain forms of metals	• Monitor impact of metals on vegetation, aquatic and human environments. • Risk assessment and risk management. • Product stewardship.
Cyanide management in tailings storage facilities	• Develop site-based targets and management plans for cyanide reduction in tailings storage facilities.
Exposure and handling of chemicals, residues and emissions e.g. mercury, asbestos, acids, dioxins	• Implement management plans for the substitution, use and disposal of chemicals and residues.
Acid mine drainage	• Prevent or manage acid mine drainage by identifying potential acid forming wastes and developing management plans.
Integrity of tailings storage facilities	• Build, operate, monitor, and close facilities according to good engineering design and practice. • Implement tailings stewardship management systems.
Mine site and smelter waste	• Identify opportunities for reducing, reusing and recycling waste. • Use of tailings as backfill in mines. Continue to investigate options for re-use of tailings.
Radiation exposure from mining uranium (and some other minerals)	• Reinforce existing procedures to protect human safety.
Soil contamination from oils, treatment residues, and spillage of chemicals	• Clean up and dispose of contaminated soils. Implement practices to prevent spills.

Issues	Actions
Abandoned mines, equipment	• Develop closure plan which covers all aspects of mine clean-up and rehabilitation.
Noise	• Monitor and reduce noise emissions to acceptable standards.

Not all of these issues can be covered in this Working Paper. This Part discusses three of the issues of particular importance to sustainable development.

- **Reducing impacts of operations**, i.e. emissions to air and water; tailings and wastes; acid generation.
- **Improving the eco-efficiency** of mines and mineral processing facilities, especially energy, water. Climate change policy and minerals processing challenges.
- **Managing land well**, for biodiversity and fragile ecosystem protection.

In Part 7 of the Working Paper, certain tools being used by the industry to make progress in managing environmental and sustainable development issues are examined.

The following gives an overview of the evolution occurring in approaches to environmental management:

- Environmental policies, management and audit systems are in place in most large companies.
- Public environmental reporting has been adopted by many major companies in the industry and is driving performance through public accountability.
- Many companies are adopting emission reduction targets, and voluntary reduction programs. Energy efficiency audits and efficiency of water use are gaining management focus.

- A number of codes of principles and practice have emerged in recent years and more are being developed.
- Environmental Impact Assessments, risk assessment and risk management tools are evolving and being widely used.
- Accident prevention and tailings management are receiving renewed attention.
- Research into intractable environmental problems such as acid rock drainage, is continuing with cooperative industry efforts. Rehabilitation and eco-system research continues as a priority.
- Technologies strategies are targeting eco-efficiency benefits as well as emission and waste reduction.
- Metal risks and toxicity issues have become better understood and tools, methodologies and data to enable sound risk assessment and management are improving.
- The difficult issue of the legacy of past environmental practices and abandoned mines remains unresolved and requires attention by governments and the industry.

4.1 Reducing Environmental Impacts of Operations

4.1.1 Reduction of Emissions

Mining and smelting and refining companies monitor key emissions to air, land and water, and key inputs used. They are required to report emissions to regulators and in some countries also report publicly under Pollution Release and Transfer Registers (e.g. the U.S. TRI, Canadian NPRI, Australian NPI). Emissions and inputs are also reported in companies' public environment reports. Typically, these cover:

• water discharges - volume, cyanide, suspended solids, metals • air emissions - sulphur dioxide - fluoride - greenhouse gases - oxides of nitrogen • waste disposal - to landfill - hazardous waste	• land disturbed, rehabilitated in use • water usage - fresh - impounded - recycled • energy and electricity usage - total + per tonne of output • spills

In some cases other data of significance are reported depending on the operation. These can include such things as dust, noise, metals discharged to the environment, composition and volume of material discharged to tailings storage facilities, waste rock moved on site, ozone depleting substances.

Monitoring these indicators allows the establishment of reduction targets - usually at the operational site level though on occasion set by the corporate centre.

Global data on emissions reductions achieved is not available. The ARET program in Canada, however, shows that progress can be and is being made.

Accelerated Reduction/Elimination of Toxics (ARET) Program

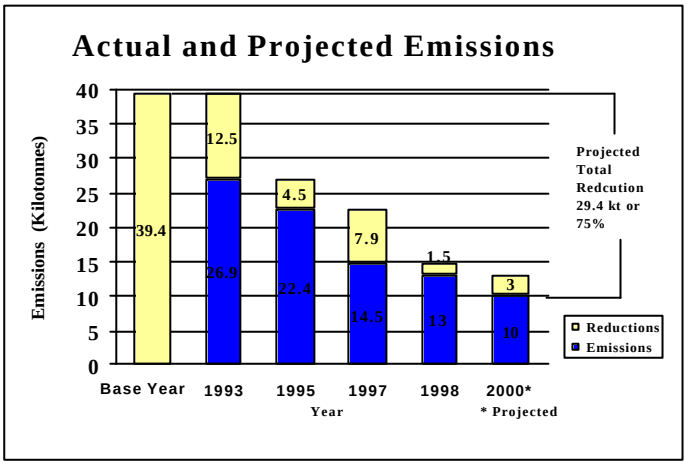
ARET is a multi-stakeholder voluntary initiative involving industry, health and professional organisations and governments. It targets 117 substances, for emission reduction.

The member companies of the Mining Association of Canada who participate in the ARET program (97% of members) have achieved a 70% reduction in emissions of ARET compounds over the 1990's.

Overall 316 facilities (mining and non-mining) have reduced toxic substance emissions to the environment by 67% from base year levels to December 1998, rising to approximately a 75% reduction by end 2000.

Reductions achieved include arsenic 50%, cadmium 69%, copper 54%, hydrogen sulphide 52%, lead 70%, mercury 90%, nickel 77% and zinc 82%.

TABLE 9: ARET EMISSION REDUCTION PROGRESS



4.1.2 Minerals Processing Emissions and Wastes

The mining and metals industries, like all industry (and community) sectors, contributes to global environmental inputs of a range of chemicals, and is perhaps unique in the huge tonnages of low concentration materials that it processes. The diversity of existing mining and metals operations makes an overall assessment of its

sectoral impacts on health and the environment difficult to collate but several key issues can be readily identified through the examination of "generic" waste issues. Key air emissions from the mining/metals industry include dust and a range of gases (sulphur gases, carbon monoxide, PAHs, volatile organics, hydrogen fluoride and ammonia). Often in metals processing, these wastes are recycled for breakdown in process furnaces and captured in baghouses in order to minimise eventual emissions. Metal oxides and sulphates also occur within the dust, so that this recycling also maximises metal recoveries.

The dust issue is one of wide interest to the industry as it affects both mines and minerals processing activities. Recent regulatory developments around the world have seen a broadening of interest from one focused solely on limits for dust of less than 10 microns in diameter to one also focused on dust less that 2.5 microns in size. The latter size is considered in scientific circles to be more relevant to health effects. The mining/metals industry has been closely involved in consultations aimed at deriving better measurement techniques for dust. This work has focused on the real time measurement rather than sporadic measurement of dust and improving the understanding of the co-removal of other contaminants (e.g. dioxins and PAHs along with dust). Much of the technology required to better understand these important aspects of dust emissions is still in its earlier stages of development.

Emissions of sulphur gases (sulphur dioxide, hydrogen sulphide) mostly occur from metals processing activities such as steel industry coke ovens and furnaces and aluminium, copper and zinc refining activities. There have been notable technological breakthroughs in metallurgical processing over the past twenty years, particularly in relation to copper and nickel smelting and refining. The Kennecott-Outokumpu flash

converting process has set new standards in sulphur capture from copper production and 99% of sulphur is now converted to sulphuric acid. The use of this technology now extends to 50% of all copper production and without it; the world's sulphur dioxide emissions would be five to ten million tonnes higher.

On dioxins, the raised international awareness of the possible health effects of exposure to these chemicals has been matched by a raised minerals and metals industry awareness of where its activities may contribute to these emissions. For example, the Minerals Council of Australia recently published two reports aimed at allowing the industry to address the dioxins issue. One report rated various sector activities as potential sources of dioxins. Extraction and primary smelting and refining activities were rated "low potential" while secondary smelting and refining was rated "medium" and iron ore sintering was rated "high". The other report reviewed in detail the testing protocols available to measure dioxin emissions across the industry and recommended the development of emission factors specific to the local industry, supplemented by limited direct measurement using the USEPA Method 1613. Both of these activities reflect industry interest in firstly establishing the extent of dioxin emissions within the industry and secondly measuring and estimating emissions in a well-credentialed and cost-effective manner.

At the company level on dioxins, there is already a focus on implementing proven technologies to reduce emissions. BHP Billiton announced this year the selection of the proven carbon packed bed technology for implementation at the Port Kembla Sinter Plant in Australia. This technology will filter dusts and destroy dioxins from the sinter plant's waste gas stream. Expectations are that waste gas dust levels will be reduced from 80-100 milligrams per cubic metre to

20 milligrams per cubic metre at the same time as dioxin emissions are reduced from 3 nanograms per cubic metre to less than 0.3 nanograms per cubic metre.

Global mercury emissions and their health and environmental impacts are currently under review by UNEP following a decision by Governing Council earlier this year. The mining and metals industries welcomes this initiative which, together with impact analyses, will examine the range of natural and anthropogenic sources, long range air transport and the cost-effectiveness of emission control measures. In the mining and metals industries, mercury may occur naturally in some mineral ores (e.g. gold and coal) but the concentration of these occurrences is dependent on the characteristics of the ore body. Where mercury is recovered during processing this is securely stored prior to its sale.

In terms of solid and liquid wastes, sludges and slags are commonly produced in minerals and metals processing. In the steel industry, such wastes, depending upon their chemical components, may be used in the sintering process or in the construction industry. Further, Outokumpu in Finland has extended its environmental diligence to cover a range of other important issues, including the recirculation of processing water and the use of slags in road building and construction or else recycling.

In the aluminium industry, hazardous waste such as that of spent cell liners has been the subject of intensive treatment research by the aluminium industry and this work continues. In addition, research into the options for the bauxite refining slurry known as "red mud" has led to innovative products such a "Bauxsol". "Bauxsol" is a pellet product made from red mud where the pH has been reduced to neutral so that the pellets offer considerable potential in the control of acidic

conditions. This solution represents a double win because an industry waste is converted into an environmental remediation agent.

The mining and metals industries have also been active participants during the development of the Convention on Long-Range Transboundary Air Pollution (LRTAP). Within the Convention are different protocols dealing with specific emissions including sulphur, nitrogen oxides, volatile organics, persistent organic pollutants and metals.

4.1.3 Tailings Management

A spate of recent and well-publicised incidents involving tailings impoundments has placed the mining industry in general, under intense scrutiny. It is estimated that there are in the order of 3,500 active tailings impoundments worldwide. Major failures occur at a frequency of less than two to five per year (i.e. about 0.1%), and minor failures at a frequency of about thirty-five per year (i.e. 1%). While low, these figures are still unacceptably high.

In most cases, relatively simple, well-understood structural failure mechanisms particularly arising from poor water management were found to be at fault in causing the incidents. That such well-understood mechanisms continue to underlie tailings dam failures illustrates that stewardship practices continue to be lacking in too many cases. This realisation is driving companies and the industry to take proactive initiatives to address tailings stewardship issues. Stewardship needs to extend from conceptual design through closure and include the application of sound design, construction according to design, good management throughout operation, inspection, surveillance, audit and review and managerial roles, responsibilities and training. Stewardship

also includes tailings handling technologies and the mill process itself where the tailings are produced.

Structural integrity is not the only concern. Geochemical stability is also an issue, and dams need to be designed and operated with reclamation and closure in mind.

Initiatives being taken within a number of companies include:

- Internal reviews of tailings management systems.
- Procedures to ensure that all personnel involved in stewardship of tailings facilities clearly understand their roles and responsibilities.
- Formalised dam safety programs including risk assessments, and detailed inspections and review of tailings facilities by specialists.
- Remedial action where weaknesses are discovered.
- Creating or improving operational manuals for tailings facilities.
- Sharing of lessons learned through workshops and publications.

Industry Associations have also been proactive, particularly the Mining Association of Canada and ICME.

The Mining Association of Canada (MAC) has published a document entitled "A Guide to the Management of Tailings Facilities" (MAC, 1998) which provides a framework of management principles, policies, and objectives, and checklists for implementing the framework through the life cycle of a tailings facility. The checklists provided in the MAC guide identify six key elements for ensuring the effective implementation of the management framework:

- Management action/management framework.
- Responsibility/accountabilities.
- Performance measure/indicators/objectives.
- Schedule for completion of significant milestones.

- Technical aspects requiring consideration.
- Other - additional technical, managerial and regulatory considerations related to the management action.

The MAC guidelines emphasise the need to "close the loop" in the management process, which includes confirming that management actions have been implemented, and which seeks to continually improve the management framework.

ICME has worked with UNEP in recent years in sponsorship of seminars, and publication of case studies (UNEP-ICME, 1997 and 1998), related to tailings management. Many of the topics covered directly address stewardship issues. Mining companies provided most of the contributions to these seminars and publications, thereby making them a means for dissemination of knowledge and experience to the international mining community.

ICMM has commenced a process to develop a comprehensive global voluntary guideline for tailings management. The work commenced with a thorough review and assessment of the wide range of tailings codes and guidelines which already exist. The assessment found that while each of the guidelines is strong in some elements, none is comprehensive in all of the dimensions necessary for an ideal universally applicable code.

ICMM will engage stakeholders and experts in a process to develop the tailings guideline. This is recognised as a high priority given the potentially severe consequences of tailings accidents. Even so, to do the work well, it could take a couple of years to develop the guideline to the satisfaction of all.

New technologies and tailings management techniques are also called for to ensure that tailings are placed in structures and in a condition that will optimise their short and long term safety, ultimate stability and aesthetic acceptability. Apart from improving conventional tailings management practices, approaches being researched or trialled include:

- Co-disposal of tailings and waste.
- Return of a proportion of tailings to underground mines.
- Improved liner design and construction.
- Designing the final land use of the structure at commencement of operation, so that the tailings stream is an integral and potentially variable part of mine and mill design construction.
- Dewatering technologies and management of tailings as a paste or as thickened tailings, thus eliminating excess water in and on the tailings structure (Excess water has been implicated in a large number of tailings dam accidents).
- Better design for geo-chemical issues including performance of dry and wet covers.

Not all of these "solutions" will be available in all mining situations, but their investigation and implementation will be driven by the need to change the way the industry manages tailings to design for minimum chronic and acute risk.

4.1.4 Riverine Tailings Disposal

The practice of disposing of tailings into river systems is highly controversial. In some quarters it is regarded as a historical practice which is no longer acceptable. Many NGO's would agree. Few major mines use this method of tailings disposal. Those which are permitted, Ok Tedi, Grasberg and Porgera do so because of the physical characteristics of the operating area which make alternatives impractical. A combination of active seismicity, steep topography,

heavy rainfall and river flows, and lack of suitable land for conventional tailings deposition is operating in these cases. This issue warrants further discussion within the industry and between industry, governments and other stakeholder groups within the economic, environmental and social context of sustainable development.

4.1.5 Submarine Tailings Disposal

Deep Sea Tailings Placement (DSTP) has attracted increasing attention in recent years from the mining industry and NGO's. The industry views DSTP as a viable alternative to terrestrial tailings containment in some locations as long as conditions are appropriate. DSTP can provide a preferred alternative to alienating land which is needed for agricultural or other livelihoods. It can also provide a safer alternative in high seismicity/high rainfall areas.

NGO's have concerns about DSTP, particularly that there is little environmental information regarding its environmental effects or long term recovery. Smothering of benthic organisms is the largest physical impact, but there are other potential impacts through increased turbidity in water columns, potential metal bioaccumulation etc. Companies agree that research is needed at mine sites currently using DSTP as well as on ecosystem recovery rates, post-closure, either via natural pathways or with intervention. Criteria or guidelines could usefully be developed to guide operators, regulators and communities on the conditions which would need to be satisfied for DSTP to be appropriate. Any such guidelines should be developed in consultation with stakeholders.

4.1.6 Preventing Acid Drainage from Mine Wastes

Mine wastes and tailings which contain sulfides such as pyrites, if not well managed, can oxidise to sulfuric acid, leading to the development

of acid water and the mobilisation of iron and heavy metals from the waste material into the environment. This has been a longstanding and intractable environmental issue for the industry.

The Canadian MEND (mine environment neutral drainage) program has undertaken studies for more than a decade to evaluate the effectiveness of dry covers, blending and segregation of waste material with alkaline waste, disposing of wastes underwater, reduction of bacterial populations, use of covers with low permeability to oxygen and the treatment of seepage through wetlands.

The International Network for Acid Prevention (INAP) is an industry based initiative with fourteen member companies that aims to expand this work and to coordinate research and development globally into the management of sulphide mine wastes.

Key areas of INAP research and practical demonstration include co-disposal of tailings and waste rock, with saturation levels maintained within the tailings; new protocols for acid drainage prediction, characterisation modelling and design of waste rock dumps; water treatment technologies; effectiveness of dry and wet covers gaps; maintaining pit lake water quality.

4.2 Improving the Eco-Efficiency of Mining and Minerals Processing

To progress towards sustainable development, further improvements in production, health, safety and environmental performance will be needed to drive the industry to seek lower cost processes which are more eco-efficient - using less resources, with attendant environmental and economic benefits. Advances in technology will be key drivers in achieving sustainable development goals for the sector.

Smelting and refining are energy intensive processes - mining less so. However metals such as aluminium and magnesium, although highly energy intensive to produce, in use, result in energy savings in many applications including autos and aircraft.

As noted, energy and water use are increasingly receiving appropriate management attention. Energy audits are a becoming a more widespread practice. Companies operating in arid environments may also undertake water audits. Improved monitoring and measuring, target-setting and reporting are occurring.

For smelters, energy is the dominant variable cost, which means that energy efficiency through technology, process and management improvements has always been a critical business imperative. Energy costs are critical to the profitability of existing operations and to investment decisions. This means that climate change policies which push energy prices higher will impact the profitability of minerals processing industries. Imposing costs on minerals smelting may drive technological change and improvement but could also result in these industries relocating over time to countries without greenhouse reduction commitments.

4.2.1 Mining - U.S. Industries of the Future Strategy

Mining is one of the industries in the U.S working together to find ways to reduce their energy use and boost their bottom line. Led by the Department of Energy's Office of Industrial Technologies, the Industries of the Future Strategy has two key elements:

- An industry-driven document outlining each industry's "vision for the future".
- A technology roadmap to identify the technologies that will be needed to reach that industry's goals.

The U.S. mining industry's "vision for the future" document includes:

- Reducing the costs of production, increasing the quality of output but minimising human health and environmental impacts.
- Maximising efficient use of energy and raw materials and minimising waste generation.
- Enabling near zero net emissions of greenhouse gases from energy generated from coal.
- Producing recyclable mining products that are competitive with other materials.

The U.S. industry is developing technology roadmaps in several areas to identify research and development pathways needed to reach these goals.

4.2.2 The Greenhouse Challenge Voluntary Agreement

Australian industry, working with the Australian Government, developed and implemented a program of voluntary reductions of greenhouse gases. The program, which has run over some five years has attracted widespread membership and strong commitment from industry and has produced substantial reductions in greenhouse gas emissions in both absolute terms as well as relative to either business-as-usual, or emissions per unit of production.

Each member company develops an inventory of emissions and an action plan of projects to reduce emissions, which is updated yearly. The company submits its plan to government and reports to it on performance against plan. Companies participating have described the cultural and management change which has resulted from the program and the business benefits which have also accrued in many cases as increased focus has been placed on energy and other operational efficiencies. The mining and minerals processing sectors have been at

the forefront of the program. In terms of participation in the Greenhouse Challenge Program by the Australian minerals industry, the recent Evaluation Report highlights that 78% of emissions from mining (including 90% from coal mining) are covered by companies participating in the Greenhouse Challenge Program. On the minerals processing side, 89% of emissions from machinery and metals manufacturing is covered by the Challenge with 100% coverage from aluminium and iron and steel.

4.3 Managing Land Well - Biodiversity and Fragile Ecosystems

While mining is an activity that disturbs land intensively the amount of land it disturbs is limited. Compared with most other industries, mining represents a particularly high "value - added" use of land. It also represents a temporary use of land. While some land may be permanently alienated, most mined areas are reclaimed, rehabilitated and returned to other beneficial use.

4.3.1 Conservation of Biodiversity

"Biodiversity" refers to maintaining the variety and variability of all living things. An important objective for the mining and metal-processing industries is the conservation and sustainability of biodiversity during all phases of mineral-related activity including exploration, operation, processing and closure. Mineral-related activities can impact on biodiversity, both through direct activities and secondary development. However, with good planning and management, the impacts can be minimised and sensitive flora and fauna avoided outright.

The industry can also contribute to the conservation of biodiversity, for example through data gathering and monitoring in remote areas and, by managing land in a way that contributes to biodiversity objectives. Mining tends to occur in remote areas, and as a result, often generates new species identification: as mining is often the first form of

development activity, baseline flora and fauna studies need to be carried out. In the past, new species have been discovered and ranges of species have been extended. Large data sets of biodiversity information covering a wide variety of environments are produced by the mining industry, often in conjunction with academic and conservation partners.

Mining and protected areas has been a controversial issue over the years. Industry agrees that mining may not be appropriate in some rare, fragile and unique ecosystems, but that multiple land use principles can generally be applied, thereby allowing the industry to operate in many protected areas (e.g. IUCN, category V1). Many protected areas are under threat and their management is not always effective. They may be exposed to impacts such as population pressures, cultivation, etc., or a lack of available resources may prevent them from being effectively managed by authorities. It is also recognised that poverty within local communities can result in activities that compromise the ecological values of protected areas. One way to address poverty alleviation and biodiversity objectives is for the conservation community and mining interests to identify areas where they can work together in the context of sustainable development.

Recent workshops to explore the issue of mining and biodiversity have been held with ICME and protected area and conservation specialists. One important event was the workshop on World Heritage and Mining that was organised by IUCN and ICME, in co-operation with the World Heritage Centre, in Gland, Switzerland, September 2000. A set of ten principles that are intended to underpin the relationship between mining and World Heritage interests were developed along with a series of recommendations targeted at three stakeholder groupings: the World Heritage Committee and State Parties; World Heritage Management Agencies; and the Mining Industry.

Regarding future World Heritage sites, agreement was reached that assessments should be based on the principles of sustainable development and sound scientific assessment of natural and mineral values. However, there was a divergence of opinion over the possibility of new and expanded mining operations and exploration activities within existing World Heritage sites. Such activities are strongly opposed by most conservation interests. Industry participants were of the view that as technology and societal priorities change, the option of re-evaluating existing boundaries should be preserved. Nonetheless, there was agreement that opportunities for co-operation and partnership between the mining industry and protected area agencies should be strongly encouraged.

At its 24th session in November 2000 in Cairns, Australia, the World Heritage Committee accepted the conclusions and recommendations of the Gland workshop. The World Heritage Committee also agreed that a working group be established to carry forward work in this field, possibly including the development of a best practice guidelines volume, based on the case studies presented at the Gland workshop.

Freeport's Grasberg mine in Indonesia is located next to the Lorentz World Heritage Site, which is the largest protected area in Southeast Asia and the only protected area to incorporate a continuous transect from snow cap to tropical marine environments. This area has the highest level of biodiversity in the region, including thirty-four vegetation types. A management plan for the reserve has been under development for years but is not yet operational because of insufficient government capacity to tackle some of these issues. As a result, sustainability issues have not been given sufficient attention; for example, there are 28,000 illegal gold miners in the area who dispose of about fourteen tons of mercury a year into the environment. Freeport is

working to develop a sustainable management program for the park and has supported a series of extensive biodiversity studies in the region. Freeport has cooperated with Conservation International and also supports the Kew Gardens in their study of the local flora.

4.3.2 Environmentally Sensitive Exploration

In the case of preliminary exploration programs, remote sensing technology (geochemical, geophysical, satellite imagery, etc.) and the use of helicopters to facilitate prospecting and preliminary drilling programs ensure that this stage of the mineral development cycle will have environmental impacts of little or no significance. Ninety percent of exploration activity ends at this stage. Nevertheless, flora and fauna surveys are increasingly being used by companies prior to exploration, especially in sensitive areas.

At the advanced exploration stage, the potential for environmental impact is greater. However, environmental impact assessment studies and "fly-in/fly-out" arrangements can result in exploration and management programs that minimise adverse impacts.

WMC Limited conducted exploratory drilling for gold in an ecologically sensitive region in Victoria, Australia. Areas where biologically important plants were found were excluded from the exploration program. The drilling area was covered by wood planks and the weight of the drilling rig was redistributed on a broad base to reduce its load on the ground. This was effective in avoiding soil compaction (to preserve plant bulbs) and contamination (from oil and drilling fluids), and in minimising disturbance to vegetation. Preventing the spread of weeds was another concern. Through agreements with local communities and government, a program of soil sampling,

geophysical testing and diamond drilling was successfully carried out with minimal impact on biodiversity.

ASARCO made biodiversity conservation a high priority in its exploration program in French Guiana. The company has formed an Environmental Advisory Committee (EAC), comprising NGO representatives as well as local and international biologists, botanists and ecologists with expertise in rain forests, to advise on all of its work, including the environmental and social aspects of mineral exploration, mine planning, mining operations, reclamation and monitoring. On the basis of a recommendation made by the EAC, ASARCO decided not to proceed with a concession for an area slated to become an extension of a rain forest preserve.

4.3.3 Reclamation and Rehabilitation of Land

Impacts on biodiversity increase when a prospect or mine is developed. However, the total area of impact is reduced significantly compared with the exploration phase. At this stage, careful planning is required to minimise impacts, avoid significant flora and fauna, and plan for rehabilitation. For example, at the outset of mine planning, it is common practice to:

- Develop a closure plan to account for rehabilitation.
- Reduce the number of access tracks and keep vehicles on the tracks.
- Conserve overburden for reuse as a growth medium.
- Plan to rehabilitate or backfill voids (mined out areas), if possible.
- Contour design and rehabilitation of waste rock landforms to encourage rehabilitation and reduce erosion.
- Model and construct final landforms that are stable, able to be rehabilitated and are aesthetically compatible with surrounding country.

- Manage the design and operation of tailings retention facilities so that tailings are contained and the area can be rehabilitated.

Restoring the biodiversity of native ecosystems after mining continues to be an important objective for the mining industry.

Alcoa World Alumina Australia mines and rehabilitates around 500 hectares of the northern jarrah forest in south-west Western Australia each year. The aims of Alcoa's rehabilitation have changed considerably over the years as a result of improved knowledge and in response to an increased emphasis on maintaining biodiversity. One of the main aims now is to restore the high botanical diversity of the jarrah forest. Alcoa has developed targets for plant species richness on rehabilitated bauxite mines to be the same as for native plant species in forest on unmined land after 15 years. In additional research, Alcoa has used fire management to reduce fuel loads and increase species similarity between the rehabilitation and the native forest.

PART 5: ENVIRONMENTALLY SOUND MANAGEMENT OF METALS/PRODUCT STEWARDSHIP

Elements in Agenda 21 relevant to the mining and metals industries

· Changing consumption patterns · Environmentally sound management of toxic chemicals, including prevention of illegal international traffic in toxic and dangerous products · Environmentally sound management of hazardous wastes, in hazardous wastes · Environmentally sound management of solid wastes and sewage-related issues

5.1 Overview

As noted earlier, metals and metal-containing products are well placed to contribute to sustainable development. Unlike other materials, metals are not consumed but merely used and recycled over and over again providing important benefits to present and future generations.

The contribution of metals to sustainable development appears to be constrained by a lack of understanding of the specific characteristics of metals. There are also legitimate concerns regarding the potential impact of metals on the environment and human health that need to be addressed.

From a sustainable development perspective, the challenge is to develop and implement material management strategies that take into account the inherent properties of metals to maximise their service or value to society (social, environmental, economic), while at the same time minimising any adverse impacts. Such strategies could be most effectively and efficiently implemented with a mix of measures, including regulations, industry-led stewardship programs and partnerships with product manufacturers and distributors, etc.

The mining and metal industries commit to working closely with government agencies, downstream users and others to develop sound, balanced and

scientifically based laws, regulations and product standards and to promote the safe production, use and recycling of metals and disposal of metal-containing products.

What follows are examples of industry contributions to important regulatory challenges and evolving risk management/material choice methodologies along with examples of product stewardship activities. The special characteristics of metals are briefly reviewed in order to provide context to the discussion.

5.2 Specific Characteristics of Metals

Metals are ubiquitous in the earth's crust. They make up about 85 percent of the 92 naturally occurring elements i.e., those elements that make up the materials of the universe. Indeed, humans, plants and animals require nutrients that contain metals essential for health, including calcium, chromium, cobalt, copper, iron, magnesium, manganese, molybdenum, potassium, selenium, sodium and zinc. It is well known that deficiencies in essential metal nutrients can have serious and deleterious effects on health. Excess amounts, of course, can also result in human and environmental health risks.

Due to their ubiquitous nature, significant quantities of metals are constantly being released into the environment as a result of natural phenomena, including water and wind erosion, volcanoes, forest fires, decaying vegetation and fissures and pipes in the ocean. Anthropogenic releases come from non-metal related sources such as coal and oil combustion as well as from mining and processing operations and diffuse uses of metals.

Geological and biological processes provide the pathways that enable metals to move between the rocks, soils, waters, atmosphere, and plants and animals. The different compounds, or species, in which metals can occur, have their own individual properties of mobility, solubility and capacity to enter the food chains (termed 'bioavailability'). Of the total amount of metals in the

environment, it is the bioavailable metal species that either meets the nutritional needs of plants, animals and humans, or present risks where they exist in excessive concentrations. Which forms of a metal may have harmful (or beneficial) effects on health and the environment and how best to evaluate those effects are questions of vital interest to regulatory authorities and the mining and metals industries.

5.3 Regulatory Challenges

New regulatory approaches are evolving that will challenge the mining and metal industries. In the forefront is the new EU Chemicals Policy that introduces new ways of assessing chemicals and products and redistributes various responsibilities from government to industry. The EU's Green Paper on Integrated Product Policy (IPP) proposes that a product be designed and manufactured in a way to reduce negative environmental impacts over its entire life cycle. Instruments to further IPP objectives include government procurement strategies, eco-labelling schemes and fiscal measures to encourage demand for greener products. The generation of life cycle assessment models to assist industry in minimising environmental impacts of production processes and products are also being contemplated.

5.3.1 Hazard versus Risk Assessment

Governments are increasingly inclined to regulate products and processes on the basis of a material's inherent toxicity and sometimes on the basis of anecdotal information and limited exposure data. However, in making risk management decisions, it is important to make clear distinctions between the inherent toxic characteristics of a chemical and the environmental and health risks it may pose in specific product applications. To illustrate the difference, use of lead solder in food cans can clearly pose an unreasonable risk because it can leach into food. On the other hand, risks associated with the use of lead in batteries are minimal due to the low human and environmental

exposures associated with the production, use and recycling of batteries. The same toxic material can be used in different product applications that pose different risks and that require different regulatory responses.

Sound decisions require careful consideration of the benefits and risks associated with particular applications, the benefits and risks associated with risk management options including substitution of an alternative substance or product and the socio-economic consequences of each option. Risk assessment models also need to take account of the special characteristics of metals and inorganic metal compounds. Unfortunately, many governments find risk assessments to be costly and time-consuming and are turning to prioritisation mechanisms or other expedient approaches. Such tools may reduce the burden on regulatory agencies but may lead to decisions that hinder, rather than foster, sustainable development.

The industry is working together with governments and other stakeholders to examine more effective ways of conducting risk assessments and contributing to data needs. In Europe, for example, industry proposals to undertake voluntary risk assessments for lead and copper uses have been well received. Industry is providing input to risk assessments being undertaken by regulatory authorities on cadmium (Belgium), zinc (Netherlands) and nickel (Denmark). Eurometaux has also developed a cooperative engagement plan on the new EU Chemicals Policy.

ICME, in aiming to advance discussions on the risk-based approach to metals, engaged experts to prepare a publication entitled "Risk Assessment and Risk Management of Non-ferrous Metals: Realising the Benefits and Managing the Risks (1997)". ICME also initiated the publication of 12 peer-reviewed fact sheets on risk assessment,

following an international workshop on environmental risk assessment of metals and sparingly soluble metal compounds (hereafter referred to as SSMCs).

5.3.2 Persistence, Bioaccumulation and Toxicity (PBT)

Of concern to the metals industry is that PBT criteria developed for organic chemicals are being used by several national and international regulatory authorities as a screening tool to prioritise metals and their inorganic compounds for regulatory consideration. The objective of identifying chemicals that may persist in the environment for long periods of time in a form that can build up in the food chain is extremely important. However, the PBT criteria developed for organic chemicals have limited application for metals and SSMCs (i.e., they do not reflect the special characteristics of SSMCs). This view was articulated by a number of academic experts and presented to the Organisation for Economic Cooperation and Development (OECD). It was also discussed at a US-EPA workshop in January 2000.

Industry is continuing work to develop an alternative, science based approach to PBT for metals. In co-operation with experts on the Ecotoxicity Technical Advisory Panel, a peer reviewed scientific proposal concerning an alternative approach to apply PBT criteria to metals and inorganic metal compounds will soon be presented to the regulatory community for consideration.

5.3.3 Classification of Labelling

Industry has been actively involved in international discussions related to the harmonisation of classification and labelling of dangerous substances. In recent years, attention has focused on classification criteria for metals and metal compounds in the aquatic and terrestrial environments as well as classification criteria for alloys.

In an effort to contribute to the development of classification and labelling criteria relevant to metals and metal compounds, ICME has produced a number of publications, including one report on testing of toxicity of metals and SSMCs in an aquatic environment, which provided a key contribution to an OECD technical workshop, held in Ottawa in 1995. The workshop concluded that hazard identification of an SSMC must be based on the bioavailable fraction in water. This led to the development of an OECD test protocol to evaluate metals, known as the transformation protocol.

A second ICME publication entitled 'Test Methods for Hazard Determination of Metals and Sparingly Soluble Metals Compounds in Soils' has been prepared as an input into ongoing discussions regarding classification criteria for SSMCs in the terrestrial environment.

In the case of alloys, industry is of the view that these should be classified on the basis of their intrinsic properties rather than those of their constituent elements. Work to develop a practical system for classifying alloys will inform discussions at the level of the EU and the OECD.

5.3.4 Waste

Current policy approaches could more effectively support the environmentally sound lifecycle management of wastes and the materials they contain. Waste is currently defined primarily on the basis of a generator's intent to discard. Little or no consideration is given to the physical nature of the waste or to other characteristics such as economic value. Current policies encourage the reduction of waste streams and seek to ensure that disposal operations are managed in an environmentally sound manner. However, they do not encourage

diversion for recycling, although recycling may be preferable from a social and environmental perspective.

Metal recyclables are considered as waste in many jurisdictions. The implications for society are significant. Not only is an important source of materials lost to present and future generations, but also there can be considerably greater environmental impacts associated with alternative sources of supply. To further sustainable development, a key challenge will be to develop waste definitions and regulations that reflect the intrinsic properties of different waste streams and provide incentives to waste managers to return waste to the material stream.

5.4 Eco-efficiency and Life Cycle Assessment

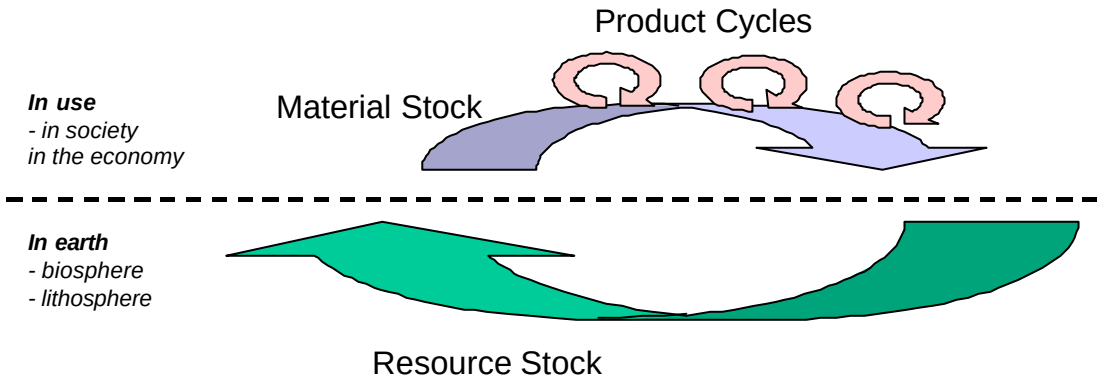
Manufacturers are increasingly concerned with minimising the adverse life cycle impacts of their products. This concern has led to the development of methodologies aimed at measuring the life cycle impacts of products. Life Cycle Assessment (LCA), as defined by an ISO standard, is the tool of choice for that purpose. However, a full LCA is often too costly and burdensome to undertake. This has led to the development of several simplified environmental impact assessment models.

5.4.1 Properties of Materials and Eco-efficiency Models

To obtain further insights into this issue, ICME commissioned a study by Five Winds International entitled: 'Eco-Efficiency and Materials'. The report, published in April 2001, develops a framework that documents and advances the understanding of the specific environmental characteristics of different types of materials. It also studies existing methodologies and examined the possibility of a more appropriate approach for measuring the life cycle impact of materials.

The study points out that there are fundamental differences between the broad families and categories of materials (i.e., wood fibre, plastics and metals) on which most products are based. These differences affect the environmental interactions and impacts throughout the life cycle, from resource extraction to waste disposal. For example, it was noted that both paper and plastic materials are recyclable, but in a limited manner, since their properties degrade with each cycle. On the other hand, metals have the potential for unlimited recyclability.

In a recent article for the ICME Newsletter (Vol. 9 No.1), the authors of the Five Winds study noted the importance of distinguishing between resource renewability and material renewability—they are not interchangeable. For example, wood fibres come from *a renewable resource* but, because of degradation, their properties are not retained when recycled, i.e. they are *a non-renewable material*. On the other hand, metals come from a *non-renewable resource* but, because they are elements, their properties can be fully restored when recycled, i.e. they are a *renewable material*.



With respect to existing methodologies, Five Winds examined seven popular models and found shortcomings in a number of areas. The study concluded that eco-efficiency/life cycle assessment methodologies should acknowledge the specificity of each material

stream. Use of such methodologies would lead to better policy-making by regulators and better material selection decisions by manufactures.

5.4.2 Life Cycle Assessments

In 2001, UNEP and the Society of Environmental Toxicology and Chemistry (SETAC) agreed to a benchmarking program for LCA methodologies. The objective is to develop and implement methods and data to support further LCA progress by establishing guidelines and case studies for best available practice, which will complement the framework of the standards and technical reports published by the International Organisation for Standardisation.

An important challenge for experts will be to determine how best to reconcile conflicts among criteria used in most eco-efficiency/LCA models. For example, what weight should be given to durability and recyclability criteria relative to intrinsic hazard?

Life cycle assessment is a valuable tool but it is still at an early stage of development. It is therefore important that regulatory authorities and downstream users exercise care in their use of LCA as a management tool. The mining and metals industries hope that the UNEP/SETAC initiative will evolve LCA into a more reliable tool and improve understanding of both their operations and products on a full life cycle basis. Such a development would provide industry an opportunity to work with product designers, distributors and other partners to promote a "cradle to cradle" approach and, in so doing, confer important benefits to society.

5.5 Product Stewardship in Action

Major commodity associations and leading companies are actively engaged in product stewardship programs. These include providing information on any potential product-related health or environment issues, as well as informing users—generally manufacturers of finished goods—on how best to use metals and design their products in order to maximise the benefits of metals and minimise their possible risks. To further the safe use of metals, product stewardship requires increased investments in research to advance understanding of the properties of metals and risks to human health and the environment over the life cycle. It also requires industry to promote recycling and to support the development of efficient and competitive collection and recycling infrastructure. Some notable examples of product stewardship in recent years are provided below:

5.5.1 A Sustainable Partnership: Noranda and Hewlett-Packard (HP) strengthen strategic alliance to recycle electronics

In 1996, HP and Micro Metallics Corporation, a wholly owned subsidiary of Noranda, formed an alliance to enhance HP's electronic hardware asset recovery and recycling program. The subsequent construction and 1998 start-up of the Metal Separation Plant in Roseville, California uses proprietary processes and equipment to recover assets for reuse and to sort various metals and other non-metallic materials for recycling. Roseville is currently one of the world's largest electronic recycling facilities and processes some 30 million pounds of electronic hardware annually. The 200,000-square-foot facility runs two state-of-the-art material separation lines and employs about 200 people.

In May 2001, Noranda announced that it was building a new facility in Tennessee, also in partnership with HP. The 140,000-square-foot plant in LaVergne, near Nashville, opened in July and will complement the

existing operation in Roseville. The Tennessee recycling facility will be managed jointly by the HP Product Recycling Solutions Group and Micro Metallics. The expansion is a direct response to increasing volumes of end-of-life electronics and will create approximately 50 jobs. It will also help to sustain a much larger number of skilled jobs by providing additional feed materials to Noranda's existing smelting and refining operations and other recyclers.

5.5.2 UMICORE: Recycling and Sustainability

Systematically increasing the proportion of recycled materials in its feedstock is one of the critical success factors in UMICORE's approach to sustainable development. Such an approach contributes largely to conserving mineral sources and reducing energy consumption, on the one hand, and to minimising waste production and emissions on the other.

An example of UMICORE's commitment to sustainable development is the program that the company has introduced at its Hoboken plant in Belgium. Recently, the plant has been undergoing a transition from a classic lead–copper smelter to a high-performance recycling plant. UMICORE carried out an extensive investment program to re-engineer its complete metallurgical flowsheet, including the commissioning of a new direct-bath smelting furnace and a new silver and gold refinery with a substantial increase in capacity for platinum group metals. This new flowsheet has made feedstock independent from concentrate input. Additionally, the old and polluting units such as roasting, sintering and converting have been dismantled and their adjacent areas rehabilitated.

The core business of the site is to market refining and recycling services to industrial customers worldwide. Its expertise is in obtaining useful and valuable metals from materials that are difficult to treat, such as

metallurgical slags, dusts, drosses, mattes, speiss and tankhouse slimes from many non-ferrous metals businesses, as well as industrial and automotive catalysts, photographic residues, industrial sweeps and bullions, and spent components like electronic circuit boards. The end products are refined precious, base and minor metals such as gold, silver and platinum group metals, copper, lead and nickel, indium and tellurium.

5.5.3 Basel Convention and the Environmentally Sound Management of Hazardous Metal Recyclables

UNEP's Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal aims to protect human health and the environment through a control regime based on prior informed consent, trade measures and capacity-building. The Convention does not differentiate between metal recyclables, materials used as manufacturing inputs, and wastes for final disposal.

In the Basel Tenth Anniversary Declaration, the parties called for priority to be given to the implementation of the Environmentally Sound Management (ESM) of hazardous waste. In response, ICME engaged a consultant to prepare a proposal for early implementation of ESM. The proposal, *Implementing and Assuring a Practical Approach for the Environmentally Sound Management of Hazardous Metal Recyclables* was published as a Working Paper in February 2001.

The proposal would require that a number of steps be taken by a variety of stakeholders, including the Basel Parties, national governments, industry and international organisations, in order to ensure that recycling facilities meet ESM requirements. The key approach is to use an internationally recognised environment management system, such as ISO 14041, and to augment it with third-party assurance that a facility

meets the level of performance required by the Basel-related ESM programs of national governments. It also provides for transparency at all levels, including the public posting of independent third-party evaluations of the performance attained by recycling facilities in implementing the ESM objectives of the Basel Convention.

The proposed approach offers a number of benefits including but not limited to: upgraded facility practices; upgraded global levels of environmental and health protection; public trust through ISO-accredited independent verification; improved handling of local recyclables; proper stewardship of valuable materials and conservation of natural resources; and the avoidance of uncontrolled disposal. It would also be consistent with WTO rules.

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PART 6: STRENGTHENING THE ROLE OF MAJOR GROUPS

Elements in Agenda 21 relevant to mining

• Genuine involvement of all social groups • Recognising and strengthening the role of indigenous people and their communities • Strengthening the role of NGO's: partners for Sustainable Development • Strengthening the role of business and industry

6.1 Overview

Agenda 21 stated clearly that critical to the effective implementation of the sustainable development agenda, is the commitment and genuine involvement of all social groups. It promoted the need for new forms of participation, for access to information about operations, impacts and products, and access to decision-making processes. It sought real social partnerships in support of common efforts for sustainable development and recognised the need for major groups to be strengthened to play an effective role.

In the years since the Rio Earth Summit, the mining and metals industries have undergone a dramatic shift in the way they work with stakeholders. They have become more transparent, accessible and consultative. They are better engaged with local communities and with civil society groups. Engagements go beyond those helpful to the function of operations, and extend also to partnerships to advance improvements in environmental and social spheres more generally. Parts of the industry have fundamentally altered the way they engage with indigenous communities and seek to do this on a basis of mutual respect and mutual advantage.

6.2 Operational Engagement

Large companies and individual mining operations actively seek to engage communities and civil society groups and to be responsive to concerns about their mines and mineral processing operations. Engagement at the project development stage is necessary and often mandatory. However, companies

and individual operations may now also have standing consultative or advisory committees to discuss issues, concerns and improvements in operations on an ongoing basis. These may involve government, civil society groups, environmental NGO's, development and church agencies etc working together with the company to cooperatively pursue shared sustainable development interests. The company may lead such efforts, but it can also be appropriate and effective for other stakeholders to do so (government, community).

Case Studies show different types of consultative arrangements in place and new ways of engagement.

6.2.1 Antamina Commission for Sustainable Development

The Peruvian Government set up a multi-sector Antamina Commission, with the United Nations Development Programme (UNDP) as the lead agency, with the aim of promoting the sustainable development of the communities located in the area of influence of the Antamina Project. With this Commission, the Government, as one important stakeholder, will support the efforts of Antamina in the Region. The installation of this Commission will help the company in integrating its programs with the social programs of the Government and will facilitate the interaction of Antamina with other cooperation agencies. The Commission also includes Caritas, the NGO run by the Catholic Church, and representatives of the Regional Government of Ancash and of the Mayors of the areas around the mine.

In creating this Commission, the Government and the United Nations recognised the efforts of Antamina in the field of Community Development. The Resolution states that "UNDP, the Ministry of Mines and Antamina are working together in the implementation of an initiative for the sustainable development of the communities located in

the area of influence of Antamina, building upon the results already achieved by Antamina in the last years."

6.2.2 The Community and Business Forum in Kyrgystan

The Forum piloted a new form of stakeholder dialogue. The Kumtor gold mine suffered a cyanide truck accident releasing cyanide to the environment in mid 1998. Information disclosure at the time of the accident became an issue with the community. However, it was recognised that there had been a breakdown in communication and trust between the mine and the community extending beyond environmental concerns and including social, economic and political aspects.

What followed was constructive engagement by various groups to develop a new form of stakeholder dialogue, i.e. The Community and Business Forum (CBF). The Forum involves three groups - NGO's, the business sector, and government agencies. Its mission is to contribute towards an effective cross-sectoral collaboration between business and communities, and to encourage sustainable social, economic, and environmental benefits. Founding work has also included a needs assessment, a technical cooperation program, with elements to strengthen Kyrgyz expertise and build NGO capacity, and public workshops and a communications program. The Kumtor mine remains one focal area, but a Small Grants Program will enable additional donor contributions in the future.

6.2.3 Australian Minerals Industry External Environmental Advisory Group

The Australian Minerals Industry Code for Environmental Management, launched in 1996, was intended to be a dynamic Code and has been reviewed and revised in consultation with key stakeholders. A standing Australian Minerals Industry External

Environmental Advisory Group (EEAG) has now been established as a forum through which the industry can seek independent advice on the Code's development and on how its environmental performance is perceived and potentially could be improved. The Group consists of high profile individuals from environmental, science, aboriginal, government and labour backgrounds.

6.2.4 External Appraisal of BHP Cannington

BHP Cannington invited the North Queensland Conservation Council to appraise its environmental performance and to produce its inaugural environmental and sustainability report. The appraisal included an evaluation of the environmental values, processes, personnel and performance of the Cannington silver, lead and zinc mine in North Queensland, including the railhead and port facility. Documents were provided by the company, with verification of data based on site observations by NQCC and specialist consultants employed by the company. Key recommendations arising from the audit included the development of product lifecycle analysis and stewardship protocols, greater incorporation of community involvement in risk assessment and review, and further detailed environmental research. The process of developing the cooperation, and processes to do this work effectively was considered by all involved to be groundbreaking.

6.3 New Ways of Working with Indigenous People

Recognition of indigenous peoples' rights in land is well advanced and supported by legislative and agreement regimes in the developed world. In particular, where traditional connections with land are maintained in the United States, Canada and New Zealand, indigenous people have been afforded first nation status by resource developers for many decades. More recently, a similar regime based on statutory native title, rights recognition and benefit agreements is becoming the norm in Australia. Many former Pacific colonial countries have the same status in their recognition of traditional land tenure. In

these countries, mining companies have dealt directly with national governments, traditional landowners and their representatives since independence.

Developing nations vary in their recognition of indigenous rights, and in many places in the world, indigenous peoples are disenfranchised by national regimes. However, taking the lead from their activities in developed nations, global mining companies and indigenous peoples are increasingly dealing with each other on a first-world and first-nation basis. While there is still much progress to be made, the will and the trajectory are clear.

Corporate mining industry leaders have recognised that it makes good business sense to work with indigenous stakeholders, to respond to local concerns and to create opportunities that meet the aspirations of indigenous people. There are a number of reasons why mining companies are paying much more attention to relations with indigenous communities.

- Legislation is increasingly recognising the rights of indigenous people or gives them the ability to influence the timing and scope of mining projects and, in some cases, the right to determine whether or not a mining project can proceed. In practice, native title legislation can be unwieldy and involve undue delay and uncertainty, and so some mining companies negotiate agreements directly with traditional owners independently of formal statutory processes.
- There is a growing corporate recognition of the business benefits that flow from proactive and positive relations with indigenous communities. These can include lower project risk and local support for the project and complementing regional economies.
- Indigenous people expect to participate more fully in the project benefits and to have more attention paid to their concerns. They have access to information and expertise to help them define their expectations. They also

want more involvement in environmental issues, since these are intimately linked to their culture, values and traditional life styles.

Experience is that successful relationships between mining companies and indigenous people require:

- Mutual respect and trust.
- Effective processes of consultation.
- Responsiveness by the company to take proactive steps to minimise negative social and economic impacts and ensure that local indigenous people benefit from the opportunities.
- Recognition and respect for indigenous peoples' rights and their interest in the land.
- Negotiated agreements.
- Proactive employment policies, education, training and skills development.
- Environmental commitments.
- Cross-cultural training and understanding.

More and more, the recognition of indigenous rights and concerns is by way of "Impact Benefit Agreements" (IBA's) rather than Social Impact Analysis. The maturing of relationships inherent in IBA's recognises that development requires tradeoffs and that the impacts from mining can be mitigated by benefits that flow directly to the indigenous peoples most affected by a mine development. IBA's negotiated under conditions of equity provide a self-determining means for indigenous communities to be involved as major players in mine development.

Case Studies

6.3.1 The Whitehorse Mining Initiative

The Mining Association of Canada, on behalf of the mining industry, took a suggestion for a multi-stakeholder process to the mines ministers

of Canada's federal and provincial governments at their annual conference in Whitehorse in September 1992. The ministers agreed to become co-sponsors and trustees of the process and named it the Whitehorse Mining Initiative. Representatives of five sectors of society agreed to participate. They were the mining industry, senior governments, labour unions, Aboriginal peoples, and the environmental community.

Full-scale discussions began in February 1993 and eighteen months later, culminated in the Whitehorse Mining Initiative Leadership Council Accord.

The Accord adopts a strategic vision for a healthy mining industry in the context of maintaining healthy and diverse ecosystems in Canada, and for sharing opportunities with aboriginal peoples. It calls for improving the investment climate for investors; streamlining and harmonising regulatory and tax regimes; ensuring the participation of aboriginal peoples in all aspects of mining; adopting sound environmental practices; establishing an ecologically based system of protected areas; providing workers with health and safe environments and a continued high standard of living; recognition and respect for aboriginal treaty rights; settling aboriginal land claims; guaranteeing stakeholder participation where the public interest is affected; and creating a climate for innovative and effective responses to change.

The current implementation of the Accord's principles and goals, at both the national and regional levels, represents phase II of the Whitehorse Mining Initiative.

6.3.2 Falconbridge Raglan Case Study

Falconbridge's Raglan property is in the Nunavik territory of northern Quebec - in a region that is sensitive from many perspectives, including environmental, socio-economic, and regulatory. The close working relationships with local stakeholders along with strong environmental management systems are necessary elements of success for the project.

From early consultations with communities, it became clear that the main concerns of the people centred on the environment, employment and the influx of southern people to their land.

A formal agreement was negotiated in respect of the mining project, and signed by the company, the Makivik Corporation (socio-economic and political development corporation) and the nearby communities, making Raglan the first Canadian mining project to complete an impact/benefits agreement with the local aboriginal people. The agreement provisions include:

- Priority of employment for qualified Inuit for the two closest communities to the project, the region as a whole, and other Inuit from Nunavik. 20% of on site positions are filled by Inuit employees.
- Priority in awarding contracts to competitive Inuit enterprises - for example, Falconbridge signed a $50 million joint venture agreement with an Inuit enterprise for open pit mining.
- The establishment of a permanent committee responsible for overseeing implementation of the agreement and reviewing any outstanding environmental issues, and the results of monitoring and mitigation measures. Should mitigative measures not be acceptable to the parties of the agreement, an arbitration process would be pursued with a mutually acceptable arbitrator.

The company has also developed Inuit training and employment programs, worked with local schools, created cross-cultural training for both employees and management, as well as developed a strong communications program with the communities.

6.3.3 Western Cape Communities Co-Existence Agreement

Aluminium company, Comalco signed a historic land use agreement with Aboriginal Traditional Owners of Australia's Western Cape York region to formalise mutual recognition and support for Native Title and mining operations. The Western Cape Communities Co-Existence Agreement was signed early in 2001 by Comalco, the Traditional Owners, the Queensland Government, the Cape York Land Council and four community councils.

The Agreement allows for annual payments to the Traditional Owners to be paid into a Trust to allow for future development of their communities. The Agreement also allows for Aboriginal employment and training programs at the mine. A key component of the agreement is the formation of a Coordinating Committee to oversee the daily implementation of the Agreement on issues such as environment protection and cultural heritage. Comalco employees, their families and principal contractors will also participate in cultural awareness training.

The Agreement is a step towards achieving reconciliation between indigenous and other Australians, and paves the way for sustainable and productive future relationships for those living and working on Western Cape York.

6.4 Partnerships for Environmental and Social Benefits

In the last few years mining companies have altered their approaches to corporate social responsibility beyond the boundaries of their operational

environmental and community responsibilities. Traditional philanthropy has tended to be replaced by an ethos of partnerships with professional bodies operating in environmental, social, development, health, and other areas. The aim is to add complementary skills and resources of companies these organisations, to achieve on-ground sustainable development results in areas relevant to the mining industry.

6.4.1 Codelco's Environmental Conservation Framework Agreement

Codelco and the National Forest Service (CONAF) maintain a framework agreement designed to contribute to improving, protecting and conserving the environment. Codelco provides material resources while CONAF contributes technical expertise to carry out plans, programs, projects, studies or activities to recover, rehabilitate, restore and conserve areas and natural ecosystems in support of environmental management policies defined by the State.

Under this framework, specific agreements are signed, with initiatives in 2000 being:

- Forestation of high - altitude arid zone to improve worker quality of life - visual impact, dust control.
- Greening the city of Calama.
- Urban forestation in the city of Salvador following studies of wild, resistant tree species.
- Soil recovery. Within the framework of the agreement that has existed for over seventeen years, El Teniente has continued to restore soil degraded by mining activity. From 1994-1999 some two million trees were planted.

6.4.2 Rio Tinto Business with Communities Program

Rio Tinto's approach to corporate social responsibility places emphasis on forming active relationships with organisations and communities.

The company provides funds, but, more importantly, contributes technical and business management skills and participates in the planning and implementation of each project. The company chooses community partnerships that it regards as integral to its business, with organisations with which interests are shared.

Examples of partnership projects are with:

- **World Wide Fund for Nature Australia** - providing opportunities for the Rio Tinto Group (and communities) to participate in frog conservation research and the active conservation of frogs and their natural habitat all around Australia.
- **Earthwatch Institute** - providing opportunities for the Rio Tinto Group (through an Employee Fellowship progam) to participate in Earthwatch research projects - contributing their expertise, energy and enhancing their own skills and understanding.
- **Australian Legal Resources International (ALRI)** - developing and implementing human rights training in the Rio Tinto Group and enhancing ALRI's human rights program including promoting the rule of law in developing countries.
- **Aboriginal and Torres Strait Islander Commission MOU** – By means of a memorandum of understanding, increasing training, employment and business development opportunities at Rio Tinto Group operations for Aboriginal people and Torres Strait Islanders. The successful Gumala Enterprises joint venture with Hamersley Iron is an example of this cooperation.

6.4.3 Falconbridge Foundation, Inc.

The Falconbridge Foundation is a private, non-profit institution, established in Santo Domingo in 1989 by Falconbridge Dominicana. Its mission is to promote equitable, responsible, and participatory self development in the provinces of Monseñor Nouel and La Vega.

Its general objectives are:

- To enhance the educational, cultural and social conditions of the provinces of Monseñor Nouel and La Vega.
- To promote the empowerment of the communities, providing them with the essential tools to solve by themselves their most urgent problems.
- To promote social and economic leadership of target groups, especially women and youth.
- To help build the human resource required for development.
- To contribute to the natural resources preservation and management.
- To support programs related to health care improvement and disease prevention in rural communities.

Program areas are:

- Education
- Environment
- Rural Development
- Health Care/Prevention
- Micro-enterprise
- Cultural
- Democracy and Civil Participation Program

6.5 Strengthening Capacity

6.5.1 Outreach Activities

To improve environmental, health and community practices and thus enhance industry's contribution to sustainable development, ICME has been involved in international outreach activities, primarily aimed at developing countries.

Conference on Development, Environment and Mining, Washington, D.C.

In 1994, in cooperation with the World Bank, UNEP and UNCTAD, ICME convened a conference in Washington entitled "Development, Environment and Mining: Enhancing the Contribution of the Mineral Industry to Sustainable Development." Some 150 representatives from developing countries attended, chiefly senior government and other officials. Participants identified mineral resources as a catalyst for economic development and discussed the issues related to industry, government and community roles. The workshop identified needs for capacity building in a number of areas.

Seminar on Environmental Management Systems and Practices, Kazakhstan

In 1994, at the request of two Kazakh government ministers, ICME held a workshop on environmental management systems and practices in the non-ferrous mining industry. The objective was to assist the Government of Kazakhstan in finding solutions for environmental problems associated with aspects of the minerals industry. This industry is the most important industrial sector of this nation and the principal generator of export income. The seminar enabled a valuable information exchange with the mining industry and international agencies assisting in developmental and environmental efforts. Practical advice was also given during site visits.

Exposure Assessment Training Session, Bulgaria

In the spring of 1999, ICME in collaboration with Union Minière (now Umicore) (Belgium) performed an assessment of ICME's data-gathering system (see Exposure assessment/Dose response above) with an on-site demonstration in Bulgaria. This training session was to encourage operators to gather data to assist in clarifying the relationship between

exposure to metal species and occupational health effects. It showed that the system was sufficiently comprehensive to be used in instructing various ICME members at their facilities around the world on the importance of developing a data-gathering system; the systematic sampling and analysis of speciated exposure data; and the establishment and maintenance of employees' medical histories and health outcomes.

Workshop on Sustainable Development and the Mining and Metal Industries, South Africa

ICME and the World Bank, in cooperation with the Southern African Development Community (SADC), the Geological Survey of Namibia, the South African Department of Minerals and Energy, the Chamber of Mines of South Africa and the South African Institute of Mining and Metallurgy organised a regional workshop for seven countries in Southern Africa in November, 2000 in Pretoria. The objective of the workshop was to share experiences and provide information on policies and practices at the national, regional and international levels to enable policy makers in Southern African countries to better address the major issues and challenges concerning sustainable development and the mining and metal industries.

6.5.2 ICME/UNEP Environmental Protection Working Group

UNEP and ICME have worked together for almost a decade to help spread knowledge and best environmental practice in relation to a number of important issues. An Environmental Protection Working Group has operated since 1993, with members from ICME companies, UNEP staff with, on occasion, participation from other stakeholder groups. The Working Group initiated two publications:

- Case Studies Illustrating Environmental Practices in Mining and Metallurgical Processes, 1996.
- Case Studies on Tailings Management, 1998.

In 1997, ICME and UNEP in cooperation with the Swedish International Development Agency hosted the "International Workshop on Managing the Risks of Tailings Disposal" in Stockholm. As a result of views at the Stockholm workshop, ICME and UNEP, with the support of the Mining Geological Survey of Argentina (SEGEMAR), hosted a workshop in Buenos Aires in 1998 on "Risk Management and Contingency Planning in the Management of Mine Tailings."

The workshops provided a significant body of work on issues, and practices in tailings management, for governments and companies. They drew a lot of developing country participants and proceedings were published in English and Spanish.

The Working Group has identified water as a priority area for future cooperative work, not only water management, but also the political, economic and social issues associated with responsible use of water with the mining and metals industries being one of many users.

6.5.3 Best Practice in Environmental Management

In Australia the mining industry and NGO's have been heavily involved with the Federal Government, in developing the Best Practice in Environmental Management (BPEM) in mining program. This started in 1994 and has produced various tools including 21 booklets and a video, which aim to help mining firms improve their environmental performance. They are written by industry and external experts and use case studies of leading edge practices. In September 1999, the World Bank stated that the program was 'the current benchmark for the industry'. In addition, Bahasa, Chinese (Mandarin) and Spanish language versions of nine of the booklets have allowed the sharing of experiences in environmental management with overseas mining

operations. Training kits, based on eight of the BPEM in mining booklets, are now being developed and these should further help improve the environmental performance of companies globally. UNEP is a supporter of the program and is assisting with the development of the training kits.

PART 7: MEANS OF IMPLEMENTATION

7.1 Overview

What are the levers that are making the difference to the implementation of sustainable development by the mining and metal industries? What are the tools which are delivering change?

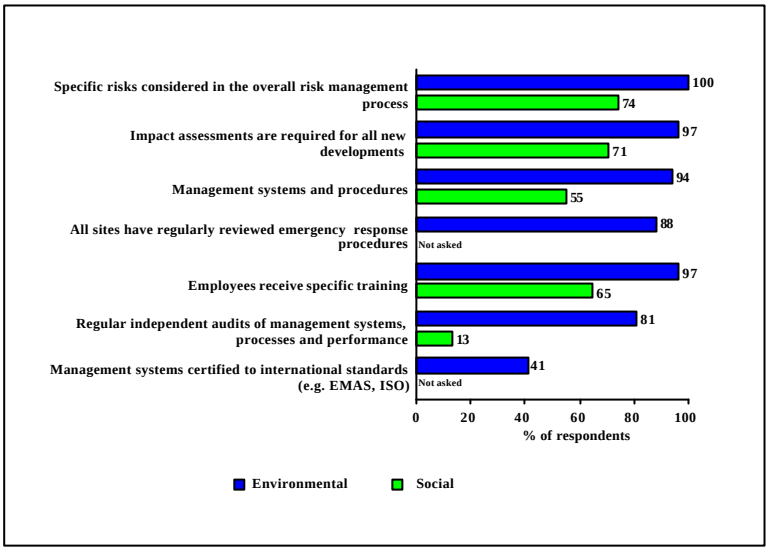
Within the industry, three sets of implementation tools are important:

- The spread and strengthening of company policies, systems and procedures.
- The development of a body of codes, guidelines and other voluntary initiatives.
- Growth in public environmental and social reporting, which is becoming more comprehensive sustainability reporting.

7.2 Strengthening Company Policies, Systems and Procedures to Advance Towards Sustainability

Most companies that responded to the PWC survey have, and are in the process of further developing, environmental and social systems and procedures to support sustainable development. As shown in Table 10, the tools most commonly used by companies are: consideration of environmental and/or social risk in the overall risk management process; training employees on environmental and social issues; and using impact assessments for all new developments. The major of respondents also stated that they have dedicated personnel to perform regular environmental monitoring and that regular independent audits of management systems, processes and performance are conducted.

TABLE 10: KEY PRACTICES AND PROCEDURES IN PLACE TO SUPPORT SUSTAINABLE DEVELOPMENT



Ninety four per cent of organisations stated that they have an environmental management system, with just under half that number certified against ISO, EMAS or other international standard. ISO 14001 provides a systematic framework to ensure the continual improvement in environmental performance through a cyclical process of planning, operating, monitoring, and auditing environmental issues. The ISO 14001 framework provides guidance in ensuring that all significant environmental issues at an operation are identified in a risk-based manner, that management plans are developed for each aspect, and that impacts are monitored. It also requires that personnel are appropriately trained to manage environmental impacts and emergency situations.

7.2.1 Application of Standards Globally

The mining and metals industry is under scrutiny over the question of whether it applies the same standards in developing countries as in developed countries. The issue is fuelled by fears that developing

country governments may not have the capacity to regulate effectively or that they will allow lower standards in order to secure investment. In fact regulations and legislation are tending to replicate globally, driven by the World Bank, EPAs, and use of international consultants. Private sector lenders and national export development agencies that provide debt financing or equity also expect borrowers to operate in a responsible manner in order to reduce credit and reputational risks. Companies are also subject to global NGO scrutiny and a company's reputation and shareholder support are at stake if poor practices are in place at any of its operations anywhere.

Many companies are signatories to charters or codes including the ICME Charter and the Australian Minerals Industry Code for Environmental Management. The ICME Charter expresses the commitment of members to a common set of principles. The Australian Code requires signatories to apply its principles wherever they operate. A Cyanide Code is being developed to set out common principles and standards of practice which all signatories will adopt (see 7.3.2). Clearly such documents are codifying universal principles, but they do not prescribe how they are to be applied in site - specific circumstances. The PWC Survey shows the diversity of corporate approaches to the question of universal standards versus local flexibility.

TABLE 11: THE EXTENT TO WHICH RESPONDENTS APPLY THE HIGHEST LEVEL OF STANDARDS THROUGHOUT ALL OPERATIONS REGARDLESS OF LOCATION AND LOCAL STANDARDS

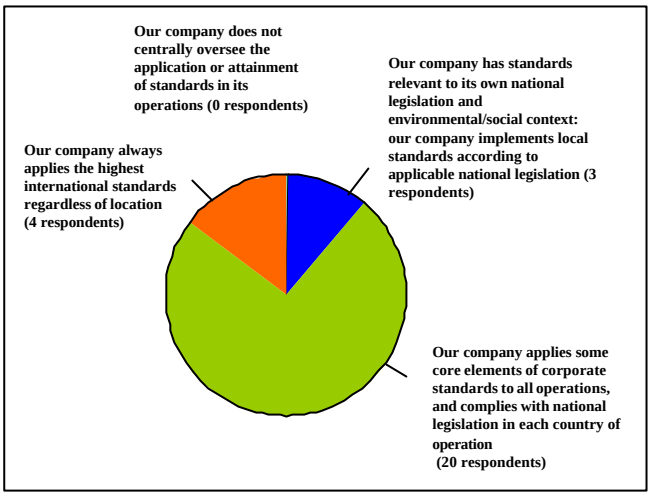


Table 11 shows that the majority of respondents (20 out of 27) reported that they apply some core elements of corporate standards to all operations whilst complying with the national legislation in each country of operation. Only four respondents said that they apply the highest international standards in every case regardless of location.

As noted, the discrepancy may be more apparent than real, reflecting the fact that principles and policies (including corporate policies) can be universally applied, but standards and practices often need to be site specific. Nevertheless this apparent dichotomy of global principles versus local practices remains an ongoing concern and is a weakness in the industry's attempts to address stakeholder concerns.

7.3 Codes/Guidelines/Voluntary Initiatives

The mining and metals industries have embraced a number of significant voluntary initiatives in recent years. Some have demonstrably been successful in reducing the environmental impact of the industries. Others should make a difference in the near future.

In 1998, at is sixth session, the UN Commission on Sustainable Development noted the value of voluntary initiatives and agreements in providing content and direction to the dialogue between governments, industry, trade unions, NGO's and international organisations. Although important, voluntary approaches need to be seen as complementary to other environmental policy instruments.

7.3.1 UNEP Declaration

In October 2000, ICME became a signatory to the Declaration, which represents a voluntary commitment to adopt improved sustainable production practices. Cleaner production involves the continuous application of an integrated preventative strategy applied to processes, products and services in pursuit of economic, social, health, safety and environment. ICME was the first mining and metals-related organisation to sign the Declaration.

The Declaration is a set of high level commitments which will need to be advanced with and through the members of ICMM over time. UNEP's work to advance and support implementation of the Declaration will be of assistance to ICMM as it considers its work with members in this area.

7.3.2 Voluntary Code for the use of Cyanide in Mining

As a result of several widely reported cyanide spills related to gold mining operations, there has been increasing public concern about its use. As a result the International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold (i.e., the "Code") has been developed by a multi-stakeholder Steering Committee formed under the auspices of the United Nations Environment Programme and ICME. This effort represents the first

time that an industry has worked with other stakeholders to develop a voluntary, transparent and certifiable voluntary Code of Practice.

The Code's mission is:

> *"To assist the global mining industry in improving cyanide management, thereby minimizing risks to workers, communities and the environment from the use of cyanide in gold mining, and reducing community concern about its use."*

Objectives of the Code identified by the Steering Committee include the following:

- To protect workers, communities and the environment from adverse effects of cyanide
- To control, manage and improve the management of cyanide
- To be used by large and small gold mining companies, cyanide manufacturers and transporters and to serve as a form of assurance for interested parties including regulators, financiers, communities and non-governmental organizations
- To be applicable internationally, in both developed and developing countries
- To be credible and verifiable
- To be dynamic over time.

While the Code does not cover all aspects of cyanide management (i.e., does not address tailings dam construction), it does represent a important step forward for the mining sector and the development of voluntary and verifiable compliance programs.

7.3.3 South African Guideline on Cyanide Management for Gold Mining

A related, complementary cyanide management initiative has been taken by South African companies. The South African Chamber of Mines published, in July 2001, a comprehensive guideline on cyanide management. It is designed around best practice principles and includes the latest operational expertise and application of technology for the management of cyanide. It is a practical and comprehensive guideline of 166 pages, including a 30 page audit checklist.

7.3.4 The Australian Minerals Industry Code for Environmental Management

The code commits the Australian minerals industry to continually improve its environmental performance, and to be open and accountable to the community in the way it manages its environmental responsibilities.

Signatories to the code commit to a set of values as well as a set of key principles which companies are required to follow. It does not prescribe the details of how the companies will implement those principles, thus allowing flexibility in the improvement path. The code is to be applied by companies wherever they operate. Signatories are required to produce public environmental reports as well as to audit their performance in implementing the code on a regular basis. Over forty companies have signed on to the code representing more than three hundred mining or mineral processing operations, producing about 85% of Australia's mineral production. To date, there have been over forty public environmental reports published.

The Australian industry sees the potential for this code to be adopted or adapted into a global code and would welcome discussions on its use. The United Nations Environment Programme has praised the code as

being one of the most comprehensive voluntary codes yet devised for the mining industry.

In addition to the above, as further programs, codes or possibly certification schemes to facilitate the process of achieving sustainable development goals for the mining, minerals and metals sector are developed and implemented, some of them will require external mechanisms to oversight their activities and develop appropriate public reporting programs. Third party verification on certification is a priority for many NGO's. There have also been calls for the establishment and implementation of a professional dispute resolution and mediation function.

7.4 Public Environmental/Social/Sustainability Reporting

Philip Peck, Lund University in an article on "Environmental Self-Reporting in the Mining Industry", 2001, noted that one of the specific tools adopted by the industry in recent years has been the environmental report or statement. He says that often addressing dimensions of social as well as environmental performance, most significant mining companies have begun some form of external reporting. Peck's survey found that some reports are rudimentary while others have been recognised as among the best produced by industry in general. For example, WMC was among the companies mentioned in a benchmarking report published by SustainAbility Ltd and the United Nations Environment Programme (SustainAbility/UNEP, 1997). He also found that environmental reports are becoming quite well defined both in terms of the subject matter they deal with, and in the manner in which they fulfil the preferred requirements presented by a number of guide frameworks developed by UNEP, GRI (the Global Reporting Initiative) and private report verifiers. Within the sector, the environmental reports of several industry actors have now been produced for a number of years.

In analysing and categorising the reports of thirty mining organisations, Peck found variability on such key criteria as data richness and openness, with reporting being most advanced in Australia in part because of the Minerals Industry Code.

The results of two surveys of mining and metal processing companies, (ICME (internal study), KPMG) show a trend towards environmental, social and sustainable development reporting, though separate reports are not yet majority practice. Within the reports, trends are to provide an increasing degree of detail on emissions (e.g. carbon dioxide, cyanide) and resource conservation factors (e.g. water, recycling) at both the corporate and site level to provide a greater level of transparency on performance.

More companies are ensuring their reports are externally verified, and some are beginning to incorporate social issues as part of their verification. Performance targets as tools for reducing emissions are being increasingly used and reported against by companies.

The KPMG survey reviewed annual reports from forty of the world's largest mining companies and the findings illustrate the above trends:

- 38% of respondents produced a separate report addressing environment, health and safety or social issues.
- Of these reports, 40% included some form of external verification.
- Nineteen companies disclosed performance against goals and targets in either their annual report or separate environmental reports.
- 90% addressed health and safety issues in annual report or separate publication.
- 73% set goals with respect to health and safety.

Surveyed companies were interested in developing a single set of guidelines for the minerals sector so that comparisons can be made between companies in a consistent manner, for example as part of the Global Reporting Initiative.

Public Environmental reporting is proving to be an effective implementation tool in advancing towards environmental and social sustainability. Demands for transparency and openness in communication have unleashed competitive pressures to perform better as well as report better than other companies.

- Open and honest reporting helps to increase community confidence in the mineral industry's ability to manage its environmental and social impacts. Greater trust encourages reputation as a responsible corporation and maintains access to land and resources.
- Better communication of environmental and social performance through public reporting also provides an important source of information for ethical investment and the emerging link between a company's sustainability behaviour and shareholder value.

PART 8: FUTURE CHALLENGES

8.1 The Industry's Sustainable Development Initiative

The rationale and scope of the Global Mining Initiative was described briefly in Section 1.1 of this Working Paper.

The GMI is an unprecedented initiative taken by leaders of many of the world's largest mining and minerals companies to bring about changes that will improve economic, social and environmental performance. The three strands of the GMI - the Mining, Minerals and Sustainable Development Project (MMSD), the Conference in Toronto in May 2002, and the new ICMM's sustainable development mandate are all about identifying and responding to the challenges facing the industry.

Work to crystallise the challenges and to define pathways for the future sustainable development agenda started in 1998 and will continue until mid 2002. It is work in progress and it is not appropriate to predict what the outcomes of the GMI work will be. Specific options that will flow from the MMSD project are unknown at this time and deliberations of the May conference will crystallise the issues and future directions.

It is worth however giving more information on the approach being taken to enable the mining and metals industries to be at the vanguard of all industries in engaging with stakeholders to define its challenges and responses.

MMSD is the cornerstone of the GMI. The world around the metals and minerals industries includes a great variety of interests. The industry itself is diverse and ranges from multi-national companies to artisans, producing perhaps 150 different commodities. MMSD is attempting to reflect the variety of perspectives in a balanced way to develop pathways and options for a change agenda for the future. To ensure the analysis includes issues particular

to specific regions, six regional groups were established in principal producing/consumer regions to address specific geographical perspectives and priorities. Each of the regions owns their process and drives local priorities.
The MMSD project structure includes an assurance group comprising twenty-five independent and international individuals from key stakeholder groups representing a wide range of expertise in the field of mining and minerals to provide peer review of the MMSD work.

In addition to the thirty mining company sponsors there are a number of non-industry sponsors who attach strategic importance to the future of mining as an economic force in regional economies. These non-industry sponsors comprise governments, conservation groups, foundations, academic institutions and inter-governmental organisations.

The MMSD project report preliminary draft will be presented to the assurance group in February, 2002 with the draft report published in March, 2002. After discussions, the final report will be published in May, 2002. It will synthesise and summarise a large body of information, providing pointers for future directions. There will be a number of regional reports, individual research papers, workshop proceedings and other documents.

The MMSD Report will inform discussions at the conference in Toronto from 12-15 May, 2002. This is a policy dialogue conference, the themes for which will reflect the structure of the MMSD report. Most of the conference will be devoted to dialogue, drawing on views of those outside the industry that have a stake in industry activities. Development of the conference program is a consultative process itself.

The conference provides the opportunity for the industry to make its initial response to the pathways and options developed by the MMSD analysis. The

outcomes will govern the industry contribution to the World Summit on Sustainable Development in August-September 2002.

While the GMI and MMSD conclude and the conference ends, the ICMM as a restructured industry body will continue to address the industry's future challenges and the way forward after GMI.

While the detailed outcomes of MMSD are not yet available, the work has identified key challenges and opportunities. These will help structure the MMSD report. The principal challenges are:

- Can the industry move towards a viable structure that contributes more effectively to sustainable development? This includes a baseline assessment of current corporate practice.
- How can the industry support development of national economies, especially in the poorest countries? For this, a study is under way on managing mineral wealth which will examine the obstacles to using mineral revenues as an effective catalyst to economic and social development.
- How can the industry contribute to sustained improvements in livelihoods and well-being at the community level? This includes a study of small-scale mining as well as communication and conflict resolution.
- How can the industry become a leader in environmental management? Under this topic, there was a workshop on mining and biodiversity in association with Conservation International.
- How can the industry ensure future markets and consumption patterns are compatible with a sustainable world?
- How can the industry ensure meaningful access to information for all stakeholders? This focuses on the development of stakeholder participation, the value of communication as opposed to information, capacity building, and the role of communication to spotlight good and bad practices.

- What should be the administrative relationships, role, responsibilities and performance standards of the key actors in a more sustainable future? One of the topics under this heading includes a global finance dialogue in cooperation with the World Bank and the United National Environment Programme to address sustainability issues around the financing the projects.

These themes are judged by MMSD to capture the essence of the challenges facing the industry. Overall, this sustainable development initiative involves the industry listening, learning and engaging with all key stakeholder groups to clarify mutual expectations between industry, governments, international organisations and civil society groups to understand better the links between mining and metals and sustainable development, and to covert this knowledge into action.

8.2 Challenges identified by Mining and Metals Executives

The Mining and Metals Sustainability Survey 2001 (PriceWaterhouse Coopers), provides valuable insights into the sustainable development challenges as viewed by senior executives in the industry. The organisations surveyed represented a broad commodity and global geographic distribution. Their focus naturally tends to be operational; in particular what are the challenges in adopting sustainable development within their organisations and in communities around their operations, as well as in relation to governments, customers, suppliers, etc.

To quote one survey respondent:

> *"we recognise that the full implications of sustainable development are still being explored by society and we will be part of that process by pursuing the practical ways of realising the concept".*

In giving their thoughts on the future (next 10-15 years) key themes from the executives were:

- Drivers for sustainable development will continue to be enhanced shareholder value, and improved relationships, but improving operational efficiencies and exploiting competitive advantage would be increasingly important.
- There is a need for long term strategies and for leadership and direction to be demonstrated by the industry as a whole.
- To address reputation damage to the whole industry of the poor performance of some, there is a widespread call for uniform codes of practice, standards and metrics and perhaps certification schemes for sustainability.
- A marked improvement in the industry's performance at operating level is required, in particular the elimination of high profile environmental and social incidents and accidents.
- The ongoing future importance of embedding sustainable development practices throughout their organisations was stressed, a key element of this being employee awareness.
- Respondents called consistently for improved internal and external stakeholder engagement processed increased transparency with key audiences and greater accountability. Reporting and verification were also seen as increasingly important tools in the dialogue with stakeholders.
- Recognition that technological development and innovation are urgently needed. There was widespread recognition that the industry will need to transform its processes, by engineering a "quantum leap in eco-efficiency", waste reduction and recycling. Improving recovery rates and production processes, prolonging the life of metals and minerals, eliminating and /or recycling waste, conserving energy and pursuing greater use of renewable resources are all seen as critical.
- Respondents talked of the possible need to change from being "mining and processing" to being "suppliers of raw materials". Implicit in such a

change of mind-set is a much greater awareness of life-cycle analysis, eco-efficiency and product stewardship.

- Globalisation and consolidation within the industry will bring with it increasing responsibility.

In presenting the survey results, PWC also identifies a distilled set of debates arising from the results. These are:

- Do organisations need to extend the boundaries of their understanding of sustainable development?
- How can accurate and robust tools be developed to allow efforts in sustainability to be reflected in share value?
- Will government policy be a key driver for addressing sustainable development issues in the future? How will government policy change to reflect the demands of stakeholders?
- Is the Board being adequately informed on sustainability related issues, in order to maximise opportunities and satisfy due diligence?
- Does the mining and minerals industry need to develop globally agreed standards to be applied irrespective of location and local standards?
- How can the industry develop suitable economic tools to improve investment analysis relating to sustainability issues?
- Indirect costs and benefits associated with sustainable development: should we change how and what we measure?
- Should the mining and minerals industry increase the social and ethical standards required of critical business partners?
- How will the interface between industry organisations and stakeholders change to make engagement more effective, transparent and help build trust?

Clearly there is a very large degree of overlap and resonance between the challenges identified by the MMSD work through its detailed analysis and

engagement with stakeholders, and the challenges as seen from those within the industry - which is encouraging in itself.

8.3 Challenges for Governments and Other Stakeholders

To maximise the contribution of metals and mining to sustainable development objectives of society, decision-makers in government are also faced with challenges, e.g.

- To ensure that metals are produced, transported, used, recycled and disposed of safely by the industry, in general, and smaller companies, in particular.
- To ensure that decision making (e.g. material selection and regulations) is based on precise and explicit criteria as well as cost-effective and timely risk assessments that take into account the special characteristics of metals and metal-containing products.
- To ensure openness and transparency and that the views of all stakeholders are taken into account in decision-making processes likely to affect them.
- To establish market incentives to encourage product design, technologies and uses that promote the recyclability as well as the economic collection and recovery of metals.
- To take the lead in ensuring that the benefits from mineral development are more fully realised, through the development of effective economic and development policies, and to encourage partnership involving other organisations, stakeholder groups and the industry.

Civil society groups and non-government organisations also need to play a role in the mining and metals industries' advance towards sustainable development. ICMM looks forward to a productive dialogue in future with all groups and to cooperation to advance our shared agendas.

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