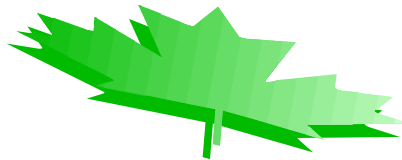


FOR DISCUSSION

SUSTAINABLE DEVELOPMENT AND MINERALS AND METALS

An Issues Paper
by Natural Resources Canada

September 1995



Natural Resources
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F O R D I S C U S S I O N

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September 1995



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Canada

This Issues Paper is for discussion purposes only.
It should not be considered an expression of official views
of the Government of Canada

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Foreword

In the foyer of the House of Commons is a mural that depicts some 25,000 years of Canadian history. Included in this story is the important role that natural resource industries have played in the development of this country, including the major contribution of the minerals and metals industry.

As is the case with all human activity, mineral resource development has an impact on our environment. All Canadians, through collaboration and partnership, need to address the dual challenge of ensuring the integrity and diversity of our natural environment while maintaining a healthy and productive economy. The Canadian minerals and metals industry recognizes its responsibilities and has made significant progress in responding to this challenge. However, more can and should be done.

In *Creating Opportunity*, the Government of Canada recognized that sustainable development should be integrated into how government defines its business and makes its decisions. In our *Mining Agenda*, we made a commitment to develop a sustainable development strategy for the minerals and metals industry. In our *Guide to Green Government*, we stated that sustainable development is not only a desirable goal, but also an essential element of public policy, and that all departments must become sustainable development departments. To engage stakeholders on how the concept of sustainable development may be applied to minerals and metals, Natural Resources Canada (NRCan) has prepared this Issues Paper.

The paper is premised on the belief that the key to making sustainable development a reality is to change the way we think and act – to *integrate* environmental, social and economic considerations from the outset in our decisions. Following consultations with stakeholders, NRCan will develop, for consideration by Ministers, a new mineral and metal policy based on sustainable development.

I believe that it is in the interest of all Canadians to have in this country a prosperous minerals and metals industry that is committed to sustainable development. This Issues Paper and the dialogue which will flow from it represent an important step toward a common vision of a sustainable minerals and metals industry providing jobs and other benefits to both present and future generations of Canadians.

Minister of Natural Resources

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Executive Summary

The Government of Canada has made a strong commitment to the implementation of sustainable development in its policy statement *Creating Opportunity*. This commitment has also been reflected in a number of initiatives. For example, it released *A Guide to Green Government* signed by all federal ministers. The Guide states that "All departments must become sustainable development departments, both in terms of their policies that influence the decisions of others, and in how they manage their internal operations . . . the Government recognizes that responsibility for sustainable development is shared across government and that each Minister is accountable for making measurable progress on sustainable development within the sphere of his/her mandate."

The Government has also undertaken to update the 1987 *Mineral and Metal Policy of the Government of Canada*. To assist the Government in meeting these objectives, Natural Resources Canada (NRCan) has developed this Issues Paper for discussion with stakeholders. The paper explains how sustainable development applies to minerals and metals, describes the key sustainable development challenges facing the industry, and proposes policy guidelines to incorporate the concept into federal decision-making related to these commodities.

The focus of the paper is on the application of the concept in the context of mineral exploration and the first two stages of mineral and metal production. It does not address broader concerns regarding material consumption by society or issues specifically related to uranium and greenhouse gases. Following public consultation, NRCan will develop, for consideration by Ministers, a new federal mineral and metal policy based on sustainable development. The policy will address, in a fiscally prudent manner, mineral- and metal-related environmental, social and economic issues that are within federal jurisdiction.

The paper is composed of an Introduction and six sections (Parts I to VI). The context for the paper is set out in the **Introduction**. It notes that the apparent simplicity of the definition of sustainable development belies the enormous challenge it poses for governments, industry and society at large to render the concept operational. The paper makes the fundamental point that, while addressing the environmental challenge, governments must also address those of an economic and social nature. Consequently, they must reduce debt, prepare for potentially profound economic and social changes if Canadians are to participate successfully in an increasingly open global marketplace, eradicate poverty, and ensure that all members of society have equal opportunities for meaningful employment and social participation.

The Introduction includes an affirmation of the Government's belief that a minerals and metals industry committed to sustainable development is best placed to allocate resources among alternative activities and investments. In so doing, it will continue to contribute to Canada's economic well-being by providing Canadians with the financial tools to address their environmental, social and economic objectives. To ensure that the industry continues to make this economic contribution, the Government recognizes that it must address, in partnership with other stakeholders, the concerns associated with the industry's activities. For its part, the Government believes that in order to address these challenges, it is essential that its decisions integrate, at the earliest opportunity, environmental, social and economic considerations. This perspective underlies the paper.

Sustainable development has become a key goal of public policy. **Part I** explains how sustainable development applies to minerals and metals.

Until recently there has been little discussion about the concept of sustainable development in terms of minerals and metals. For example, the *Mineral and Metal Policy of the Government of Canada* recognized the importance of environmental and social concerns, but did not anticipate the prominence of environmental issues, nor did it frame these issues in terms of sustainable development. While Canada's environmental strategy, the *Green Plan*, released in 1990, was premised on the concept, its focus was on renewable resources. There was little discussion on the role of minerals and metals.

The paper points out that sustainable development applies to both renewable and non-renewable resources. In the case of minerals and metals, the paper proposes that the goal of sustainable development should be to find, extract, produce, add value to, use, re-use and recycle mineral and metal products in the most efficient manner possible, while respecting the needs and values of other resource users and maintaining and/or enhancing environmental quality for present and future generations. Achieving this goal requires a consideration of intra- and inter-generational equity, mineral consumption and depletion.

Intra-generational equity refers to the disparity of wealth and resource consumption in the world today. The Brundtland Report acknowledges that economic development, especially in developing countries, is a necessary pre-condition to both alleviating stress on the environment and reducing disparities in living standards around the world. *Inter-generational equity* implies that future generations should not be deprived of resources and wealth because of unsustainable levels of current consumption.

The paper notes that the global demand for minerals and metals will continue to grow because the economic performance and the standard of living in less developed countries will not improve without a corresponding increase in the consumption of minerals and metals. The paper points out, however, that while some minerals such as potash are consumed when they are used, many others are not "consumed," but instead can be recycled or re-used for other purposes by current and future generations.

Because of the international nature of the industry, less mineral development in Canada will not moderate this global increase in mineral consumption, nor will it have much impact on our domestic consumption of minerals and metals as most of our production is exported. Less Canadian production would simply lead to a shift in the source of supply to foreign producers. Given this expected increase in the consumption of minerals and metals, a question emerges as to whether equity demands that we forego some mineral development today in order to allow future generations to develop them.

Discussions surrounding the issue of mineral consumption and intra- and inter-generational equity often centre on the depletion of mineral resources. This debate does not always reflect the scope and limitations of mineral reserve estimates. The paper points out four important factors that must be considered in this debate.

First, the idea of mineral reserves is an economic concept limited to mineral deposits that are known and currently economic. Mineral reserves therefore represent only a fraction of the earth's mineral inventory. Second, there are no guarantees that the minerals and metals we use today will have the same economic value for future generations. Third, as noted above, many minerals and metals have a unique characteristic for a non-renewable resource – they can be "consumed" by people today and then be recycled by future generations. Finally, the environmental, social and economic investments we make today as a result of mineral development are not all consumed by this generation, but will also be enjoyed by future generations in the form of human and physical capital. The paper concludes that, for these

reasons, it may be some time before the world's mineral resources are depleted, if ever. The paper also points out that this debate has drawn attention away from two important considerations: first, the durability of many minerals, and second, and more importantly, the need to ensure that the activities of the industry do not place undue long-term stress on the environment and that they support our social objectives.

Part I also includes a discussion of five concepts that are shaping government policies on how environmental, social and economic considerations should be integrated in our decision-making processes: pollution prevention, the polluter pays and precautionary principles, integrated resource management, and the ecosystem approach. The paper points out that these concepts are dynamic and are important in any debate about sustainable development, but our understanding of them in the context of sustainability is still evolving.

The nature of the minerals and metals industry and its impact on the Canadian economy are considered in **Part II**. The paper emphasizes that mineral exploration and development are characterized by high risks, the use of advanced technologies, the employment of a skilled workforce, long time-periods for venture development, and high costs. As a result, changes in government policies and its regulatory regime that increase uncertainty for the investor have negative implications for a country's investment climate and its ability to attract and keep mineral investment.

Canada is a major player in this highly competitive environment, exporting some 60 commodities to more than 100 countries around the world. The industry and its related goods and services make an important economic contribution to some 115 communities across the country and contribute some \$11 billion each year to our trade surplus. Salaries paid to workers in the industry are typically among the highest across both the goods-producing or service-producing sectors. More importantly, the industry often represents one of the few opportunities for high-paying jobs in many remote communities. This not only has important implications for individual workers, but also for the country as a whole if Canadians are to pay for the high standard of living they have come to expect.

The paper notes that the impact of this world-class domestic industry on other segments of the Canadian economy is often under-estimated. For example, minerals and metals represent a significant proportion of Canada's railway traffic and coastal shipping. The industry encourages the development and export of manufacturing and related consulting and engineering services, including those in the environmental technologies sector. As the home of many world-class mining companies, Canada has become an important source of risk capital for mineral exploration and development projects around the world.

The role of the federal government in the minerals and metals sector and the environment is described in **Part III**. The rules governing the day-to-day operations of most mineral and metal operations in Canada are, for the most part, provincial. The federal government's direct impact on the industry is limited to certain prescribed circumstances (e.g., north of 60°). Its substantial influence on the industry is derived from the exercise of its powers under the Constitution (e.g., interprovincial and international trade) and in the exercise of powers that it shares with the provinces, most notably in the areas of science and technology and the environment.

Part IV examines the sustainable development challenges facing the minerals and metals industry and proposes a total of thirty-two policy guidelines to address them. The challenges are grouped under five broad headings: improved decision-making, sustainable operations, exploration and development, social infrastructure, and international leadership.

Improved decision-making requires that the federal government look beyond government and industry partners and clients to develop more meaningful consultative mechanisms with all stakeholders and the public at large. It will also require that the Government consider the role of traditional and local knowledge in arriving at policy and regulatory decisions. Three specific policy tools are considered: regulatory development, regulatory reform and harmonization; economic instruments; and voluntary action by industry. In the case of regulatory development, the paper notes that the hypothesis that stringent environmental regulations may promote an industry's competitiveness is not necessarily applicable across all industrial sectors. One of the exceptions often cited is the mining industry. In looking at voluntary action by industry, the paper emphasizes that this policy instrument does not mean that industry has the right to choose whether it will meet the commitments it has made under an agreement, nor does government abdicate its right to use other means, including regulations, to enforce those commitments.

The second challenge, **sustainable operations**, looks at four issues that arise in connection with many mineral and metal operations: reclamation, metals toxicity, metals recycling, and energy efficiency. Consideration of these four issues begins with a discussion about the meaning of the term "waste" in the context of minerals and metals, and the importance of distinguishing between material that has no economic value or use and material or waste that may be considered toxic or hazardous.

Reclamation today is an integral part of every Canadian mineral development project. Concerns associated with this issue include the treatment of acid drainage, the need for comprehensive and long-term remediation plans for lands disturbed by mining operations, and the scope and costs associated with orphaned mines.

The issue of metals toxicity is both an environmental and health and safety concern for governments and the public. The paper emphasizes two points. First, consistent with the Government's recently announced *Toxic Substances Management Policy*, policies intended to address this issue must take into account the differences between natural substances such as minerals and metals that are found in the environment and substances that are synthetic and organic. Second, the paper asserts that the regulation of metals and their products must be addressed from a risk-based approach founded on sound science. As part of the discussion, the paper also includes a description of inter-material substitution as a regulatory approach.

In the context of metals recycling, the paper points out that Canada is a major niche player in the international recycling industry. It also notes that recycling is not only environmentally beneficial, but an essential source of feedstock for Canadian smelter operations. The paper concludes that the promotion of metals recycling in Canada and internationally will require efficient domestic and international rules that distinguish between material destined for recycling and waste destined for final disposal.

The fourth issue discussed under this challenge is energy efficiency. The mining industry (Stage I) accounts for some 13 percent of total Canadian energy demand. The paper notes the steps the industry is taking to improve its energy efficiency, and the importance of this effort from an industrial and environmental perspective.

Mineral exploration and development is the third challenge addressed in this section. The paper points out that metals recycling, conservation, inter-material substitution and technological innovation may improve the efficient use of our mineral resources, but they cannot, by themselves, meet society's future need for these commodities. New mineral deposits must be found and developed to make up the difference. The first issue addressed under this challenge is Canada's prospects for mineral development. The section points out that Canada continues to offer the potential for finding new mineral deposits. In

support of this process, the paper notes the importance of acquiring and disseminating data and information on mineral occurrences and the development of innovative exploration techniques.

Certainty of mineral tenure, a prerequisite to a positive mineral investment climate, is also discussed. Land access is the third issue addressed under this challenge and, in particular, the issues of protected areas and the uncertainty surrounding industry investment pending the settlement of Aboriginal land claims. Possible responses to some of the concerns raised by the issue of land access are discussed in the segment dealing with integrated approaches to land-use development decisions. Finally, the role of taxation in achieving our sustainable development objectives is considered. Special attention is given to the recommendations put forth in the recent task force report on *Economic Instruments and Disincentives to Sound Environmental Practices*.

Sustainable development is also very much about addressing the social impacts of the industry's activities. The fourth challenge, *social infrastructure*, looks at the industry's workforce, the issue of worker health and safety, the industry's role in sustaining mining-dependent communities, and the potential for greater participation by Aboriginal peoples and other significantly under-represented groups in the industry. The paper acknowledges provincial jurisdiction over many of these matters, but notes the complementary role and influence that the federal government may play from a national perspective.

The fifth challenge, *international leadership*, looks at the growing inter-relationship between environmental and trade issues. The paper points out the international scope of the industry and Canada's significant role in it. As well, it notes the importance of the federal government showing international leadership on issues affecting the industry consistent with sustainable development. In doing so, the Government acknowledges the role it should play to use its expertise to assist developing countries and international organizations to promote sustainable development in the minerals sectors in these countries. At the same time, it affirms the Government's continuing commitment to improve market access for Canada's mineral and metal products and to promote their export.

Part V looks at the Government's role in science and technology (S&T). The paper recognizes that the solution to many of the challenges posed by sustainable development will depend on the development and use of S&T that foster technological progress and improve the knowledge base for decision-makers and the public.

The section also considers NRCan's strategic renewal document and the Memorandum of Understanding entered into by NRCan and three other natural resource departments. The latter document outlines a general framework for S&T in support of sustainable development. The discussion continues with an examination of the role that S&T will play in addressing many of the issues facing the industry and society, the importance of geoscience and geomatics in this endeavour, and the need to enhance national and international S&T linkages.

Part VI concludes with a summary of the key themes raised in the paper and the next steps in the consultative process.

Introduction

The Government of Canada has made a strong commitment to the implementation of sustainable development in its policy statement *Creating Opportunity*. This commitment has also been reflected in a number of recent initiatives (e.g., the *Toxic Substances Management Policy*). As well, the Government has committed to update the 1987 *Mineral and Metal Policy of the Government of Canada*.¹ To assist federal departments in addressing the challenge posed by sustainable development, the Government released *A Guide to Green Government* signed by all federal ministers. The Guide states that "All departments must become sustainable development departments, both in terms of their policies that influence the decisions of others, and in how they manage their internal operations . . . the Government recognizes that responsibility for sustainable development is shared across government and that each Minister is accountable for making measurable progress on sustainable development within the sphere of his/her mandate."²

SUSTAINABLE DEVELOPMENT: AN ESSENTIAL GOAL OF PUBLIC POLICY

"Over the past decade, sustainable development has become a key goal of public policy, within Canada and internationally. Individuals, businesses, voluntary groups, the scientific community and governments have been exploring how to transform sustainable development from a concept to a practical guide for action.

The Government of Canada believes that sustainable development is not only a desirable but an essential goal of public policy. Achieving sustainable development requires an approach to public policy that is comprehensive, integrated, open and accountable. It should also embody a commitment to continuous improvement."

Source: Government of Canada, *A Guide to Green Government*, 1995, p. 1.

To assist the Government in advancing this concept in the minerals and metals industry, Natural Resources Canada (NRCan) has developed this Issues Paper to engage stakeholders in the subject of sustainable development as it relates to minerals and metals. The paper builds on government policy initiatives and explains how the concept of sustainable development applies to minerals and metals, describes the key challenges facing the industry, and proposes policy guidelines to incorporate the concept into federal decision-making that affects these commodities. The focus of the paper is on mineral exploration and the first two stages of mineral and metal production. As such, it leaves for other initiatives to address the broader concern regarding material consumption by society and issues specifically related to uranium and greenhouse gases. Following public consultations, NRCan will develop, for consideration by Ministers, a new federal mineral and metal policy based on sustainable development. The policy will address, in a fiscally prudent manner, mineral- and metal-related environmental, social and economic issues that are within federal jurisdiction.

THE CHALLENGES

In 1987, the World Commission on Environment and Development released its report entitled *Our Common Future* (hereinafter referred to as the Brundtland Report). The Brundtland Report defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”³ The Brundtland Report was premised on the belief that people could “build a future that is more prosperous, more just, and more secure.”⁴ This hope, however, was conditional on decisive political action now to begin the process of change necessary to achieve the goal of sustainable development.⁵

The apparent simplicity of the definition of sustainable development belies the enormous challenge it poses for governments, industry and society to render the concept operational. While addressing the environmental challenge, governments must also reduce debt, prepare for potentially profound economic and social changes if Canadians are to participate successfully in an increasingly open global marketplace, eradicate poverty, and ensure that all members of society have equal opportunities for meaningful employment and social participation.⁶

The Government believes that to address the challenge of rendering the concept of sustainable development operational, it is essential that all of its decisions integrate, at the earliest opportunity, environmental, social and economic considerations. This integrated approach to sustainable development underlies this paper.

Minerals and metals have been mined and used for thousands of years.⁷ Today the industry continues to supply society with many of the essential raw materials for the goods and services it uses every day. Canada is a world leader in the production of many mineral commodities and related goods and services. The economic impact of this activity is felt in every region of the country and makes a significant contribution to the high standard of living that Canadians enjoy.

In recent years, however, Canada has been faced with the pressing need to ensure an internationally competitive investment climate. As will be discussed in more detail later in the paper, competition for mineral investment is not new. What has changed is its increased intensity.

Coinciding with this new competition has been a growing concern for, and public expectations regarding, the environmental and social impacts of the industry’s activities. Canadian companies recognize that environmental protection is part of good business practice and have made important strides in addressing with other stakeholders many environmental issues, and in many areas they are industry leaders. The social impact of the industry has also given rise to greater expectations and debate about the role it should play in addressing these concerns. These include its role in the future of mining-dependent communities, health and safety, and increased participation by Aboriginal peoples and other significantly under-represented groups in the industry.

Today, mineral exploration and development projects in Canada operate according to some of the highest environmental and social (e.g., health and safety) standards in the world. Yet these realities are not often reflected in the public’s perception of the industry. This view, for example, has occasionally generated pressure for government policies and regulations that focus on environmental protection without full consideration of their social and economic implications. The result has been growing investment uncertainty for the industry and the loss of economic benefits, not just for the industry and mining-dependent communities, but for all Canadians.

Like all human activity, the industry will always have an impact on the environment (including nearby communities). The challenge, therefore, for governments, industry and the public at large is how to ensure that the industry's activities are undertaken in a manner that does not place undue long-term stress on the environment and that they support our social objectives.

The Canadian minerals and metals industry* recognizes that it must address the challenges posed by sustainable development. The Whitehorse Mining Initiative (WMI), an industry-inspired, multi-stakeholder consultation process, examined the challenges facing the industry in meeting society's environmental, social and economic objectives.

The *WMI Leadership Council Accord*,⁸ signed in September 1994, is an important step in the evolution of a sustainable development approach to minerals and metals. It outlines a stakeholder consensus in a number of areas where action is required to ensure a prosperous and sustainable industry in Canada. The Accord recognizes the value of the mining industry to the country's economic well-being. Its goals focus on the need to institute changes to enhance the industry's ability to attract investment for exploration and development, and to address environmental and social issues. It also makes the point that no element of environmental, social or economic sustainability can be pursued in isolation without detrimentally affecting the other aspects.

The federal government believes that a minerals and metals industry committed to sustainable development will continue to contribute to Canada's future prosperity. A strong and competitive industry will provide Canadians with the financial ability to address their environmental, social and economic objectives. To ensure that the industry continues to make this economic contribution, the Government recognizes that it must improve Canada's mineral investment climate. At the same time, it must address, in partnership with other stakeholders, the environmental and social concerns associated with the industry's activities.

Part I of this paper examines how sustainable development applies to a non-renewable resource such as minerals and metals. It demonstrates that the label "non-renewable" is in some ways misleading. It also looks at five concepts that are shaping the federal government's perspective of sustainable development, particularly in the context of environmental protection and the natural resources sector: pollution prevention, the polluter pays principle, the precautionary principle, integrated resource management, and the ecosystem approach. An appreciation of the challenges facing the industry in the context of sustainable development requires an understanding of the key characteristics of the industry, its role in the Canadian economy, and the role and responsibilities of the federal government. The paper provides an explanation of these in Parts II and III.

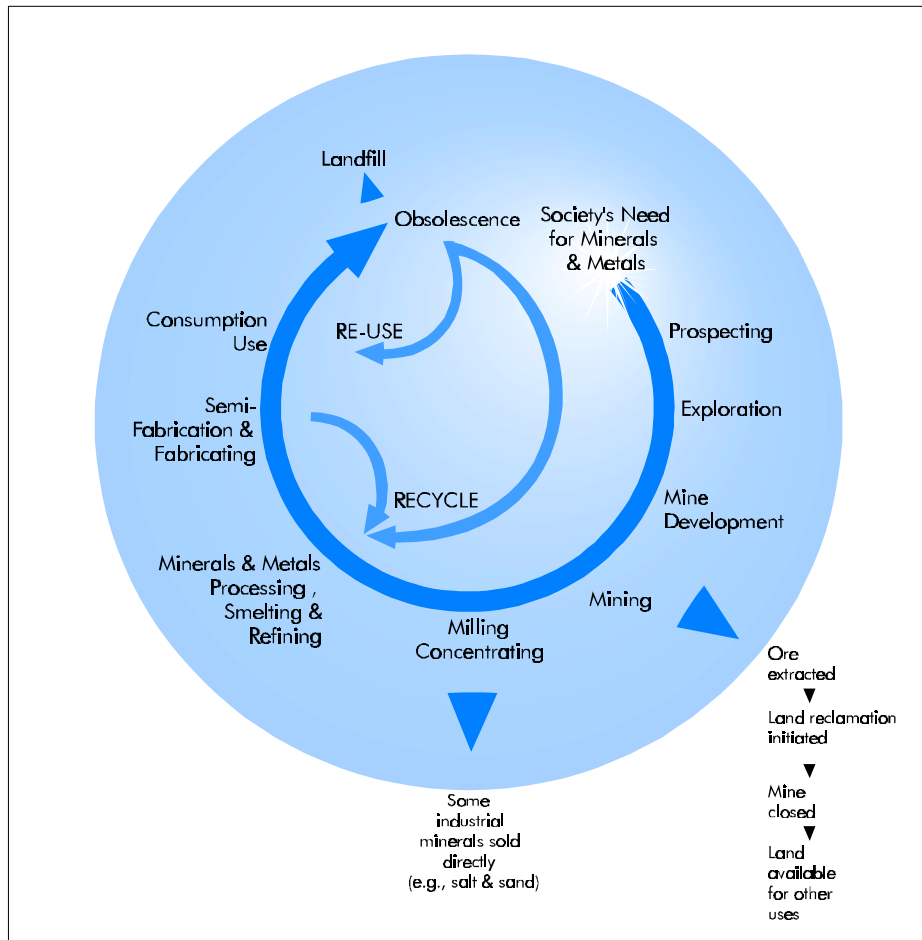
Part IV describes the key challenges facing the Canadian minerals and metals industry and proposes for discussion thirty-two policy guidelines to address them. Part V looks at the role that science and technology may play in addressing the challenges identified in Part IV.

* The term "minerals and metals industry" refers to four stages of activity. Stage I includes the discovery and extraction of ore from orebodies and its treatment to the concentrate stage. The output of Stage II is a relatively pure mineral, metal or alloy. Stage III comprises activities involved in the shaping of minerals into forms for input into other industries. Stage IV involves the production of fabricated metal products. The focus of this paper is on mineral exploration and the first two stages of minerals and metals production.

Part VI concludes with a summary of the key themes raised in the paper and the next steps in the consultative process.

The WMI demonstrated that stakeholders can come together to address sensitive issues of mutual concern. NRCan believes that this Issues Paper and its proposed policy guidelines will generate, in a similar manner, constructive discussion among stakeholders that will help the Government break new ground on how to move the minerals and metals industry in Canada to a more sustainable basis. Canada's promising geology, the Government's commitment to fiscal prudence, and the skills of the men and women who make up the industry will help ensure that the industry continues to make an important contribution to our future prosperity.

Life Cycle of Minerals and Metals



Source NRCan

Part I. Sustainable Development and Minerals and Metals

Although the Brundtland Report set out the framework for sustainable development, it did not explain how to implement it. In fact, the Brundtland Report emphasized that there is no single blueprint for sustainability⁹ and that the “way countries achieve sustainable development will vary among the many different political and economic systems around the world.”¹⁰

In its policy statement *Creating Opportunity*, and in its *Mining Agenda*, the Government stated that a strong economy is the essence of a strong society, and underlined its belief that Canada’s national environmental, social and economic agendas must be integrated. The Speech from the Throne in January 1994 reinforced the Government’s goal of promoting sustainable development as an integral component of decision-making at all levels of society. That same year, the Government announced that the Office of Commissioner of the Environment and Sustainable Development would be established. The Bill to create the Office (Bill C-83) was tabled in the House of Commons in April 1995. The Commissioner will report “annually to the public on how successfully federal programs and spending are supporting the shift to sustainable development.”¹¹ In particular, the Bill will require all federal departments to develop and table in Parliament their respective strategies for sustainable development. And in January 1995, the *Department of Natural Resources Act* came into force. Under the legislation, the Minister is required to have regard to the “sustainable development of Canada’s natural resources.”¹²

TURNING TALK INTO ACTION

“In *Creating Opportunity*, the Government of Canada charted a new way of doing business. In it, we recognized that sustainable development should be integrated into the way government defines its business and makes its decisions. This is why we are creating a Commissioner of the Environment and Sustainable Development to hold government accountable for greening its policies, operations and programs, why we set up the independent Canadian Environmental Assessment Agency to better integrate environmental considerations into project planning, and why we put in place guidelines to help government green its day-to-day operations.

The Government of Canada firmly believes that our economic health depends on our environmental health. We firmly believe that the federal government can help shape a better future for all Canadians, a future characterized by sustainable development.

This is why we want to play a leadership role in turning sustainable development thinking into action. This is why we are now taking the next step of establishing a framework in which environmental and economic signals point the same way; a framework which integrates sustainable development into the workings of the federal government – right across the board.”

Source: Government of Canada, *A Guide to Green Government*, 1995.

While the concept of sustainable development has become a key goal of public policy, its focus has largely been on renewable resources. There has, until recently, been little discussion on how the concept applies to a non-renewable resource such as minerals and metals.

SUSTAINABLE DEVELOPMENT AND THE CASE FOR MINERALS AND METALS

The Mineral and Metal Policy of the Government of Canada, released in 1987, recognized the importance of addressing issues such as environmental protection and research, labour and community adjustment, and improved health and safety. The policy did not, however, anticipate the prominence of environmental issues, nor did it frame these issues in terms of sustainable development. While Canada's environmental strategy, the *Green Plan*, released in 1990, was premised on the concept of sustainable development, it focused mainly on renewable resources such as forestry, agriculture and fisheries. There was little discussion about the role of minerals and metals.

This lack of attention to minerals and metals is not all that surprising, as it does appear incongruous to apply the concept to a resource that is non-renewable within the life span of an individual. It is clear, however, that the concept was intended to, and should, be applied to non-renewable resources. **To this end, this paper proposes that the goal of sustainable development in the context of minerals and metals is to find, extract, produce, add value to, use, re-use and recycle mineral and metal products in the most efficient manner possible, while respecting the needs and values of other resource users and maintaining and/or enhancing environmental quality for present and future generations.**

How society can achieve this goal requires the consideration of intra- and inter-generational equity, mineral consumption and depletion.

Intra- and Inter-Generational Equity

Intra- and inter-generational equity are underlying themes of the Brundtland Report. Intra-generational equity, or the disparity of wealth and resource consumption in the world, is receiving increasing attention in international discussions on how to make sustainable development operational. Debates on how to address this goal figured prominently during the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in June 1992. The Conference highlighted the serious challenge facing the global community with respect to the environment and population growth, and the disparities in per capita income and resource use between the developed and developing worlds.

The Brundtland Report contends that economic development, especially in developing countries, is a pre-condition to both alleviating stress on the environment and reducing disparities in living standards between developed and developing countries. Governments around the world are today placing increasing emphasis on market economies as the preferred mechanism to determine the path for economic development. In many of these countries (notable examples are Mexico and Chile), the minerals and metals industry is playing a role in achieving this objective.

In the short term, many developing countries may lack the expertise, infrastructure, technology or economic resources necessary to stimulate economic development, protect the environment and address their social concerns, including health and safety, population growth and poverty. The federal government recognizes that every country must do its share to help address these problems. Canada's prominent role at the UNCED and its development assistance based on sustainable development reflect this position.¹³ While the Government is committed to taking a leadership role in addressing this challenge, its ability to fulfill this commitment will depend on Canada's long-term technical and financial capabilities.

Inter-generational equity implies that future generations should not be deprived of resources and wealth because of unsustainable levels of consumption by current generations. Renewable and non-renewable resources share common elements. An example is the need to ensure that the stresses placed on the environment as a result of the production or use of natural resources, whether they be forests, fisheries, oil and gas, or minerals, do not result in an environment in which future generations cannot meet their own needs. The issue, however, takes on special importance when the focus is on a non-renewable resource. Consideration of intra- and inter-generational equity in the context of mineral consumption and depletion must take into account some of the unique characteristics of this resource and the nature of mineral development.

Consumption

Society as a whole is making some progress in addressing the issue of consumption. Advances in science and technology, changing social attitudes towards material consumption, inter-material substitution, and increased concern for conservation and energy efficiency are leading to new approaches to the use and recycling of mineral and metal products and reduced environmental impacts. At a more fundamental level, however, there is continuing concern by many people about the need to change social attitudes, especially in industrialized countries, in order to reduce their overall consumption of resources, including minerals and metals.

The long-term global demand for minerals and metals will grow as populations increase and developing countries improve their economic performance and standard of living. This view is based on the fact that the economic performance and standard of living in these countries cannot improve without a corresponding increase in the consumption of minerals and metals.

THE IMPORTANCE OF MINERALS

The world of today could not exist without mineral products. The manufacturing sector, the high tech industries and even the better known resource industries are all dependent, in some way, on the mining industry. Minerals are a key part of the food chain. Growing plants depend on minerals added to the soil – potash, phosphate – which are the fertilizers, or plant foods necessary to produce abundant crops.

This is just the start of the chain. Food products from the farm must be shipped to processors or to markets in trucks, railway cars and planes made of steel, stainless steel, copper and titanium. Food processing is done in metal equipment using metal machinery and food is often packed in metal containers.

Clothing, too, depends on the production of minerals. Natural fibres, such as linen, silk and cotton, are grown with the aid of mineral fertilizers. Homes, apartments, office buildings and factories are built from mineral products and can only function efficiently with the use of equipment made possible by minerals. Modern buildings use metal pipes, electric cables and telephone wires, metal ducts, air-conditioning and heating units and thousands of items of hardware – all depending, in whole or in part, on minerals for their manufacture.

Each and every product, of course, is not necessarily made of minerals. But it is the mineral output of mines that makes the manufacture of every other product possible – from wood to plastic.

Source: The Mining Association of Canada, *Mining: What it Means to Canada*, 1987, pp. 4-5.

This global increase in consumption raises concerns regarding the long-term availability of our natural resources. It is important to note, however, that while some minerals such as potash are consumed, many other minerals and metals are not “consumed” when they are used but, instead, may be recycled by current and future generations. This means, for example, that a portion of the gold or copper being used or recycled by people today may have been mined hundreds of years ago and will still be available for use by future generations.

Less mineral development in Canada will not moderate the global increase in the consumption of minerals, nor will it have much impact on our domestic consumption. Because of the international nature of the industry, a decrease in such development in Canada would simply lead to a shift in the source of supply from Canadian to foreign producers. Moreover, the shift in global mineral development may have little or no positive benefit from a sustainable development perspective. Domestically, however, it could have serious economic implications for Canadians.

Given the expected increase in mineral consumption worldwide, the question is sometimes asked whether equity demands that we forego some mineral development today so that future generations have the opportunity to develop them.

Depletion

Concerns regarding the future availability of mineral resources usually centre on current estimates of existing mineral reserves. For example, it is common to hear that the reserves of a particular mineral or metal are only sufficient for a relatively short period of time at current rates of production. This view reflects a misunderstanding of the scope and the limitations of mineral reserve estimates.

THE INFINITELY FINITE

“The experiences of Palabora Copper in South Africa demonstrate the dynamics of changing ore reserves at the level of the individual mine. At its start up in 1966, the ore deposit was estimated to contain almost 1.8 million tonnes of copper. Today’s estimate is almost 4.7 million tonnes. The mine’s life was originally estimated at 24 years but it is now assessed at 34 years. If an underground mine were to be developed, the reserves and life would be further extended . . .”

Source: Phillip Crowson, RTZ Ltd., *The Infinitely Finite*, The International Council on Metals and the Environment.

First, minerals and metals are natural substances found throughout the environment. The idea of mineral reserves is an economic concept which, by definition, only includes mineral deposits that are known and currently economic. Because of the uncertainties associated with trying to predict the future demand and price for a particular commodity and the often times high cost of exploration, ore reserve calculations may vary from a few months to twenty-five years or more. This does not mean that a mine is expected to operate for only the period covered by the initial ore reserve calculation. The Sigma mine in Val-d’Or, Quebec, and the Dome mine in Timmins, Ontario, for example, have been operating on the basis of two- to three-year ore reserve calculations for more than 50 years.

Mineral reserves, therefore, represent only a fraction of the earth’s mineral inventory. The quantity of such reserves at any given time will be a function of a number of factors. A decrease may result from reduced discoveries, lower commodity prices, or higher production costs. An increase in mineral

reserves may result from the discovery of new mineral deposits, a rise in commodity prices or a reduction in production costs, usually achieved through the introduction of more efficient technologies or improved geological knowledge. The process of discovery and technical advances has historically allowed the world supply of minerals and metals to meet demand. A United Nations document summarizes the present situation in the following manner:

“In the context of sustainable development, the depletion of natural assets is a cause for concern. In the case of mineral resources, however, new geological discoveries continue to add to world mineral reserves; moreover, many mineral commodities, especially metallic mineral products, can be recovered after use and recycled. For these reasons, depletion *per se* does not appear as the main concern at the global level in the case of non-fuel minerals (although it may be, of course, a major concern for individual countries).”¹⁴

Second, the use of minerals and metals in applications beneficial to mankind has not been static. Changing patterns with respect to demand, use, technology and inter-material substitution are common themes throughout history.¹⁵ A specific deposit will therefore be developed only if there is a current or anticipated demand for that mineral which makes it economically viable to develop. There are no assurances that the mineral resources we use today will have the same economic value for future generations. For example, at the turn of this century, mica was extensively mined in eastern Canada because it was transparent, electrically insulating and heat resistant. Today, it has been largely replaced by other minerals. To meet the demand of the Allies for zinc in World War I, Cominco pioneered the electrolytic zinc process which made zinc metal widely available. Previously, zinc in orebodies mined for their lead content was often not processed. Zinc is now widely used in appliances, automobiles, hardware and plumbing. Bastnasite, a mineral valuable for its content of rare earths, did not assume any great importance until the era of the colour television.¹⁶ In a similar vein, synthetic gypsum generated as a by-product by utilities as part of their efforts to reduce sulphur dioxide emissions increasingly competes with mined gypsum for use in wallboards in some regional markets.¹⁷

Third, as noted above, many minerals have a unique characteristic for a resource that is labelled non-renewable – they may be used by people today and then be recycled. Thus, an individual mine may be said to be depleted, but the mineral extracted from that particular mine is not necessarily consumed. Moreover, a portion of these minerals will be recycled and added to the stock of mineral resources that we pass on to future generations.

IMPROVING OUR QUALITY OF LIFE AND WELL-BEING

“The ultimate aim of development is to improve the quality of human life. People depend on their environment and on economic development to meet their basic needs and to improve their quality of life. Economic growth is an important component of development, and reviving growth through improved productivity is the primary focus of economic policy. Economic growth also provides the wealth to make investments in protecting the environment, supporting education, science and technology, and in maintaining the health and well-being of Canadians.”

Source: Government of Canada, *A Guide to Green Government*, 1995, p. 9.

Finally, this debate sometimes loses sight of the fact that our children do not just inherit our pollution and resource depletion, but also enjoy the fruits of our labour in the form of human and physical capital, including investments in natural resources.¹⁸ In other words, the economic benefits we enjoy today as a result of mineral development allow us to make important and necessary environmental, social and economic investments in the form of infrastructure, schools, libraries, research facilities, measures to promote human health and safety (e.g., sewer systems), and improvements to the environment (e.g., cleaner air, water and land) that remain to benefit future generations.

For the reasons stated in this section, it may be some time before the world's mineral resources are depleted, if ever. In some ways, the concern about mineral depletion has drawn attention away from two important considerations: first, the durability of many minerals and their ability to be recycled and re-used across generations; and second, and more importantly, the fundamental need to ensure that the activities of industry do not place undue long-term stress on the environment and that they support our social objectives.

CONCEPTS FOR IMPLEMENTING SUSTAINABLE DEVELOPMENT

A number of concepts have evolved that promote the integration of environmental, social and economic considerations in our decision-making processes. For example, the polluter pays and precautionary principles underlie many of our environmental regulatory decisions. Concepts such as integrated resource management and the ecosystem approach offer ways to achieve a more comprehensive and integrated decision-making process. More recently, the prevention of pollution has been recognized by the federal government as an efficient and effective means of protecting the environment and promoting sustainable development.

The concepts noted above are not rigid rules of law or of interpretation. Our understanding of them in the context of sustainable development is still evolving. They are sometimes defined in a number of different ways and are the subject of a variety of interpretations. Moreover, they will need to be applied on the basis of sound science. The challenge for governments will be to use these concepts in ways that can help identify and better integrate environmental, social and economic considerations in their decision-making processes.

Despite their dynamic nature, these concepts are playing an increasingly important role in the public debate about sustainable development and the direction of government policies. The five concepts noted above are discussed below.

Pollution Prevention

In recent years there has been a fundamental shift in emphasis in pollution prevention – from trying to manage pollutants after they have been generated to not creating them in the first place. In its policy document entitled *Pollution Prevention – A Federal Strategy for Action*, the Government has defined pollution prevention as “the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste, and reduce overall risk to human health or the environment.”¹⁹

The federal pollution prevention strategy calls for Canadians to change the way we design and operate our activities. It acknowledges that “how pollution prevention is implemented may vary from sector to sector.”²⁰ The application of this strategy in the minerals and metals industry will therefore need to

recognize the differences associated with various stages of the industry, from the extraction of the mineral to its manufacture into a mineral- or metal-based product, and its subsequent re-use or recycling.

Polluter Pays Principle

Canada and other member countries of the Organisation for Economic Co-operation and Development (OECD) agreed in 1972 to adopt guiding principles concerning certain international economic aspects of environmental policies.²¹ Included among these was the polluter pays principle. According to this principle, “the polluter should bear the expenses of carrying out the . . . measures decided by public authorities to ensure that the environment is in an acceptable state.”²² What is important is that the potential polluter be the first in the market chain to pay, so that the full weight of bearing these costs will be taken into consideration in the decision-making process.²³ Exceptions to the principle may, however, be justified (e.g., polluters are given aid in their initial retroactive or transitional efforts).²⁴

Problems in applying the principle sometimes arise in identifying and recovering costs for clean-up and rehabilitation when the identity of the polluter is unknown, for example, or where the pollution transcends political and institutional borders. While increasing importance is being placed on reducing pollution at its source, the polluter pays principle still provides the basis for many of Canada’s environmental policies and approaches to regulation.

Precautionary Principle

Simply stated, the application of the precautionary principle means that governments should tend to err on the side of caution. Canada is a signatory to two international declarations which define this principle: the 1990 *Bergen Declaration*²⁵ and the 1992 *Rio Declaration on Environment and Development*. According to the Rio Declaration, “where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

The task for governments in applying the principle is to determine when a “threat” or “risk” is present and when there is the likelihood of “serious or irreversible damage” or “serious adverse impacts.” While complete scientific certainty is not needed, the decision on what degree of certainty less than 100 percent is required in order to take action remains subjective. Consequently, the challenge for governments is to decide on appropriate actions to ensure protection of the environment while at the same time meeting their economic and social objectives.

Another issue for governments is to ensure that the action taken is “appropriate” and “cost-effective.” This requires taking into account not only the risk of a serious environmental threat, but also the cost (value for money) of the proposed response. The use of risk assessment and economic analysis in this context provides a more objective basis for decision-making and promotes a fuller integration of our environmental, social and economic objectives.

Integrated Resource Management

Integrated resource management (IRM) involves the consideration of the competing interests of all resource users. For example, in British Columbia, the Commission on Resources and the Environment (CORE) defines IRM as “a process to identify, assess and compare all resource values as a basis for making decisions on resource use management. IRM includes: considering the land’s capabilities for sustained use; considering social, economic and environmental values, needs and objectives; assigning

resource use and management emphasis based on the relative merits of various resource uses; piecing decisions together to produce a picture of resource uses and priorities for large areas; and selecting the best uses for the present and scheduling resource use changes over time.”²⁶

The federal *Department of Natural Resources Act* states that the Minister of Natural Resources will “have regard to integrated resource management.” Acting on this mandate will require that decision-making processes integrate information on relative natural resource values and uses, the stresses placed on ecosystems, and environmental, social and economic objectives and values. It will be particularly relevant to land-use and permitting decisions because mineral development may compete with alternate resource uses such as the maintenance of fish habitat that supports commercial, sport or traditional fisheries.

Several departments and agencies have responsibilities related to environmental management and for resource development in areas of federal jurisdiction. As a result, policy decisions pertaining to the use of resources are sometimes made on a sectoral basis, thereby leading to conflicts and confusion rather than achieving optimal resource use choices. It is recognized that making reasoned decisions related to present and future resource uses must be approached from an IRM basis. An IRM approach, based on a scientific understanding of ecosystems and aimed at enhancing and optimizing the use of an area’s resources consistent with our environmental, social and economic objectives, may help alleviate future conflicts over resource use.

Ecosystem Approach

The ecosystem approach is a way of viewing humans and their environment that recognizes basic principles of ecology. It places equal emphasis on concerns related to the environment, the economy and the community. This approach has been defined more specifically as: the integrated management of natural and managed landscapes, ecological processes, physical and biological components, and human activities, designed to maintain the integrity of an ecosystem.”²⁷ Such an approach requires that the impact of human activity on the integrity of our ecosystems be minimized. While ecosystem health incorporates the concept of ecological integrity, it also includes social and economic components, as a healthy ecosystem may be described as one where the environment is viable and the economy is sustainable.

More work is needed to understand the application of the ecosystem approach to the minerals and metals industry before adopting specific policies for implementation. Implementation of the concept will require the development of science-based indicators of ecosystem health that can be used to guide decision-making. In particular, further work is needed to develop indicators that reflect an understanding of the impact of minerals and metals on ecological processes and the impact of applying the concept to the industry.

SUMMARY

Sustainable development can and should be applied to a non-renewable resource such as minerals and metals. We can expect an increase in the global demand for these commodities as economies and living standards improve around the world. Despite this increased consumption, it may be some time before the world’s mineral resources are depleted, if ever. The more pressing issue is to ensure that the activities of the minerals and metals industry do not place undue long-term stress on the environment and that they

support our social objectives. Finally, while concepts have been developed to help us apply sustainable development, they are not rigid rules and our understanding and interpretation of them continue to evolve.

While looking at some of the specific environmental, social and economic issues facing the industry in Canada from a sustainable development perspective, it is important to understand the nature of the industry and its contribution to our economy. This is the purpose of Part II.

Part II. The Minerals and Metals Industry

As some 75 percent of Canada's population now lives in urban areas,²⁸ it is perhaps not surprising that many Canadians sometimes forget the ways in which mineral exploration, mining, smelting and refining, and the manufacture of mineral- and metal-based products contribute to Canada's economy and our standard of living. This understanding is necessary if one is to fully appreciate the environmental, social and economic issues that arise when minerals and metals are discussed in the context of sustainable development.

NATURE OF THE INDUSTRY

The minerals and metals industry is highly competitive both in its search for markets and in its search for investment dollars. Only a few years ago, many countries with known mineral potential were not seriously considered by investors because they were seen to be politically unstable. In other cases, countries discouraged or severely limited foreign investment in their mineral sectors. Today, many of these same jurisdictions are liberalizing their political and economic systems and are actively promoting their minerals sectors as attractive investment opportunities. This has resulted in increased competition for investment dollars.

In general terms, mineral exploration and development may be characterized by the following:

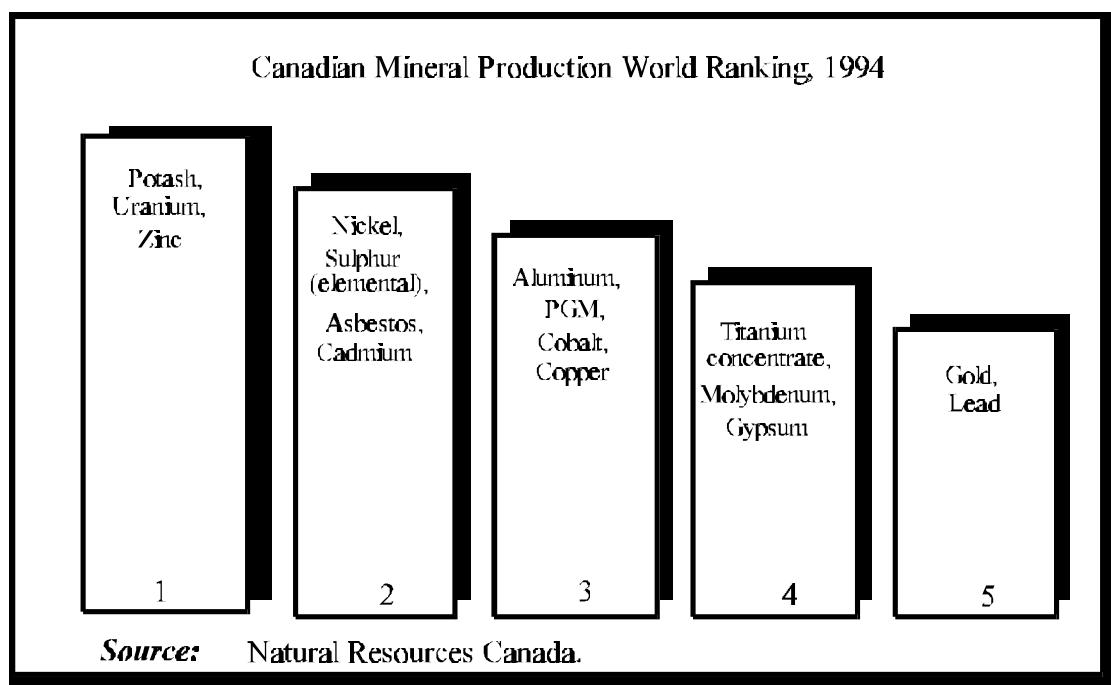
- ! Mineral deposits are located where nature has placed them.
- ! The probability of any particular exploration program finding an economically viable mineral deposit is very low while the associated exploration costs may be very high.
- ! To increase the probability of finding an economically viable mineral deposit, the industry requires access to the largest amount of land possible. Once the exploration stage is past, mining uses relatively small areas of land, on a temporary basis, to recover the mineral resources. The majority of this land will eventually be reclaimed for other uses.
- ! Each individual venture draws upon a mineral resource that will eventually be economically depleted.
- ! The value of the minerals extracted (a function of the size and grade of the orebody) must cover all costs incurred, including capital investment, taxes, and environmental and social costs.
- ! Because the properties of a pure metal (such as copper) are the same regardless of where it is mined, the cost of its extraction determines the competitiveness of a given mining operation with regard to the world price for that commodity.

- ! The industry is characterized by highly complex technology, a knowledgeable, highly skilled workforce, substantial financial risk, long periods of time for venture development, and heavy capital investment requirements.
- ! The prices of most minerals and metals are set in international markets and are beyond the control of any one company.

As a result of these factors, it is not uncommon for a mining operation to require several years and expenditures of hundreds of millions of dollars before it becomes fully operational and profitable. This in turn means that a potential investor in an exploration or development project must look not only at a country's investment climate today, but also at future trends. As a result, changes in a government's policies and its regulatory framework that increase uncertainty for the investor have negative implications for a country's investment climate and its ability to attract and keep mineral investment.

ROLE IN THE NATIONAL ECONOMY

Canada's minerals and metals industry produces some 60 mineral commodities and is a world leader in the production of many of them. Some 80 percent of domestic production is exported to more than 100 countries. Apart from materials such as bauxite, ferroalloy constituents (e.g., chromium and manganese), phosphate rock,²⁹ and a number of minor commodities (in terms of quantity) such as rare earths, Canada is essentially self-sufficient in mineral commodities. With the exception of locally consumed commodities such as sand and gravel (whose prices are mainly influenced by local transportation costs), minerals and metals produced in Canada are subject to prices set in international markets.



Canadian mineral exploration companies may be divided into senior and junior categories.³⁰ The majority of the senior and junior companies operating in Canada are Canadian-owned and controlled. The industry competes by using the most advanced science and technologies. This in turn has created a

demand for skilled workers and professionals in a number of fields. The skill level of these workers and the nature of their work are reflected in their average weekly earnings, which are typically among the highest when compared to those of both the goods- and service-producing industries. These high-paying jobs not only have important implications for individual workers in the industry and their local communities, but also for the country as a whole if Canadians are to pay for the high standard of living they have come to expect.

AVERAGE WEEKLY EARNINGS IN 1994 (FOR SELECTED INDUSTRIES)

Goods-Producing Industries (average)	\$709.87
Mining	972.67
Services incidental to mineral extraction	824.28
Logging and forestry	730.83
Manufacturing	685.07
Construction	657.87
Service-Producing Industries (average)	524.39
Transportation and storage	675.48
Retail trade	339.51
Accommodation services	294.06
Food and beverage services	208.32

Source: Statistics Canada, Labour Division.

In 1994, the four stages of the industry³¹ (mineral and mineral products including coal, but excluding mineral fuels) represented 14.6 percent of Canada's total export earnings, valued at \$31.2 billion, and contributed \$11.7 billion to Canada's trade surplus.

Inter-Sector Linkages

In addition to being the economic mainstay for each of some 115 communities across Canada,³² the industry has numerous links to other segments of Canada's economy. For example, its need for skilled workers provides close ties with schools, technical colleges, universities and research organizations.

In order to compete, the industry is constantly looking for new methods and equipment, such as advanced geophysical equipment, with which to enhance its international competitiveness. This has promoted the growth of Canadian manufacturers of mining- and mineral industry-related equipment and associated consulting and engineering services, particularly near mining-dependent communities. The existence of a sophisticated domestic mining industry, combined with the efforts of the federal government through the programs of the Geological Survey of Canada (GSC), has helped position the Canadian geophysical contracting industry as a world leader.³³

The industry also stimulates the development of environmental technologies and services. The expertise, technologies, management practices and reputations for excellence developed in Canada to meet the industry's domestic environmental requirements make it easier for environmental companies to export

their goods and services. Moreover, Canadian mining projects overseas will often call upon consulting, engineering and environmental technologies and services with which they are already familiar. In many cases, these will be Canadian-based companies.

The industry's impact on other segments of our economy is often under-estimated. For example, some 55 percent of Canadian rail and sea freight tonnage can be attributed directly to the activities of the mining industry. As the home for many of the world's leading mining companies, Canada's capital markets have also become important sources of risk capital for mineral exploration and development projects around the world.³⁴

Contribution to Regional Development

The minerals and metals industry makes an important economic contribution to Canada's regional economies through major expenditures on mineral exploration activity, capital investments and wages. Although employment in the industry has declined since its peak in 1980, the industry has increased its productivity and continued to provide direct employment (Stages I to IV) for some 327,000 Canadians in 1994. In many rural communities, mining is the primary source of employment or offers one of the few opportunities for high-paying jobs.

Exploration activities contribute to regional economies. For example, total estimated expenditures for non-fuel mineral exploration in 1994 in Canada were approximately \$630 million, an increase from the \$477 million spent in 1993. Associated activities (e.g., local service and supply industries) in mineral exploration and construction are also an important source of livelihood for many northern communities. In addition to its expenditures on exploration, the industry also spends considerable amounts on capital investments and repairs.³⁵

SUMMARY

The minerals and metals industry is high-risk and capital-intensive. It is one of the few Canadian industries that is a dominant player in the global marketplace. It makes a substantial contribution to our national economy. Moreover, this contribution is felt across a number of industrial sectors and plays an important role in regional development. The scope that the federal government has to influence the shift of industry to a sustainable basis is defined by its powers under the Constitution. This is explained in Part III.

Part III. Government Role in Minerals and Metals

FEDERAL ROLE

Both levels of government play a complementary role in the minerals and metals sector. Section 92A of the *Constitution Act, 1867* recognizes the jurisdiction of the provinces to enact laws in relation to the exploration, development, conservation and management of non-renewable natural resources located within a province. This means that the rules governing the day-to-day operations of most mineral and metal operations in Canada (e.g., health and safety) are enacted under provincial legislation.

The federal government's direct impact on the industry is limited under the Constitution to prescribed areas. For example, these include some aspects of uranium mining and mining operations located on Canada lands (e.g., Canada's offshore and the two territories). Its influence on the industry is derived from the exercise of its powers under the Constitution. These include:

- ! Aboriginal affairs;
- ! taxation;
- ! fisheries;
- ! interprovincial and international trade;
- ! interprovincial transportation;
- ! monetary, fiscal and commercial policies; and
- ! peace, order and good government.

Both levels of government share jurisdiction in a number of areas, including science and technology, labour (*Canada Labour Code*), and the environment. A number of federal departments and agencies impact on the minerals and metals industry. The most notable include: Canadian Heritage, Environment Canada, Finance, Fisheries and Oceans, Foreign Affairs and International Trade, Human Resources Development, Indian and Northern Affairs, and the Canadian Environmental Assessment Agency. Many federal policies and legislation affecting the industry relate to the protection of the environment. These include: protected areas (*National Parks Act*); environmental assessment (*Canadian Environmental Assessment Act* (CEAA)); effluent and toxics management (*Canadian Environmental Protection Act* (CEPA) and the *Fisheries Act*); habitat management (*Fisheries Act* and *Migratory Birds Convention Act*); and the transportation of materials (*Transportation of Dangerous Goods Act*).

NRCAN ROLE

NRCAN is the main source of minerals- and metals-related scientific and economic expertise in the federal government. It works with other federal departments and agencies to ensure that federal policies and strategies that impact on the minerals and metals industry are consistent with sustainable development, have a balanced impact on stakeholders, and are transparent. As well, the forging of productive partnerships with the public and private sectors remains a critical element of the Department's activities.

NATURAL RESOURCES CANADA VISION

“By 2000, Canada will be a global leader in the sustainable development and use of energy, forest and mineral resources. Natural Resources Canada, with leading-edge expertise in natural resource science, technology and economics, will be recognized nationally and internationally for its contribution to:

- ! improving resource sector competitiveness and environmental performance;
- ! formulating principles, practices and the knowledge base for the sustainable development of natural resources; and
- ! enhancing the health and safety of Canadians.”

Source: Natural Resources Canada, *Natural Resources Canada: Strategic Renewal*, February 27, 1995.

NRCan policies are based on sound science, and science activities reflect policy priorities. The Department focuses on the following main areas:

- ! sustainable development of natural resources;
- ! revitalization of the natural resource sectors;
- ! national and international leadership;
- ! knowledge of the land mass and natural resources; and
- ! health, safety and resource-related environmental concerns.³⁶

With the background provided in Parts I, II and III in mind, the next section (Part IV) addresses some of the key issues facing the industry and proposes federal policy guidelines consistent with the concept of sustainable development.

Part IV. Sustainable Development Challenges

This Part sets out the context for considering how sustainable development may be applied to federal policies affecting the minerals and metals industry. As it is an all-embracing concept, the issues discussed here are inter-related. Many of them fall within the mandate of a number of different federal departments and agencies, others fall primarily within provincial jurisdiction, and still others cross jurisdictional lines. The focus here, however, is on the role that the federal government plays in promoting its goal of a prosperous minerals and metals industry that meets the challenge of sustainable development.

Issues are grouped under five Areas of Challenge. The first issue or challenge is *Improved Decision-Making*. This challenge recognizes that sustainable development will become a reality when, to paraphrase the language of the National Round Table on the Environment and the Economy (NRTEE), we move away from an institutional perspective to one that addresses issues in an integrated manner.³⁷

The direct impact of mineral and metal operations on the environment can be substantial. While this impact may vary, four of the most important areas of challenge for the industry in terms of *Sustainable Operations* are mine reclamation, metals toxicity, metals recycling, and energy efficiency.

Mineral Exploration and Development must be considered if the concerns about the industry's long-term competitiveness are to be resolved. The key issues in this regard are Canada's mineral prospects, certainty of mineral tenure, land access, including the issues of protected areas and the uncertainty surrounding Aboriginal land claims, and a discussion of integrated approaches to land-use development decisions.

Sustainable development is as much about social objectives as it is about environmental and economic goals. *Social Infrastructure* issues include developing a skilled and adaptable workforce, improved working conditions, portability and employment opportunities in the industry, the long-term stability of mining-dependent communities, and greater participation of Aboriginal peoples and other significantly under-represented groups in the industry.

Many of the challenges facing the industry will require global solutions. As a prominent player in the industry, Canada has a vested interest in taking an *International Leadership* role in addressing these issues, particularly those related to the environment, health and trade.

Thirty-two policy guidelines are proposed by the Minister of Natural Resources to address the challenges described in Part IV. This paper and the draft policy guidelines are intended to serve as a basis for consultations with stakeholders. As noted earlier, the input from this consultative process will be used to update the 1987 *Mineral and Metal Policy of the Government of Canada* based on sustainable development.

1. IMPROVED DECISION-MAKING

As highlighted in *Agenda 21*, governments must improve or redesign the decision-making process so that consideration of socio-economic and environmental issues are fully integrated, and a broader range of public perception is assured at the earliest point possible.³⁸ For example, environmental assessments require that the environmental impacts of a process or project be considered and addressed at the outset of the planning process. In the area of regional land-use management, there is increasing interest in taking this integration one step further by dealing with environmental assessment considerations at the outset when undertaking other regional land-use planning processes.

In the past, many government programs and environmental regulations have focused on pollution control, which deal with the results of poor environmental practices. The emphasis has now shifted to anticipating problems and pollution prevention. Avoiding the creation of pollution at source will ensure a higher degree of environmental protection and, in the longer term, may be more cost-effective for both governments and industry.

An area where more consideration will also need to be given is the role of traditional and local knowledge. For example, a study³⁹ has suggested that the greatest practical application of traditional ecological knowledge may occur in three areas: development projects, renewable resource management, and impact studies.⁴⁰ The role that traditional ecological knowledge may play in future mineral development projects is reflected in the fact that it will be considered as part of the evaluation of the BHP Minerals Canada Ltd. proposal to develop a diamond mine in the Northwest Territories.

It is also important to note two principles that underlie this paper, and in particular Part IV. The first was mentioned in Part I, namely, that the Government believes that to address the challenge of sustainable development, it is essential that all of its decisions integrate, at the earliest opportunity, environmental, social and economic considerations.

The second premise is that for industry to prosper in international markets, its decisions must be taken on the basis of commercial considerations within the context of sustainable development.

It is proposed that the Government . . .

- 1) . . . integrate environmental, social and economic considerations from the outset in its decisions affecting the minerals and metals industry.**
- 2) . . . design policy and regulatory frameworks that allow the minerals and metals industry, to the extent that is feasible and realistic, to achieve sustainable development through its own decisions and choices.**

Policy Instruments

Attention is increasingly being focused on economic instruments and voluntary action in addition to regulation. The following is a review of these three policy approaches.

i) Regulatory Development, Regulatory Reform and Harmonization

A number of policy instruments are available to governments to encourage certain types of behaviour. They range from the coercive (e.g., regulation) to the less coercive (e.g., incentives), to the symbolic (e.g., moral suasion). Legislation and regulation are the most widely used tools to ensure acceptable environmental practices, and will continue to play a major role in the way governments approach environmental protection. The challenge for governments is to know when to use regulations and when to consider other approaches. In deciding which policy instrument or combination of policy instruments to use, governments will need to determine which approach will most effectively and efficiently lead to the achievement of its environmental, social and economic objectives.

In many instances, the use of regulations coupled with sound enforcement offers the greatest degree of certainty that a desired standard of protection or behaviour will be met. A disadvantage of this approach is that it does not reward efforts to exceed established standards, provides little incentive for proactive action by industry, and may require substantial public resources to administer. As well, regulations that prescribe procedures rather than standards may also be inflexible and may not provide the most efficient means of achieving an environmental objective.

DIRECT GOVERNMENT EXPENDITURE

"In the past, the federal government often tried to use direct intervention or financial incentives aimed at the private sector or households to encourage them to adopt practices that would contribute to sustainable development. Government expenditure was also used to correct past mistakes. Increasingly, however, direct spending by governments has become less viable as a result of fiscal restraint. To meet its goals, the balance of government actions must shift away from direct government spending towards voluntary efforts, economic instruments and well-designed regulations."

Source: Government of Canada, *A Guide to Green Government*, 1995, p. 15.

Environmental regulations should be designed to ensure a proper standard of environmental protection while placing the least burden on governments, industry and society, for example, through unnecessarily higher costs or lengthy delays. Addressing this concern has at times been dismissed on the basis that stringent environmental regulations may actually promote industrial competitiveness.

The above-noted hypothesis has been the subject of a number of academic studies as it contradicts conventional economic wisdom that environmental regulations which impose higher costs on an industry will harm that industry's competitiveness. Studies by the NRTEE and the U.S. Environmental Protection Agency (EPA) have both concluded that there was no convincing evidence to support the hypothesis.⁴¹ Other studies, including some that support the hypothesis, acknowledge that its applicability may not be the same across all industrial sectors.⁴² One of the exceptions often cited is the mining industry. Environmental policies applicable to minerals and metals should therefore be justified on their merits, and not on dubious arguments about competitiveness. The right policies will be those that deliver the greenest result for the lowest cost to government, industry and society.⁴³

WMI participants agreed that where a sound scientific assessment of ecological effects indicates a need, environmental standards and controls should be established. They should be implemented, however, in an open and transparent manner, taking into account impacts on competitiveness, and they should be based on affordable and commercially proven technology.⁴⁴

Science and technology are rightfully playing an increasingly important role in the development of regulations and in achieving the integration of our environmental, social and economic objectives. WMI stakeholders stressed the importance of improving the existing knowledge base of the environmental effects of mining and the need for high-quality, relevant and objective scientific information.

Ideally, the design of regulatory systems should also take into account cumulative impacts, both of economic activity and regulatory initiatives. For example, the CEAA now requires a cumulative environmental impact assessment of economic initiatives that fall under its ambit such as mineral development. Proposals and guidelines are being prepared to provide guidance on how this assessment should be carried out. Currently, the economic impact of a federal regulatory proposal is undertaken through a Regulatory Impact Analysis Statement (RIAS). The RIAS generally looks at a specific regulatory proposal in isolation, and does not necessarily address the cumulative regulatory impact on the industry. Nor does it cover departmental policies that guide regulatory decisions that could have a significant impact on economic development, or those that guide the application of those policies.

Regulatory systems must not only provide effective environmental protection, for example, but also operate efficiently. In *Creating Opportunity* and in its *Mining Agenda*, the federal government underlined its commitment to address the issue of regulatory reform as a means of encouraging a prosperous mining industry that operates on a sustainable basis.

Canada's environmental regulatory regime is a result of a number of factors. These include: shared jurisdiction over the environment; new international environmental initiatives; the complexity of the issues being addressed and the corresponding regulatory response; the pace of change; uncertainty resulting from the introduction of new concepts (e.g., the ecosystem approach) as part of the regulatory and policy response; and the lack of experience (or precedents) on the part of regulators or the regulated industry regarding the interpretation of new regulations.

Industry officials have identified a number of regulatory factors that inhibit the domestic mineral investment climate: "increased costs, uncertainty, and delays caused by what they perceive as poorly designed and inefficient regulations."⁴⁵ WMI participants echoed similar sentiments when they agreed that the "elimination of unnecessary regulatory duplication and overlap, with appropriate checks and balances, will aid the effective protection of the environment and achieve greater efficiency in regulating the mining industry."⁴⁶

Steps are being taken to address the concerns of stakeholders in the mining sector with respect to regulatory inefficiency and overlap and duplication. In December 1994, the Government released its *Building a More Innovative Economy* initiative,⁴⁷ one of the components in the Government's strategy to foster job creation and economic growth. The mining industry is included as part of the regulatory reform section of the strategy.⁴⁸

Some members of the public, most notably representatives of the environmental community and consumer and social activists, have voiced concerns that the initiative may result in reduced environmental and other regulatory standards. The Government has stated that in addressing the challenge of regulatory reform, it will "continue to be vigilant in safeguarding public interests in areas such as consumer protection, environmental responsibility, health and safety."⁴⁹ Stakeholders will be consulted on the mining-related initiatives noted above.

Efforts are also under way to harmonize federal and provincial/territorial programs and activities. In the past two years, nine separate agreements, including Pulp and Paper Agreements with British Columbia and Quebec, a CEPA Equivalency Agreement with Alberta, and a CEPA Administrative Agreement with Saskatchewan, have been signed. In the coming months, several more such agreements should follow. The negotiation of these agreements is guided by a set of principles and objectives established through multilateral harmonization discussions between the federal government, nine of the provinces, and the territories.

Some progress has also been made in addressing the single-window environmental assessment process identified as a priority in the Government's *Mining Agenda*. The Government recently signed an agreement with the Province of Alberta which provides for a higher level of federal-provincial coordination for dealing with the proponents involved in an environmental assessment. A similar agreement has also been signed with the Province of Manitoba. The CCME is currently consulting with stakeholders on a proposal under the National Environmental Management Framework (NEMF) which would result in a nationally consistent approach to environmental assessment. The Government has made a commitment to consult with stakeholders as this initiative develops.

It is proposed that the Government . . .

- 3) . . . foster regulatory regimes for minerals and metals that promote sustainable development in ways that minimize uncertainty, delay and cost. These regimes include regulations as well as guidelines and policies that interpret and implement the regulations.
- 4) . . . commit to the elimination of unnecessary overlap and duplication with the provinces. Consequently, it supports the harmonization of mineral and metal regulations with the provinces. Such harmonization should be based on consistent and effective national standards for environmental management and protection that respect federal and provincial jurisdictions and, where necessary, address regional needs and conditions.

ii) Economic Instruments

Many environmental resources (e.g., air, land and water) have historically not been assigned a market price. This failure to attach a market price to these resources has sometimes resulted in their misuse and the imposition of costs on society in the form of lost wildlife habitat, a decline in land productivity or aesthetic value, or lower air and water quality. In other cases, the prevailing market price covers the private cost to the user, but not the external costs imposed on third parties or on society at large. These considerations also fail to provide an incentive for the development of new technologies or approaches to prevent environmental problems. Economic theory suggests that an appropriate environmental charge can raise the price of these resources to a level that more accurately reflects their true value which, in turn, would result in positive changes in behaviour. The challenge in applying such instruments will be

to quantify non-market resource values and to harness market forces to create financial incentives to ensure the appropriate consideration of environmental resources.

More generally, environmental charges and other types of economic instruments, such as tradeable permits and deposit-refund systems, can serve as complements or alternatives to traditional regulatory approaches. Economic instruments can potentially be more cost-effective than regulations, and can provide an incentive to innovation. The decision to use an economic instrument or a regulatory or voluntary approach to address a particular environmental problem needs also to consider environmental effectiveness, competitiveness and fairness.

The tax system will likely play an important role in achieving our sustainable development objectives. For example, as part of the February 1994 Budget, the Government announced the creation of a Task Force on Economic Instruments and Disincentives to Sound Environmental Practices. The Task Force presented its report to the Ministers of Finance and the Environment in November 1994.⁵⁰ Of particular interest was a recommendation to promote greater use of recyclable material, “including the provision of equitable tax treatment of virgin and recycled material, to remove barriers and disincentives to the use of recycled material.”⁵¹ This issue is discussed in more detail later in the paper in the section dealing with taxation.

iii) Voluntary Action by Industry

Voluntary action by industry is increasingly being looked upon as an alternative or complement to the traditional regulatory approach used by governments to address many environmental protection issues.

Voluntary action by industry is preferable when it encourages performance exceeding the minimum requirement imposed by regulation. To be successful, voluntary action must allow companies the flexibility to meet objectives based on individually tailored company plans. For example, it may be more efficient and effective for a company to combine changes in production processes with other measures to meet or surpass an emission standard than to impose a particular technological solution.

Canada’s minerals and metals industry is a leader in adopting voluntary measures to address the challenge of sustainable development. In 1989, for example, The Mining Association of Canada (MAC) became the first national mining body in the world to adopt an Environmental Policy which specifies that member companies are committed to the concept of sustainable development and the implementation of this policy in Canada and abroad. The following year, MAC adopted supporting *Guides for Environmental Practice*. Similar environmental policies have also been adopted by most of Canada’s national and provincial mining associations, including the Prospectors and Developers Association of Canada (PDAC) and the Canadian Institute of Mining, Metallurgy and Petroleum (CIM).

Many Canadian mining companies have adopted codes of conduct or policies committed to environmental protection.⁵² These companies have also been active participants in a number of cooperative environmental initiatives. For example, members of MAC have been prominent in the Accelerated Reduction and Elimination of Toxics (ARET) program, a multi-stakeholder initiative launched in 1992 to focus on the voluntary reduction or elimination of toxic substances by industry.

Other joint initiatives include the Mine Environment Neutral Drainage (MEND) program launched in 1988 by industry and government to address the issue of acid mine drainage (AMD).⁵³ Canadian mining companies also played an important role in the creation of the International Council on Metals and the Environment (ICME).⁵⁴

VOLUNTARY EMISSIONS REDUCTION: THE MINING INDUSTRY AND THE ARET PROGRAM

ARET stands for the Accelerated Reduction/Elimination of Toxics. It provides an opportunity for industry to take the lead in establishing and achieving environmental goals. It also represents an encouraging step toward a more cooperative, flexible approach to advancing environmental protection as an alternative to regulatory methods.

ARET was established as a consensus-oriented multi-stakeholder group to use good science combined with common sense. It includes members from several industries, health and academic associations, and government, both federal and provincial.

In March 1994, the group announced the "ARET Challenge" – an invitation to members to put together their own action plans for reducing and eliminating emissions. Thirteen members of The Mining Association of Canada representing 83 percent of the value of Canadian base-metal production in Canada have voluntarily submitted action plans to reduce their ARET-listed emissions dramatically by the end of this decade. The industry's commitments project a reduction of 71 percent of the annual emissions of 12 substances combined, from 7,927 tonnes in the base year (1988 or later) to 2,307 in the year 2000. This means 5,620 fewer tonnes of ARET-listed substances being released each year into the water, air and land. This news is all the more encouraging because similar results are being achieved in the other industrial sectors participating in the ARET program.

Source: The Mining Association of Canada, *Voluntary Emissions Reduction: The Mining Industry and the ARET Program*.

In the context of voluntary action by industry, it is important to understand what is meant by the term, and the issues that governments will need to address when considering its use as a policy tool. Voluntary action by industry may include unilateral initiatives by an industry, such as an industry-sponsored environmental policy or code. In other cases, it may include formal written agreements between government and industry whereby the latter undertakes to meet specific targets that go beyond the minimum prescribed for industry within a specified period of time. In this case, there may or may not be regulations in place should the industry fail to live up to its commitment. In all cases, however, industry will be required to comply with existing regulations and the Government retains the right to use regulatory means to compel the industry to meet its undertakings. In this sense, the use of the term "voluntary action" does not mean that industry has the right to decide whether it will meet the commitments it has made.

While voluntary action by industry may have appeal both for the regulator and the regulated industry in terms of possible cost savings for both parties, flexibility and innovation, a number of policy issues will need to be addressed when considering its use. They include issues of fairness (e.g., big vs. small companies), the role of public involvement, constitutional limits (e.g., federal vs. provincially regulated companies), and the choice of the most efficient and effective means of achieving the desired goal. The task for governments will be to find innovative ways to harness voluntary action by industry to meet the goal of sustainable development.

It is proposed that the Government . . .

- 5) . . . favour pollution prevention strategies that spur innovation, competitiveness and the development of Canadian-based technologies.**
- 6) . . . in assessing regulatory options, first look at ways of encouraging industry to meet the goal of sustainable development through voluntary action. If necessary, the Government should use other means, including regulation, to ensure commitment by industry.**

Public Consultations

The federal government has consulted regularly with industry as well as with its provincial and territorial counterparts to better understand the environment in which its policies are to be implemented. In the case of minerals and metals, the Government consults with its provincial counterparts and key industry players through a number of mechanisms.

Despite this seemingly wide circle of consultations, sustainable development demands the consideration of not just economic concerns, but also related environmental and social concerns in an integrated manner. WMI participants recognized the value of public involvement in mining-related decision-making processes, while identifying a number of practical impediments.⁵⁵ It is also important to note that regular consultations are not only of benefit to governments, but may also benefit other stakeholders.

STATEMENT OF PRINCIPLE

“Consultation of those most affected by decisions is an integral part of the public policy development process.”

Joint Advisory Committee on Consultation

Source: Privy Council Office, Communications and Consultations Secretariat.

The federal government recognizes that it must make a diligent effort to consult with all legitimate stakeholders who may be affected by its policies and is taking steps to address this issue in the context of minerals and metals. For example, the Minister of Natural Resources recently established an Advisory Committee on WMI Implementation.⁵⁶ Membership on the Committee is drawn from the non-governmental organizations (NGOs) who participated in the WMI. NRCan is also a member of the Canadian Aboriginal Minerals Association (CAMA) formed in 1992,⁵⁷ and has developed working relationships with the Canadian Environmental Network (CEN). NRCan will look to further develop such relationships in the future.

Having a full understanding of the issues is an important element of effective consultations. Efforts by the federal government to improve the amount and quality of information which it makes available to the public include mechanisms such as Environment Canada's *National Pollutant Release Inventory* (NPRI), the only legislated, nation-wide, publicly accessible inventory of pollutant releases and transfers in Canada. NRCan provides geoscientific and economic data and analysis, including basic geological data, information on economic, environmental and social issues, and future supply and demand patterns for mineral products. The Minister of Natural Resources also announced that the Governor General had proclaimed the second week of May as *National Mining Week*. The purpose of this initiative is to focus attention on the mining industry, its role in the economy, and its importance to Canada's future economic development.⁵⁸ The industry also recognizes that it must do its part to better inform Canadians about the contribution of mining to their well-being through initiatives such as *Keep Mining in Canada*.

It is proposed that the Government . . .

- 7) . . . continue to commit to meaningful participation by stakeholders when it develops or reviews policies, programs or regulations affecting the minerals and metals industry.
- 8) . . . work to improve the quality, timeliness and accessibility of information on the environmental, social and economic challenges and performance of the minerals and metals industry in order to facilitate more informed decision-making.

2. SUSTAINABLE OPERATIONS

The need to prevent or minimize the environmental impacts associated with mineral and metal operations, such as the production of waste and effluent, is an underlying theme of this paper. Governments, industry and other stakeholders have come to recognize that preventing or minimizing the creation of pollution or other environmental problems is often a more efficient and effective strategy for environmental protection than end-of-pipe solutions. The industry has made major strides in improving its environmental performance. Examples include the development of closed-loop systems which have greatly reduced water use and contamination associated with hydrometallurgical processes, and the development and use of low-sulphur coal and clean fuel technologies to minimize the release of sulphur dioxide and other gases.

The fact remains, however, that the environmental impacts of mineral and metal operations, while often localized, can still be substantial if not properly managed. Different environmental impacts are associated with the various stages of mineral exploration and development. The nature of potential effects and the methods of treatment will vary widely depending on the geographic location of the activity, the characteristics of the local ecosystem, the climatic conditions of the region, the type of exploration involved, the size and nature of the mine, and the ore being mined or processed.

The issue of waste generated as a result of the industry's activities illustrates the dynamics of many of these factors. For example, the extraction of sand and gravel generates little waste, while the valuable metals in a copper orebody may represent as little as 1 percent or less of the mined ore – the rest would be considered waste. It is important to note, however, that the term "waste" is employed in the industry

sense – material not having economic value. While not aesthetically pleasing to look at or necessarily an addition to environmental habitat, much of this waste is benign; it is simply broken rock, but it must be properly stored and contained to avoid potential problems such as landslides. A portion of waste from some mining operations may be potentially acid-generating as a result of its sulphide content. Potentially acid-generating waste must be stored under special conditions to prevent the formation of acid drainage and the subsequent pollution of water by metallic ions. Unfortunately, the public's legitimate concern about waste that could be potentially harmful has created an erroneous negative image in which all wastes are labelled toxic or hazardous. Mine waste is not synonymous with toxic or hazardous waste. Materials that should be considered toxic or hazardous waste are identified as such in the paper.

Four issues from a sustainable operations perspective are discussed here. The first is mine reclamation. The goal of reclamation is to prevent or minimize the environmental impact of mining activities. It is today an integral part of every mining project in Canada. While an important environmental issue, mine reclamation also has important implications for the industry's long-term competitiveness.

How we address the question of metals toxicity is another important issue. Metals are, in some cases, toxic. At the same time, however, they occur naturally in the environment and are in trace amounts essential to life. As we do not live in a risk-free environment, the question for society is how to deal with naturally occurring substances that are, at the same time, and under certain circumstances, potentially harmful to life.

Sustainable development is also about conservation and energy efficiency. Metals have been recycled for thousands of years. Recycling helps promote conservation and is integral to any sustainable development strategy for minerals and metals. Canada has a well developed, efficient metals recycling industry. There is still, however, a great deal of opportunity to increase our rate of recycling for many metals. As a major industrial consumer of energy, there is also an opportunity for the industry to improve its energy efficiency, thereby making it more competitive while at the same time enhancing the environment.

Mine Reclamation

Reclamation is designed to restore to an acceptable state the physical, chemical and biological quality of the environmental resources disturbed by mineral exploration or development. Today it is an integral part of every modern mineral development project.

Effective reclamation begins *before* a mine is actually opened. The process involves a continuous series of activities, from the planning and undertaking of environmental baseline studies, through project design and construction and, ultimately, the rehabilitation of the mine site to a viable and, wherever practicable, self-sustaining ecosystem. There are no internationally recognized standards applying to mine reclamation. Canadian standards, which have evolved dramatically in recent years, are among the most advanced in the world.

A large proportion of the ore mined in Canada is extracted through surface mining, which can result in considerable localized land disturbance and generation of waste rock. Each year, the Canadian mining industry produces about 500 million tonnes of waste rock and tailings, half of which are from sulphide ore operations. Seepage from some of these sites is acidic and may contain heavy metals and other dissolved solids which, in the absence of effective treatment and control, can threaten the environment. Acid drainage may also occur naturally when sulphide rocks or materials come into contact with atmospheric oxygen and water (e.g., through weathering and erosion). The exposure of sulphide-containing rocks may be accelerated by human activities, including mining and civil construction.

Most Canadian mining jurisdictions require the approval of a detailed closure and reclamation plan as part of the permitting process before a company can begin mining operations. In addition to restoring the land's visual amenity value, reclamation requirements can include containing and neutralizing the acid drainage that may persist following mine closure. In certain cases, continuous treatment and monitoring may be required for decades. Because much of the world's nonferrous metals are found in sulphide ores, acid drainage is a major problem facing mining companies worldwide. In Canada, significant progress has been made to minimize AMD from occurring at mine sites through the implementation of environmentally safe tailings management programs and new technologies developed under the MEND program.

Mines in Canada are no longer abandoned. Legislation governing mine closure and reclamation primarily applies to current and future mines. An emerging issue involves the question of liability for the reclamation of abandoned and orphaned sites. Generally speaking, an abandoned mine site is one where the owner of the mineral rights has "walked away" from the site for any number of reasons. An orphaned mine site is one where the owner of the mineral rights can no longer be identified and the mineral rights have reverted to the Crown. As most mines are located within provincial jurisdiction, this is a special concern for provincial governments.

The problem is in identifying old mine sites that may have been abandoned decades ago and determining how to deal with the issue of reclamation in terms of liability and responsibility for funding.⁵⁹ For example, while the state of some of these former mine sites may be unacceptable by today's standards, the mine operators were complying with the laws prevailing at that time. Second, assigning responsibility for the reclamation of these abandoned properties to present owners is not always straightforward. Moreover, where an owner is identified, it does not guarantee that funds are available to pay for the necessary reclamation. In many cases the mineral rights have reverted to the Crown.

WMI participants discussed the issue of old mine sites at some length. The participants' success in achieving a consensus approach to addressing issues associated with old mine sites was limited. One option identified to fund the reclamation of orphaned sites was a combination of government revenues, taxes on the industry, and taxes on the consumer. Further progress was limited because of fundamental differences of opinion among participants over the applicability of joint and several liability as a method of identifying responsible parties.⁶⁰

In 1994, a Contaminated Site Liability Task Force established by the CCME organized an orphaned site funding workshop. Workshop participants considered various funding options and related administrative criteria. At about the same time, a two-day workshop hosted by the Intergovernmental Working Group on the Mineral Industry (IGWG)-Industry Task Force on Mine Reclamation took place.⁶¹ Among the concerns discussed was the issue of orphaned sites. Initiatives are now under way in several provinces to conduct a survey of abandoned mines. NRCan, for example, is cooperating with Nova Scotia and Ontario in the generation of more precise data on abandoned mines.

More work is needed to determine the scope of the problem and the associated resources that will be required to undertake the necessary reclamation of these old mine sites. Addressing the issue poses a number of policy challenges, including what level of remediation should be targeted and the applicability of the polluter pays principle.

It is proposed that the Government . . .

- 9) . . . ensure that, as a condition for mine development on federal lands, comprehensive plans for the reclamation of disturbed areas are developed, including the provision of satisfactory assurances to cover the costs of reclamation and, where necessary, long-term maintenance.**
- 10) . . . determine the scope of the issue on federal lands and continue to work with its provincial and territorial counterparts, industry and other stakeholders to develop responses supporting the goal of sustainable development.**

Metals Toxicity

Metals occur naturally in the environment in various chemical forms and in highly variable concentrations. They cycle through the environment via natural processes governed by the laws of thermodynamics. While human activity and natural processes may redistribute, concentrate or modify metals and their compounds, they cannot create them.

The complexity and diversity of the interactions between metals and the environment are not always well understood. Some forms of naturally occurring elements may be toxic to human health or to the environment under some conditions. On the other hand, many of these same elements are *essential* to life and good health (e.g., manganese, copper, cobalt, zinc, iron and fluorine function as enzyme activators). To be available to living organisms they must be in a form that plants and animals, including humans, can absorb them (in other words, in a form that is bioavailable for uptake). Not all metals can bioaccumulate in biological tissues. Harmful effects may take place if the concentration of the bioavailable form of a metal is either insufficient to meet the organism's needs (e.g., a deficiency of copper in soils can reduce crop yields), or is significantly in excess of biologically required concentrations.

Scientific awareness of the health effects and benefits of metals and their compounds is well documented. Extensive regulatory regimes that closely monitor and control metal exposures and emissions, particularly in the work environment, are in place in many countries, including Canada. While metals toxicity continues to be a public health issue, public concern is increasingly centred on the possible effects of environmental exposures which are generally orders of magnitude lower than in occupational settings.

Given the complexity of natural processes, and the low levels in question, the assessment of metals' real and long-term impacts on the environment is difficult and is, consequently, the subject of debate. Two assessment approaches are actively under discussion. These are risk and hazard assessments. The principal difference between a risk assessment and a hazard assessment is the *exposure* criterion. If the exposure criterion is removed, the regulatory process will have to rely on the 'inherent hazard' or 'inherent toxicity' of the substance under review, without regard to whether it is released, or may be released, into the environment in sufficient amounts, in the course of normal use to exert a deleterious effect."⁶²

Consequently, the principal drawback in relying on intrinsic hazard assessment is that this approach does not provide the kind of information needed to develop sound life-cycle management approaches for specific products or substances. Only by properly considering the risks at each stage of a product's life can a realistic picture emerge of the product's potential impacts, and hence where to focus risk-based efforts. Such "risk-based" approaches can lead to effective and efficient risk-based decisions that are least burdensome to society.

Studies have shown that with the application of common-sense risk-based approaches to ensure that metals and their compounds are used safely and intelligently, potential exposures and risks will be negligible. For example, while demand for lead (and its products) in OECD countries has increased to record levels, its average concentration in air, food, water and human blood has declined to below levels of concern in many of these countries. This was achieved through the elimination of lead in a number of dispersive applications, such as in paints and gasoline. The elimination of lead in all uses was not necessary to achieve this reduction. As a result, society continues to enjoy the benefits of a number of low-risk lead products and applications that are important for reasons of safety or for use in every-day life (e.g., x-ray protection, batteries, and as a protective coating on computer screens).

RISK ASSESSMENT

The assessment of risk is the ultimate measure of potential harm; hence this assessment technique will always provide the maximum public protection for the resources that are applied

The "first law" of toxicology states "the dose makes the poison" (coined by Paracelsus, 1534). This statement recognizes that everything is toxic, and one must have details of the DOSE (i.e. exposure) (quantity, level or concentration in air, water or soil; emission rate, etc.) in order to manage any substance

Exposure is, in part, a function of release. Even for substances which are persistent and highly toxic, the benefits can be safely enjoyed if there is minimal release.

The use of criteria such as persistence, bioaccumulation or toxicity are appropriate for screening candidates for assessment, but the actual assessment must be risk-based if the objective is to provide the maximum public protection without destroying the benefits of the many substances upon which human enjoyment depends Basing assessments on hazard is less efficient than basing assessments on risk as much time will be wasted on substances with minimal releases which result in minimal or no exposure and there will be a failure to deal with substances that are harmful by virtue of their high potential for exposure

Risk reduction involves broad-based approaches to reducing the risks of toxic chemicals taking into account the entire life cycle of the chemicals. Such approaches could encompass both regulatory and non-regulatory measures, such as promotion of the use of cleaner products and technologies, pollution prevention procedures and programmes, emission inventories, product labelling, use limitations, economic incentives, procedures for safe handling and exposure regulations, and the phasing out or banning of chemicals that pose unreasonable and otherwise unmanageable risks to human health and the environment and of those that are toxic, persistent and bio-accumulative and whose use cannot be adequately controlled.

Source: The Canadian Chemical Producers' Association, *Preliminary CCPA Submission and Analysis of The Report of the House of Commons Standing Committee on Environment and Sustainable Development: It's Our Health – CCPA Revisited*, July 1995.

As recognized in Canada's *Toxic Substances Management Policy*,⁶³ regulatory principles developed for addressing organic chemicals are not necessarily appropriate when dealing with naturally occurring inorganic chemical substances. Thus, in the context of risk-based approaches, the phase-out or banning of a mineral- or metal-containing product should only be considered where the application or use of the product presents an unreasonable risk that cannot otherwise be managed. Thus, the notion of banning or sunseting of a mineral or metal in all of its applications and uses, i.e., in its entirety, makes little sense in the context of sustainable development. This is because the notion presumes that risk will always outweigh benefits in all cases; that technology or progress could never manage these risks; and that a "risk-free" condition is a societal goal that is attainable, even for substances that exist in nature.

The example of lead underscores the need for sound scientific information and a clear understanding of the behaviour and effects of certain metals, their chemical form and their role in the environment (e.g., looking at the species of concern or speciation). It also demonstrates the importance of a scientific, risk-based approach to the regulation of metals, their products and applications. This approach should be promoted and strengthened domestically and internationally because it allows society to weigh the threat to the environment with the economic and social costs and benefits associated with various policy responses.

SUBSTITUTION AS A REGULATORY APPROACH

Two kinds of inter-material substitution take place in the marketplace. The most common may be described as inter-material competition, whereby a decision is made as to what material should be used (e.g., to make a chair out of metal, wood or plastic) to make a product. The decision to use a particular material in a product will be based on a number of factors, including price, aesthetic qualities, availability, cultural tastes, performance, and technical features. Substitution of the material in the product may be considered or required when one of these factors changes sufficiently to impact on the product's marketability.

The second type of inter-material substitution occurs as a result of a regulatory decision. This is where a material used in a specific product that is considered hazardous to human health and/or the environment is replaced by another material that is considered benign or less dangerous. Such action is sometimes taken without clear evidence that the substitute is less hazardous than the material it is replacing. This type of substitution may not be as simple or beneficial as it may first appear. Substitution in the case of minerals and metals is complicated by the fact that every mineral or metal has unique properties and uses. Few if any of the "forced" substitutions of minerals and metals have been effective when all the cost-benefit and life-cycle considerations are examined. For example, various synthetic fibres have been developed to replace asbestos in a number of products (e.g., brake linings and insulation) as a result of the legitimate concern for the health hazard posed by this commodity when improperly handled or used. However, many of these new products have not met the technical performance of those containing asbestos, and have either failed in the marketplace or have required costly remedies to achieve the same level of performance. Another important point in the debate is that substitutes are often not as well understood as the material they replace, nor are they necessarily as stringently regulated.

Because it can take many years to understand the health and environmental consequences of the synthetic fibres, it is only now that we have studies by Health Canada, Environment Canada, the U.S. Environmental Protection Agency, and international health organizations that suggest that such fibres may be potentially as dangerous as the material they replaced. In 1993, for example, the World Health Organization published a study that recommended that all fibres that are respirable and biopersistent undergo testing for toxicity and carcinogenicity. A fundamental problem in such a substitution is that to be a technically viable substitute, the material often must have the same physical and chemical properties as the material it is replacing, implying that the risks are often similar. Clearly, when considering substitution as a regulatory approach, it is essential to take a risk-based, life-cycle approach founded on sound science.

Source: Natural Resources Canada.

Initiatives under way are considering strategies to totally eliminate certain pollutants, such as the “virtual elimination” of discharges of persistent toxic substances to the environment, including hazardous mine effluent. The federal government has stated in its *Toxic Substances Management Policy* that naturally occurring substances, elements or radionuclides are not candidates for virtual elimination under Track 1. However, where warranted, a natural substance that is used or released as a result of human activity may be targeted for reduction to naturally occurring levels under Track 2 (life-cycle management). In these situations, more risk-based approaches need to be considered, with the goal of minimizing the harmful environmental impacts of all human activities, including mining. In this regard, more field studies are needed by industry and government to fully understand the cumulative impact of the various stages of the mining life cycle. An example is the AQUAMIN program. AQUAMIN stands for the Assessment of the Aquatic Effects of Mining in Canada. The agreed objective of the assessment is to examine the effectiveness of the Metal Mining Liquid Effluent Regulations (MMLER) by assessing existing information on the aquatic effects of mining, and to make recommendations on: amendments to the MMLER; the design of a national environmental effects monitoring (EEM) program for metal mining; and information gaps requiring research.

Certain metals and their compounds are regulated under CEPA. One of the primary goals of the Act, which is presently undergoing a review, is to regulate toxic substances through all stages of a product’s life cycle. The CEPA definition of “toxic” expands the traditional scientific definition based on the intrinsic potential of a substance to damage organisms. It adds the concept of the likelihood of releases or emissions of the substance in quantities that would endanger the health of humans, animals or plants. The intent of CEPA is to introduce the concept of risk assessment in determining the toxicity of metals and their compounds for the purpose of regulation and control.

More recently, a regulatory approach has taken hold internationally that toxic-persistent bioaccumulative substances are particularly harmful to the environment and should therefore be targeted for phase-out or elimination. Substitution for these kinds of materials is viewed as the solution. This approach may be relevant for synthetic organic substances, but it is difficult to apply to minerals and metals. Moreover, it casts metals in a particularly negative light because, by definition, metals are persistent and bioaccumulative. Yet it is the persistence and the bioaccumulation of essential metals that ensure their uptake, distribution and stability in all living things, and that contribute to the beneficial effects of essential metals to life.

It is proposed that the Government . . .

- 11) . . . develop programs and regulations consistent with the federal *Toxic Substances Management Policy* to prevent or minimize harmful effects to human health or the environment from emissions and exposures to minerals, metals and substances used in their processing and, consistent with the policy, evaluate the potential for harmful effects by adopting a risk-based approach founded on sound science that recognizes natural occurrences and processes, speciation, bioavailability and the essentiality of certain minerals and metals.

Metals Recycling Industry

Society has benefitted from metals recycling for thousands of years. This activity embodies the spirit of sustainable development. Metals recycling is an economic activity in which materials, whose original uses have been served, once again become raw materials in the production chain without loss in quality and are re-introduced into value-added products. There are clear environmental benefits to recycling metals, including less demand for virgin material, more efficient use of Canada's mineral resources and increased energy conservation. For example, the production of copper and aluminum from scrap can result in energy savings of more than 90 percent when compared with the energy requirements consumed in primary production. Lastly, while metals recycling is a commercial activity and thus cannot be considered a waste management strategy *per se*, the indirect benefits include a reduction in the growing pressures on municipal landfills, while diverting potentially hazardous products into new uses.

Because of their high value, metals are not intentionally discarded to landfill. Recyclable metals are highly sought-after commodities and are subject to intense competition. The metals recycling industry is the most mature of all recycling industries. As such, metals are, by far, the most recycled of all materials. Because of the extended life span of most metal products (e.g., copper wire used in electric transmission cables may have a life span in excess of 50 years), it is important to remember that the metals we recycle today may have been first extracted and used by society many years ago. It is therefore often impossible to accurately calculate recycling rates. Where it has been possible to calculate individual recycling rates for consumer products of short life spans, high recycling rates indicate both the efficiency and the effectiveness of the metals recycling industry. For example, the estimated Canadian recycling rate for spent automotive lead-acid batteries is in excess of 94 percent.

The life-cycle management approach to resources and product development must also be considered in the context of metals recycling. The high recyclability of metals should be a major consideration in both product design and development. Product designers will need to become more aware of the recycling potential of the materials they choose. Consumers should also be educated to direct their purchases to products with a high probability of being recycled, such as those containing metallic components. The recycling of metallic products can be further encouraged if consumers are informed about the conservation potential of the metallic materials they have chosen.

Most metal products manufactured in Canada today are made from a mixture of primary and recycled metals. The latter represent an essential source of raw material for our domestic smelting and refining operations. For example, half of the 15 million tonnes of iron and steel produced annually in Canada is from recycled iron and steel scrap. Because of its relatively small metals-consuming economy compared to the United States, Japan or the European Union, its geographic size, the relatively high transportation costs of scrap, and regional variations in supply and demand, Canada is both an exporter and importer of recyclable metals. Today, Canada's recycling industry is an important niche player in this global market. The social and economic benefits of the industry are reflected in the more than 300 recycling companies that provide direct employment for some 15,000 people. Collectively, these companies handle over 11 million tonnes of metals annually valued at more than \$3 billion. These metals are purchased, processed and sold on a for-profit basis.

The federal government affirmed its commitment to a strong domestic metals recycling industry in its *Mining Agenda*, and recognizes that the minerals and metals industry is dependent on a vibrant international metals recycling industry. A major problem that has emerged in international trade in recyclable metals involves regulations designed to impose the same level of control on material destined for recycling as is imposed on waste destined for final disposal. Wastes are materials that are abandoned

or are sent for final disposal. Products or materials no longer used for their original purpose and that are not re-introduced into value-adding commercial applications are waste. Conversely, materials that have an inherently positive economic value and which are treated in a manner designed to minimize loss and return to commerce as an ultimate product should not, for legislative purposes, be defined as waste. In response to concerns about the international movement and disposal of hazardous wastes, the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* (Basel Convention), sponsored by the United Nations Environment Programme (UNEP), was signed in 1989 and came into force in May 1992.

The Basel Convention defines “wastes” to include recyclable metals and “disposal” to include recovery-recycling operations. As a result, recyclable metals, “value notwithstanding,” are defined as waste. Consequently, under the Basel Convention, many metal recyclables are controlled in the same manner as hazardous waste destined for final disposal. In the international market, such a control system reduces the ability of companies to access economic sources of many grades of recyclable metals, resulting in a less efficient minerals and metals industry. In a far more serious context, the increased cost of recyclables as the result of such controls may lead to valuable materials being sent for disposal in landfill sites. Partially to mitigate this problem, OECD countries responded with a Council Decision governing the transboundary movement of wastes destined for recovery operations between member countries,⁶⁴ a decision that pre-dates the Basel Convention entering into force.

The federal government has taken a leadership role in regulating the safe and environmentally sound movement of wastes across international and provincial boundaries and in promoting consistent standards and guidelines. In 1992, Canada enacted the Export and Import of Hazardous Wastes Regulations (EIHWRs) to implement its obligations under the Basel Convention and within the Council Decision. While these regulations do not exempt recyclables from the definition of wastes, they do differentiate between waste for final disposal and waste for recycling, as provided by the OECD Council Decision, and allow controls appropriate for OECD nations. Some aspects of the EIHWRs prohibit trade in metal recyclables between Canada and non-OECD countries who have not ratified the Basel Convention unless there exists a bilateral/ multilateral agreement on the transboundary movements of hazardous waste. In doing so, Canadian industry is denied access to consumer markets and potential supplies of recyclable materials from developing countries.

The Basel Convention will help address the serious problems associated with the transboundary movement of hazardous wastes, particularly in developing countries. However it could also result in unintended environmental, social and economic implications for some developing countries. For example, if industries in these countries have insufficient domestic supplies of recyclable raw materials worth hundreds to thousands of dollars per tonne and are unable to access such materials via imports, they may be unable to efficiently operate on a competitive basis. Operating inefficiencies may initially discourage necessary investments in pollution control equipment and could prevent those industries from recycling even domestically generated recyclable materials. The result is that more of the country’s domestically generated scrap metal could be landfilled or recycled in a less-than-ideal environmental manner. In addition, these inefficiencies may create more demand for virgin material and reduce the economic ability of these countries to address their other environmental and social concerns.

Federal departments have worked cooperatively to develop approaches responding to the regulatory challenges imposed on the world’s commercial metals recycling industry. Canada, with its relatively

small population and industrial base but large metals industry, could be vulnerable to trade restrictions on metal recyclables. Environment Canada, in cooperation with Natural Resources Canada and other departments, has attempted, among other things, to focus efforts at meetings of the Basel Convention and the OECD on solutions to problems associated with controlling and disposing of wastes, while at the same time seeking to avoid overly onerous or unnecessary regulations on metal recyclables sold commercially. In response to industry concerns, Environment Canada undertook a review of the Canadian definition of waste via the CCME to harmonize this definition domestically and within the North American context.

The intention of the Government, as stated in its *Mining Agenda*, involves undertaking the steps necessary to derive a logical definition of "waste", to be used in both domestic and international legislation and to exempt secondary materials containing metals used in recycling or other environmentally beneficial processes from the boundary restrictions imposed by the Basel Convention.

It is proposed that the Government . . .

- 12) . . . recognize the importance of recycling in the life-cycle management of minerals and metals.
- 13) . . . work to remove impediments to the development of a vibrant minerals and metals recycling industry, both within Canada and internationally, and continue to advocate the differentiation between recyclable materials destined for recovery operations and wastes destined for final disposal.

Energy Efficiency

Fossil fuel use has been identified as the major contributor to human-generated greenhouse gas emissions, which in turn have been linked to the issue of climate change. If climate change occurs to the extent predicted by current climate change models, it would have potentially serious consequences for Canada's economy, particularly agriculture, forestry and fisheries. At the same time, energy efficiency is an important component of industrial competitiveness.

The mining industry (Stage I) accounts for some 13 percent of total Canadian industrial energy demand. The Canadian Industry Program for Energy Conservation (CIPEC) was established in 1975 to promote and monitor voluntary efforts to improve energy efficiency in Canada's industrial sectors, including mining and metallurgy. Between 1973 and 1990, the energy efficiency per unit of output, across all companies participating in CIPEC, improved by 26 percent. Within this overall figure, the mining and metallurgy sector component improved by about 14 percent and ferrous metals improved by some 10 percent.

CIPEC was originally formed in response to energy supply, price and security issues. In 1992, it was incorporated within NRCan's Industrial Energy Efficiency Initiative (IEEI), a voluntary, industry-driven approach to foster industrial energy efficiency and economic competitiveness. A reduction in energy usage also contributes to reductions in greenhouse gas emissions. The Initiative includes a Minister's Advisory Council on Industrial Energy Efficiency (MACIEE), through which CEOs provide advice on

industrial energy efficiency to the Minister of Natural Resources. The MACIEE also provides direction to CIPEC, which now contains four elements, including a sectoral task force component.

MAC has signed a letter of cooperation with CIPEC and a Mining/Metallurgy Sector Task Force has been formed. Its target is a 1 percent per annum increase in energy efficiency until the year 2000. The program uses 1990 as its base year and assumes that the annual rate of industrial growth will not exceed 2 percent per annum between 1995 and 2000.

A third component of the IEEI, the Industrial Energy Innovators Initiative, works with individual companies to establish energy efficiency commitments and to develop long-term energy management planning and replication strategies.

3. MINERAL EXPLORATION AND DEVELOPMENT

Metals recycling, conservation, inter-material substitution and technological innovation all improve the efficient use of our mineral resources, but they cannot, by themselves, meet society's future needs for minerals and metals. New mineral deposits must be discovered and developed to meet this global demand. Ensuring that Canada has adequate mineral reserves for the future will necessitate continuing investment in mineral exploration and development.

A country's ability to attract mineral investment depends on a number of factors, foremost of which is its mineral prospects. Canada's pre-eminent position as a mineral producer has also depended on its political stability, skilled workforce, infrastructure, and positive investment climate. The recent entry into the global minerals market of many new mineral-rich nations competing for investment dollars, and concerns about our mineral investment climate, have led some people to speculate that Canada is losing its competitive edge to attract the investment necessary to sustain the level of mineral exploration and development needed to maintain its mineral reserves.

In response to concerns over the decline in Canada's base-metal reserves, federal-provincial/territorial Mines Ministers established a government-industry task force to examine the issues affecting the Canadian mineral investment climate. The final report of the task force,⁶⁵ released in September 1993, drew attention to a number of domestic factors discouraging investment in mineral exploration and development in Canada. These factors included increased uncertainties related to land access, certainty of mineral tenure, and Canada's environmental regulatory regime.

In order for mining to continue to make an important contribution to the Canadian economy and way of life, governments must ensure that industry has access to land identified as open for exploration and development, that there are fair and certain rules for making mineral development decisions, and that there is certainty of mineral tenure.

Canada's Mineral Prospects

Canada's rich and varied geology has enormous potential for the discovery of new mineral deposits. The Voisey Bay nickel-copper-cobalt discovery in Labrador is an excellent example. If these new mineral deposits are developed into mines in a manner that recognizes the importance of environmental and social concerns, Canadians will continue to enjoy the benefits associated with a prosperous minerals and metals industry.

Given a favourable investment climate, the potential for new discoveries will be greatly enhanced by improving the scientific infrastructure for exploration. This includes accurate geological, geophysical and geochemical maps, databases of mineral occurrences, interpretive mineral deposit models, and advanced exploration concepts and techniques.

The industry considers exploration *per se* to be a vital research activity and relies heavily on public agencies to provide the basic geological knowledge essential to the formation and success of exploration efforts. Most companies prefer to target their exploration expenditures to regions with high mineral potential. Communicating the features of Canada's geology, through the acquisition and dissemination of geological data and exploration guidelines and techniques, is becoming increasingly important if this country is to maintain its position among the leading world targets of mineral exploration capital. Also important is the availability of innovative exploration techniques for areas of thick glacial sediment cover, characteristic of much of the Canadian landscape. As will be noted later in this paper, much of this research may also be used to address environmental and social concerns.

The GSC represents an important competitive advantage for Canada. It has helped contribute to the development of a vibrant Canadian junior mining sector made up of over 1,000 small companies and individual prospectors. Information compiled by the GSC comes from a number of sources, including in-house research, provincial mines departments and individual prospectors. Continued efforts by the Government are under way to make this information more easily and speedily accessible to target audiences through means such as digitized maps on CD-ROM and digital databases available on-line, as well as directly through seminars and other fora.

It is proposed that the Government . . .

- 14) . . . work with provincial and territorial governments and other stakeholders to promote investment in Canada's mineral potential through the provision of relevant information.**

Certainty of Mineral Tenure

In general, the majority of the lands and minerals situated within a province are owned by that jurisdiction. Although private ownership of surface rights predominates in some provinces, in most cases the provinces retain the mineral rights to the privately owned land. Each jurisdiction in Canada has mining legislation that outlines how the Crown may dispose of its minerals and how others may obtain rights to them. For industry, it is important to have certainty that it may develop a mineral deposit providing that it meets the conditions of any relevant permitting and environmental assessment processes. In practical terms, this means that governments have the central role in determining one of the key components of a positive mineral investment climate – certainty of mineral tenure.

An operator who wants to enter an area for the purposes of mineral exploration or development must consider a number of factors, such as who owns the land and who owns the associated mineral rights. It is also important to determine if the lands in question are used by Aboriginal peoples for traditional purposes such as hunting and trapping. A well-defined system of property rights is required to ensure that exploration for minerals can be undertaken, that investments are secure, and that if due processes are followed, production may proceed.

At a United Nations Conference in the 1960s, security of mineral tenure was described as a central theme of the world's successful mining laws. The U.S. delegation offered Canada as an example of the success of an approach which ensures security of mineral tenure.⁶⁶ Today, the minerals and metals industry has expressed concerns about Canada's continued commitment to such a system. Addressing this issue not only has implications for mineral investment in the country today, but also in the future when exploration and development projects are being considered.

The concern about certainty of mineral tenure was an important issue during the WMI consultations. The interplay of environmental, social and economic considerations involved in addressing this issue are reflected in the agreement of the WMI participants that it was important to provide:

individuals and companies committed to exploration and development, and the investors who choose to support them, the confidence that their investment is protected. This includes certainty that upon an individual staking a claim, that individual is exclusively entitled to further explore, develop and acquire the mineral rights under claim and develop that claim through to production so long as all statutory and regulatory obligations are met and required approvals obtained. On the other hand, governments need some latitude to manage public resources during periods of rapidly changing public policy. The challenge to governments, therefore, is to balance the needs of the mining industry and the other stakeholders so that the industry has a high degree of certainty with respect to mineral tenure and governments can continue to develop public policies, subject to clear guidelines on issuing and modifying or revoking mineral tenure.⁶⁷

Land Access

Exploration, which is essential to discover new mineral deposits, requires access to large amounts of land to increase the chances of success, but the area eventually required for development is relatively small. The total area of land used for mining in Canada since Confederation accounts for considerably less than 1 percent of our land mass.

Because the location of a mineral deposit is determined by geology, exploration and development sometime come into conflict with alternate land uses – designated, planned or, in some cases, retroactively identified. Many land-use designations preclude or restrict access to land for exploration and development. Important impacts on mineral development, however, result from lands being set aside for various forms of protection and from the uncertainty surrounding development pending the settlement of Aboriginal land claims. The challenge for governments is to provide access to large amounts of land while meeting environmental, social and economic objectives such as fulfilling commitments to ecosystem and biodiversity protection and respecting the aspirations of Aboriginal peoples to manage their own resources and benefit from their development.

Protected Areas

Article 2 of the United Nations *Convention on Biological Diversity* (1992) defines protected areas to mean, “a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives.” In Canada, areas are protected for a number of reasons: to safeguard ecological integrity, to ensure the preservation of species and genetic diversity, to protect wildlife habitat and wilderness, to protect specific natural and cultural features, to foster environmental education and scientific research, and to promote outdoor recreation and tourism.

A number of federal and provincial acts and regulations identify areas for the protection of various environmental values. The level of protection afforded to an area will vary depending on the amount of human alterations which are allowed. For example, national parks seek to protect outstanding natural environments and therefore do not permit any commercial extractive activities. Migratory bird sanctuaries, on the other hand, are intended to ensure the preservation of species, but may allow multiple land uses where compatible.

In 1992, the federal and provincial ministers responsible for parks, wildlife, forestry and the environment made a commitment to complete Canada's Networks of Protected Areas by the year 2000.⁶⁸ It was envisioned that this would result in 12 percent of Canada's land mass being protected for representative purposes. There was a consensus amongst WMI stakeholders that Canada needed to protect representative samples of both its natural regions and its critical wildlife habitats. There was also consensus on the need for clear, scientifically based criteria for the identification of protected areas and for all stakeholders to be involved in the final selection of protected areas. However, there was not yet agreement amongst stakeholders regarding the number of regions and the amount of a region that need to be protected in order to achieve representativeness.⁶⁹ The federal government's main contribution to this initiative is the completion of the National Parks System, which would encompass about 3 percent of the Canadian land mass. Of the 39 natural regions to be represented, 23 are already represented by national parks.

The closing of lands to development can be an important mechanism for contributing to goals such as ensuring the preservation of biodiversity and safeguarding ecosystem integrity. Concerns were expressed, however, that the decisions to close areas to resource development were sometimes being taken without due consideration of the foregone economic opportunities or, indeed, of the social impacts. To address the former, in 1979, the federal government approved a National Parks Policy which provides for Mineral and Energy Resource Assessments (MERAs) of proposed national parks north of 60°. The use of MERAs ensures that a decision to set aside land for the creation of a national park takes into consideration not just environmental issues, but also social and economic factors.

The MERA process only applies to lands under federal jurisdiction north of 60°. A similar process is being informally applied to the offshore. Some provinces, such as British Columbia, have adopted a MERA-like process prior to transferring lands to the federal government for new national parks, but there is no federal requirement for them to do so. It is also important to note the inherent weakness of MERA-type approaches, namely, that knowledge of the mineral potential of a region at any particular time is imperfect and may change as a result of a number of factors. New technologies, improved geological theories, changes in economic conditions, and luck have all played a role in finding new mineral deposits. The history of mining is replete with stories of deposits having been found in areas that had been extensively explored in the past and were thought to have little mineral potential, the Hemlo gold mine in Ontario being an example. It therefore becomes all the more important to ensure that such processes efficiently and effectively capture the best available information from all sources in order to make informed decisions that are in the best interests of all Canadians.

The objectives and hierarchy of protection levels have evolved differently across Canadian jurisdictions and may result in inconsistency in the meaning of the term "protected" and in the criteria used for selecting protected areas. Coordination between jurisdictions in developing science-based decision-making criteria, identifying areas and determining appropriate levels of protection would help ensure that protected area objectives are achieved efficiently and at minimal economic or social costs associated with foregone resource development.

Exploring opportunities for greater cooperation between the federal, provincial and territorial governments with respect to the identification and establishment of protected areas may lead to approaches that help ensure that environmental and other objectives (e.g., scientific and educational) are achieved while minimizing the negative social or economic impacts. One area where federal-provincial coordination will be necessary is in Canada's coastal and marine regions. The selection of marine areas for protection will require a process which integrates the social and cultural interests of local communities, including Aboriginal groups; the potential for development of renewable and non-renewable resources in the area; the importance of the area to shipping and navigation; the tourism potential; and the environmental and conservation goals to be met.

To allay some of the uncertainty that has been affecting the investment climate for mining in Canada, NRCan, provincial/territorial mines departments and the mining industry are working together to develop information on land designations as they affect mineral activity. This information will provide a national perspective of the amount of land closed to the mining industry and an illustration of where these lands are situated. In addition, it will identify the regions not yet represented by protected areas and the areas being considered for protection.

The federal government is committed to protecting representative areas in each of the country's natural regions, safeguarding ecosystem integrity and the preservation of biodiversity. At the same time, it recognizes that access to land for mineral exploration and development is a fundamental requirement for the mining industry. Through process improvements such as those mentioned above, it should be possible to achieve Canada's protected area objectives and preserve ecosystem integrity and biodiversity, while at the same time minimizing the amount of land closed to mineral exploration and development.

It is proposed that the Government . . .

- 15) . . . promote coordinated, timely and efficient processes for completing Canada's networks of protected areas that meet environmental, social and economic objectives while minimizing the amount of land closed to mineral exploration and development.

Aboriginal Lands

Aboriginal peoples in Canada have rights protected under the *Constitution Act, 1982*. These consist of Aboriginal rights or rights set out in treaties and land claim agreements, including rights respecting land and resource management. There are also unresolved, unrecognized or pending land claims and non-ceded areas where Aboriginal peoples have maintained a use and occupancy of, and affinity for, the land.

In most cases in the past, mineral development in the traditional territories has proceeded without the direct participation of the Aboriginal community or without its consent. There are still some instances where the community does not derive direct benefits, even when it does consent to development. Where

land claims are unresolved, unrecognized or pending in areas where Aboriginal peoples have maintained a use and occupancy of, and affinity for, the land, interim business or resource development agreements are sometimes being used where development is proposed.

The settlement of some land claims has resulted in the transfer of mineral title to Aboriginal groups and the establishment of new resource management regimes to govern development. For example, as a result of the settlement of the Tungavik Federation of the Nunavut Land Claim Agreement in the Northwest Territories, Nunavut Tunngavik Incorporated now holds title to the subsurface rights of 37 941 square kilometres of land. This land is open for mineral exploration and development pursuant to its management regime.

A number of outstanding land claims remain to be negotiated. This situation leads to uncertainty concerning processes for obtaining decisions on mineral development and therefore affects the investment climate. In most cases, however, these areas remain open to exploration⁷⁰ and established third-party rights continue to be protected. In addition to affecting the investment climate, delays in settling land claims may also limit the ability of Aboriginal peoples to benefit from resource development.

Another concern is that the multiplicity of land claims may lead to a corresponding number of complex land management regimes across the country. The federal government is encouraging Aboriginal groups to model their land management regimes after those already operating in Canada.

It is proposed that the Government . . .

- 16) . . . promote efficient and effective rules and processes for sustainable resource development in Aboriginal land claims areas and post-settlement areas.**

Integrated Approaches to Land-Use Development Decisions

As discussed in the section on improved decision-making, more integrated approaches to land-use decisions will be helpful in taking into account the interests of local communities, industry, labour, and Aboriginal and environmental groups. As noted in the discussion of IRM, these approaches⁷¹ provide a longer-term view of how the development of a land area might evolve and how to develop information on the possible cumulative impacts of various types of development, as well as competing social and environmental priorities within the area.

IRM is a practical application of sustainable development that has evolved from traditional land-use planning. It recognizes that a variety of resource interests (e.g., mining, forestry, energy, agriculture, fisheries) make legitimate demands on the aquatic, terrestrial and atmospheric components of ecosystems. These demands can lead to potential conflicts that must be resolved at the planning stages through balanced and informed decisions.

IRM endeavours to achieve integrated use within an ecosystem as opposed to traditional land-use zoning. It is premised on the principle that, to the maximum extent possible, no one resource should be developed to the exclusion of other resource opportunities.

This integrated approach can enable governments to realize policy objectives such as the completion of a network of protected areas. It can also provide flexibility for making decisions that reflect current needs and information without being locked into a rigid long-term plan that may no longer reflect what is needed to achieve our environmental, social or economic objectives.

In areas where Aboriginal interests are involved, representation of the Aboriginal group in the planning process is particularly important as treaty negotiations are not limited by land-use management designations. This approach is particularly important as the use and ownership of the lands, and the jurisdiction to manage them, may change as a result of negotiated treaties. The early involvement of Aboriginal groups will improve the longer-term viability of the land-use decisions reached and ensure that all interests are protected.

In order for IRM to be effective, potential resource and environmental conflicts must be identified and resolved at the planning stage. Resolution requires shared decision-making, close coordination and cooperation, a good information base, and a recognition of the legitimacy of other resource uses. In practical terms, this poses many challenges due to overlapping responsibilities and multiple jurisdictions.

One example of an integrated approach that is of current interest in the context of mining development is the regional study now being undertaken of the Slave Geological Province in the Northwest Territories. Officially known as the West Kitikmeot Slave Study (WKSS), this study is examining the potential impact and benefits (environmental, social and economic) of mineral development in this area. It involves the participation of local communities and the representation of outside interests and expertise, including the consideration of traditional ecological knowledge.

MAJOR REGIONAL STUDY OF THE SLAVE GEOLOGICAL PROVINCE

The Slave Geological Province in the central Northwest Territories (NWT) has been the focus of a great deal of activity since the discovery of diamonds was announced in 1991. The area in question is roughly equivalent to one-third the size of Alberta. Five gold mines are operating in the region, and proposals to develop other mineral deposits are being considered. Infrastructure requirements, such as roads and hydroelectric facilities to support these potential mining operations, have also been discussed.

The region's wildlife supports the traditional harvesting activities of local Aboriginal communities, several outfitting and tourism businesses, and wilderness recreation. There is little information, however, on the sensitivity of the wildlife and habitat in the Slave Geological Province to industrial development or its potential impact on local communities. To address these concerns, the Governments of Canada and the NWT announced in December 1994 that a major study of environmental, social and economic issues related to mineral development in the Slave Geological Province will be undertaken. Consultations will involve Aboriginal organizations, the mining industry, environmental organizations, federal and territorial government agencies, and other stakeholders directly involved in the management of this region. Some of the associated research projects may take up to five years to complete. Traditional ecological knowledge will be considered where appropriate.

Source: Indian and Northern Affairs Canada, *Major Regional Study Announced*, News Release, No. 1-9433, December 9, 1994.

The study was prompted in part by the recognition that regional information will be needed for project-specific environmental assessments. In the past, land-use planning processes have been largely distinct from those associated with development permitting, such as environmental assessment. Integrated approaches may reduce the costs associated with carrying out several project-specific environmental assessments by resolving regional and national policy issues in advance. Proceeding without clear

policies that reflect the needs of the region may result in reconsideration of, or amendments to, a decision at a later date. Such a retroactive change of the ground rules will impact on the investment climate and possibly result in significant costs to the government due to the necessity to compensate affected parties. The linkage of project-specific impact assessments and regional land-use management will be all the more important as specific projects are required to undertake cumulative environmental impact assessments.

Integrated approaches to land-use decision-making are of particular value when dealing with a geographic area which crosses administrative boundaries. Examples include an ecologically relevant regional land-use management framework (e.g., a drainage basin) or the cumulative environmental assessment of a project that crosses administrative boundaries. The WKSS, for example, is being designed to accommodate the fact that the Slave Geological Province crosses the boundaries of Nunavut, the remaining eastern portion of the Northwest Territories, as well as several land claims.

One impediment to broader acceptance of integrated approaches is the time and cost it takes to develop regional baseline information and carry out stakeholder consultations. Hopefully, studies such as the WKSS will provide examples of cost-effective processes that will promote the integration of regional land management and project-specific permitting.

In reaching ecosystem-based decisions, authorities must be cognizant of the implications of both an individual project and the cumulative impacts of all human activities on each component of the ecosystem. For example, when considering a proposal that could impact on the aquatic environment, consideration must be given to the protection of fish habitat and productivity. Section 32 of the *Fisheries Act* prohibits the destruction of fish by any means other than fishing, except as authorized by the Minister of Fisheries and Oceans or pursuant to regulations under the Act. Under Section 35 of the Act, any work or undertaking which results in harmful alteration, disruption or destruction of fish habitat is prohibited, while Section 36 controls the deposit of deleterious substances into waters frequented by fish. The MMLER are an example of regulations under Section 36 that enable mining effluents to be discharged into fish-bearing waters while ensuring that fish and other aquatic life are protected.

It is proposed that the Government . . .

- 17) . . . assess current and proposed major government aquatic resource policies, programs and aquatic resource management mechanisms to ensure that ecological, economic, social and cultural objectives are considered.**

In 1992 the federal government, with support from provincial and territorial governments, ratified the *United Nations Convention on Biological Diversity*. Two strategic directions in the *Canadian Biodiversity Strategy* pertaining to IRM identify the need to:

- ! ?Assess current and proposed major government aquatic resource policies and programs to ensure that ecological, economic, social and cultural objectives are considered.

- ! Investigate the use of alternative aquatic resource management mechanisms to enhance the integration of social, cultural, economic and ecological objectives.”⁷²

Determining appropriate or acceptable land uses requires the careful consideration of the environmental, social and economic implications of the decision. Land-use management decisions that identify access or use as early as possible have the greatest potential to help us meet our environmental objectives and provide certainty on the ground rules for access for development. These decisions may result in setting aside representative areas where no development is permitted, or allowing multiple or sequential land uses where these meet both conservation and development objectives. In areas where development is permitted, it may be necessary to balance the interests of activities such as mineral development, fisheries and tourism to determine what types of resource development or economic activity are acceptable.

The integration of policy, land-use management and decision-making, and permitting is in a state of transition. Not only are our perceptions of the inter-relationship of these processes changing but, in the case of Aboriginal land claims, so too is ownership of the land and who will govern it. The challenge will be to design effective and efficient processes that will allow us to meet our environmental, social and economic objectives.

It is proposed that the Government . . .

- 18) . . . promote the development of efficient processes that effectively integrate policy, land-use management and pre-production approval processes that support the goal of sustainable development.**

Taxation

Canada’s tax system is an important determinant of our industrial competitiveness and investment climate. It is also used with other government activities (e.g., unemployment insurance) to address other societal goals. The challenge for governments in the context of the tax system is to promote the competitiveness of industry while ensuring that industry is encouraged to meet society’s environmental and social objectives.

Two trends are affecting the competitiveness of Canada’s tax regime for mineral exploration and development. Domestically, the cumulative impact of tax reform has increased the risk of investing in grassroots exploration. To this concern must be added the impact of increasing levels of profit- and non-profit-based taxes and of financial liability associated with mine reclamation. Internationally, a number of mineral-rich countries in the developing world are aggressively changing their tax regimes to attract investors, including those from Canada.

More attention is also being paid to ways to make the tax system “green.” For example, the International Institute for Sustainable Development (IISD) has published a study on how to make budgets green.⁷³ The complexity of the tax system, however, raises a number of questions when trying to introduce a green objective. As a working paper by the NRTEE points out, there are a number of different interests at stake. “Environmentalists are concerned about environmental effectiveness, industry with impacts on competitiveness, production and profitability, and consumers’ organizations with impacts on the price of goods and services, especially on those least able to afford them.”⁷⁴ Much of the focus of this work is on

taking advantage of opportunities to restructure the tax system in order to achieve both economic and environmental objectives. Two initiatives have examined this latter issue. As noted earlier, the Task Force on Economic Instruments and Disincentives to Sound Environmental Practices tabled its report in November 1994, and in January 1995 the *Projet de société* released a draft document entitled *Canadian Choices for Transitions to Sustainability*.⁷⁵

The Task Force report made a number of recommendations that could affect the minerals and metals industry. In particular, it recommended that the federal government provide “equitable tax treatment of virgin and recycled material, to remove barriers and disincentives to the use of recycled material.”⁷⁶ The *Projet* report offered a number of choices to address various sustainable development issues, including the proposal that Canada “reduce indirect subsidies of virgin materials through national/international harmonization negotiations.”⁷⁷ An examination of these proposals from a minerals and metals perspective illustrates the complexity of the issue.

First, the fact that our trading partners did not identify any such subsidies during the past decade of trade liberalization negotiations indicates that its effect on trade and investment was not considered by them to be distortionary. The tax treatment accorded to the mining industry and the recycling industry reflects the real differences between these two industries. The 100 percent write-off for mineral exploration costs and the provision for accelerated depreciation for new mines and the expansion of existing mines are based on the inherent risks associated with mineral exploration and development. The aforementioned costs are not incurred by the recycling industry, and therefore it does not benefit from the corresponding write-offs. Similarly, as scrap and waste dealers, by definition, specialize in the collection and sale of secondary recyclable material, they are not involved in manufacturing, and therefore do not qualify for the manufacturing and processing (M&P) allowance provided for under the *Income Tax Act*. However, those recycling firms that do specialize in reprocessing these materials may claim the M&P allowance.

Other policy issues must also be considered. What does equitable tax treatment mean when the risks associated with the mining and recycling industries are of a quite different nature? How does one take account of our regional development policies, given the fact that many mining operations are located in areas where there are few other job opportunities, and it is unlikely that recycling operations would take their place?⁷⁸

The tax system offers an opportunity to address our concerns about the competitiveness of the minerals and metals industry and at the same time promote sustainable industry practices. For example, the February 1994 Budget introduced a measure to allow companies to immediately deduct a contribution made to government-mandated mine reclamation trust funds. It is recognized, however, that the complex nature of tax policy requires careful consideration of the implications that any changes to the tax system may engender.

In the 1995 Budget, the federal government indicated that, as part of its ongoing responsibilities to monitor the environmental implications of the tax system, the Department of Finance will examine whether the income and sales tax systems contain any barriers and disincentives to the use of recycled material and will consider options for their reduction where appropriate.

It is proposed that the Government . . .

- 19) . . . consider the environmental, social and economic impacts of its tax policies and programs as they pertain to minerals and metals in a manner that promotes both the competitiveness of the industry and sound environmental practices.**

4. SOCIAL INFRASTRUCTURE

The people who work in the minerals and metals industry have a vital role in its future. Many of these jobs are located in remote communities and support a population of some one million people.

Many of the solutions to the differing circumstances of communities and workers will depend, above all, on greater dialogue and collaboration among mining companies, workers and the affected communities. For example, consultative mechanisms to encourage community involvement in planning mining operations can help ensure that these activities are compatible with the socio-economic development needs of the local community, the preservation of local traditions, and the protection of recreational and environmental values.

The public ownership of most mineral resources in Canada means that governments also have a role in ensuring an adequate level of public benefits from their exploitation. While fiscal policy is the main tool available to governments, efforts must also be made to ensure that the opportunity to benefit from mineral development is available to all Canadians. A related requirement is the need to minimize the negative impacts of mineral activity on the welfare of workers and surrounding communities. Of particular importance in this regard is the health and safety of the industry's workers and the impact of mine closures. In the latter case, it is important not only to prevent or mitigate the environmental impacts of the industry's activities, but also the negative social and economic impacts of mine closures on workers and their communities.

SUSTAINING OUR NATURAL RESOURCES - SUSTAINABLE JOBS, COMMUNITIES AND INDUSTRIES

"Much of Canada's wealth is based on its rich endowment of natural resources. For the many Canadians dependent on the natural resource sector, sustainable development of the resource base is linked not only to job security but also to a way of life that has supported their communities for decades. Thousands of Canadian communities and one in thirteen Canadians depend on a productive resource base and healthy ecosystems for their employment in the resource industries, tourism or recreation. More than one-quarter of Canada's trade is dependent on the resource sector."

Source: Government of Canada, *A Guide to Green Government*, 1995, p. 5.

While recognizing provincial jurisdiction over many of the workforce and community issues facing the industry, there are a number of challenges that must be addressed collectively by both levels of government,

the industry and other stakeholders. This section focuses on issues of shared responsibility which are important to ensure a socially responsible minerals and metals industry in Canada.

Workforce

Training and Education

Canada is among the world's most efficient and competitive producers of mineral and metal products. The old image of miners and prospectors working with picks and shovels has been largely replaced by an industry whose workers employ the most sophisticated equipment and instrumentation. The technological realities of the industry's labour force have created a shift towards higher skills and educational requirements that has implications both for the industry's future and its present workforce. The industry must continue to attract and retain qualified people to meet its future employment needs. For the current workforce, it means that their training and education must be continuously upgraded.

The federal government recognizes the exclusive jurisdiction of the provinces over the education curriculum, including certification and occupational standards. However, both levels of government share a responsibility for ensuring that Canadian workers have the training and skills to allow them to gain meaningful employment and to participate in the process of rapid technological change.

In August 1993, Human Resources Development Canada released a study entitled, *Breaking New Ground: Human Resource Challenges and Opportunities in the Canadian Mining Industry*.⁷⁹ The study, which was led by a Steering Committee composed of federal-provincial governments, industry and labour representatives, identified eight key human resource challenges facing the Canadian mining sector: ongoing training and development, upgrading of basic academic skills, nation-wide occupational standards, addressing workforce dislocation and adjustment, training in trades, workforce diversity, mining-related post-secondary education, and industry partnerships with secondary schools. A major recommendation of the Steering Committee was to establish a joint industry/labour human resources council to address these issues.

Many of the challenges identified in the study, including the need for a human resources council, were echoed during the WMI consultations. In November 1994, the federal government announced its commitment to provide developmental funding for the establishment of a joint industry/labour mining sector council. This joint labour-management "skills council" is similar to councils that have been created in the steel industry and several other industrial sectors. Once fully operational, the council, to be known as the Mining Industry Training and Adjustment Council (MITAC), will assist in the development of skills needed to enhance worker health and safety, productivity, mobility and adjustment. It will also act as a vehicle for addressing issues identified during the WMI consultations.

It is proposed that the Government . . .

- 20) . . . work with industry, labour and the provincial and territorial governments to promote the portability, skills and expertise of Canadians in the minerals and metals industry, including increased opportunities for significantly under-represented groups.

Worker Health and Safety

Improved working conditions are an integral part of achieving a better quality of life for all Canadians. In the minerals and metals industry, a high priority must be given to ensuring that workers at all stages of mineral exploration, development and production operate in a healthy and safe environment.

Occupational concerns related to mineral fibres and their effects are currently under debate. Natural (e.g., asbestos) and man-made mineral fibres (MMMFs) (e.g., fibreglass, refractory ceramic fibres, and kevlar) are extensively used in contemporary products. Health concerns for workers relate to both prolonged exposure and to the two biologically pertinent parameters of fibre dimension and dose. Effective measures and practices to ensure that all mineral fibres are used with caution, and disposed of safely, are essential.

Mining itself is recognized as a potentially hazardous occupation. A particular concern to mining companies is the work environment for operational personnel, rock failure and mine subsidence, and exposure to airborne elements. There is also the stress from working shifts in what is often a 24-hour-a-day industry.

While health and safety in the industry is primarily a matter that resides in provincial jurisdiction, the federal government, under the *Canada Labour Code*, provides a collective bargaining framework, minimum employment standards and occupational health and safety requirements for mines that fall under federal jurisdiction.

It is proposed that the Government . . .

- 21) . . . promote equal treatment across jurisdictions for worker health and safety in the minerals and metals industry.
- 22) . . . promote health and safety initiatives which recognize the need to accommodate changing technology and changing working environments.

Community Stability

Adjustment

Every mine will eventually close. Even when the ore deposit has not been depleted, the unpredictability and cyclical nature of mineral and metal markets may render the deposit uneconomic, leading to downsizing or temporary mine closures. These events can lead to significant social and economic hardships for workers, their families and mining-dependent communities.

WMI participants concluded that a number of the social and economic impacts resulting from mine closures could be averted or minimized by carefully integrating the life cycle of existing and new mines into local community development plans and by increasing the mobility of the mining workforce. Apart from the need for greater uniformity across jurisdictions in both curricula and occupational standards for

mining professions and trades to allow for interprovincial relocation, the development of skills and knowledge that are recognized both in and outside the industry is another element of worker mobility that can help prepare workers and their communities well in advance of a mine closure.

Both governments and industry can assist workers and communities to increase the success of adjustment by carefully assessing and providing notice of the mine's closure as far in advance as possible and by encouraging or assisting in the proactive development of long-term closure plans.

New Mine Development

Despite technological advances to extend the economic life of existing mines, such as increased recovery efficiencies from lower-grade ores, every orebody will eventually be economically depleted. In the case of new mines, it may be preferable that no new single-industry town or community be established around new deposits. A recent trend by mining companies is to rely on "fly-in" workers from established towns, thus allowing these towns to maintain their population and supporting industries. While long-distance commuting may address a number of problems associated with remote mining towns, it introduces other issues for both employers and workers. For example, rotational schedules and working shifts may disrupt the lifestyle of workers and their families and affect their health and productivity.

As the development of a mine may take many years, efforts to identify promising mineral areas near existing communities by conducting geological and mineral appraisals, and to attract mineral investment in these areas, must begin at the earliest opportunity. Moreover, future discoveries may need to rely on advanced exploration techniques for the discovery of more deeply buried deposits. Land-use designations that may render local mineral resources permanently inaccessible must be avoided wherever possible.

NRCan has a number of programs designed to assist mineral exploration. For example, the National Geoscience Mapping Program (NATMAP) provides for collaboration among scientists from the GSC and provincial surveys, industry and universities in field-based projects across the country. It provides coordination and funding support to mapping projects that assist Canada's mining industry, fill gaps in our knowledge of Canada's geology, or address questions related to environmental or other societal issues.⁸⁰ The Exploration Science and Technology (EXTECH) program aims to improve concepts and technologies applicable to exploration for volcanogenic massive base-metal sulphide deposits. This is being achieved through the formulation of integrated regional and deposit-scale models, and the development of geophysical and geochemical methodologies and equipment. EXTECH projects, carried out in collaboration with provincial surveys and industry, are nearing completion in the Snow Lake and Ruttan Mine areas of Manitoba and are actively running in the Bathurst area of New Brunswick.

It is proposed that the Government . . .

- 23) . . . work with industry, labour, provincial and territorial governments, and mining-dependent communities to mitigate and alleviate the socio-economic impacts of temporary and permanent mine closures.

Aboriginal Participation

Canada's Aboriginal peoples are becoming more aware of the opportunities that mining activities may provide. Potential benefits include revenues from mining operations, training, improved infrastructure and amenities, direct employment, and other business opportunities which result as an indirect benefit of local economic development. There is also growing interest within the industry in the potential of Aboriginal peoples and remote Aboriginal communities to contribute to the industry's long-term future.

Many Aboriginal communities face many of the same issues of general concern to mining-dependent communities. However, there are some important differences in the position of Aboriginal communities that must be recognized.⁸¹ Canadian Aboriginal peoples see their physical environment as more than a valuable source of resources; it provides the basis for a way of life for many Aboriginal communities.

Some forms of title enable Aboriginal communities to exercise a greater measure of influence on the mining industry's activities. However, while almost all Aboriginal communities retain a strong attachment to the land, outside of interim and comprehensive land claim agreements there are no formal mechanisms to ensure that local Aboriginal communities share in the benefits of mineral development, or to ensure that these activities are complementary to their traditional economy and lifestyles. The federal, provincial and territorial Mines Ministers recognize the problems and opportunities related to increasing Aboriginal participation in mining. In 1989, IGWG set up a sub-committee to examine these issues through consultation with the mining industry and Aboriginal organizations. The sub-committee has since expanded its membership through the addition of Aboriginal representatives from a number of jurisdictions. A series of reports has been submitted to Canadian Mines Ministers on the sub-committee's ongoing analyses. For example, the sub-committee has reported that prospects for greater Aboriginal participation in mining are improved through formalized participation or business agreements and has developed a guidebook on the use of Socio-Economic Benefit Agreements. As with mining-dependent communities, better communications between the industry and Aboriginal communities was identified as a key factor. These findings were affirmed during the WMI consultations.

It is proposed that the Government . . .

- 24) **. . . in collaboration with industry, Aboriginal peoples, and provincial and territorial governments, strive to increase opportunities for Canada's Aboriginal peoples to participate in all stages of mineral resource development and associated industries.**

5. INTERNATIONAL LEADERSHIP

Issues affecting the minerals and metals industry, particularly with regard to the environment, are increasingly arising out of international fora. Addressing many of these challenges in the context of sustainable development will require international solutions, both in order to protect the global environment and to continue to realize the potential of trade as a vehicle for economic development.

Evidence of the positive correlation between a country's per capita income and the quality of its environment indicates that economic development and trade, by providing the technical and financial capacity to deal with environmental issues and other societal concerns such as population growth and

poverty, can contribute to environmental protection. A report by the IISD summarized the issue in the following manner:

“Sustainable development cannot be achieved worldwide while massive poverty persists. Poverty alleviation is a central objective of development, and a key concern for environmental policies. *Wealth created by trade is an essential means of achieving this end*. . . . Barriers to trade can create impediments to the achievement of sustainable development, particularly for developing countries, and trade liberalization is an important component of progress toward sustainable development for all countries.”⁸²

Trade and development may have repercussions on the environment. Conversely, environmental concerns have the potential to significantly affect global trade. These linkages underline the need for an integrated approach to the formulation of trade, environmental, social and economic development policies. As a trading nation and major player in the international minerals and metals industry, Canada has a vested interest in international activities affecting the industry. In addition, other mineral producers look to Canada to exercise a leadership role in discussions on these issues.

The responsibility of managing issues in international and bilateral fora rests with national governments. In February 1995, the federal government released its *Response to the Recommendations of the Special Joint Parliamentary Committee Reviewing Canadian Foreign Policy*. The response affirmed that sustainable development is a guiding philosophy of Canada’s foreign policy, stating that “To be implemented effectively, sustainable development must fully integrate environmental, economic and social (including political-cultural) considerations.”⁸³

International Cooperation

The achievement of the UNCED was confirmation of a worldwide consensus on the need to pursue sustainable development on a global scale. Since then, new international activities have been created to facilitate the integration of environmental, social and economic development policies. Examples include the U.N. Commission on Sustainable Development (CSD) and the Trade and Environment Committee established in 1994 under the World Trade Organization (WTO). Canada is actively involved in these two bodies and in a number of other organizations which are playing a growing role in discussions on sustainable development, including the United Nations Development Programme, the Global Environment Facility, and the OECD.

More recently, metals have come under attack by some environmental groups and certain countries belonging to the OECD as being a principal cause of environmental degradation and health-related problems. For example, pressure is mounting for international action to initially reduce the use of lead and later eliminate its use altogether. Similarly, concerns have also been raised regarding copper, zinc and other metals. At issue is how to deal with substances like metals which, under certain circumstances, can be toxic. As discussed in more detail in the section of the paper dealing with metals toxicity, an approach to the issue of metals toxicity must recognize the essential role that metals, as natural substances, play in human health and the environment, and their essential role in society. NRCan, in consultation with other federal departments, the provinces and territories, and other stakeholders, therefore intends to develop a National Metals Strategy that will set forth approaches to respond to domestic and international initiatives involving mineral-related environmental issues that are based on sustainable development principles, sound science, and the importance of metals to Canada.

The federal government also recognizes the importance of ensuring that its international commitments are consistent with Canada's sustainable development goals and are implementable at the domestic level. For example, WMI participants emphasized the need for the federal government to ensure that all legitimate stakeholders are consulted in the development of bilateral and international agreements on the environment. The Government has stated that "such consultations will help to ensure coherence between Canada's domestic and international policies – something that the Government views as a requirement for sustainable development."⁸⁴ The Government has therefore stated that, "Where possible, representatives from groups other than government will also continue to participate in special meetings, workshops and delegations to international gatherings."⁸⁵

It is proposed that the Government . . .

- 25) . . . play a leadership role in international fora to ensure that environmental and occupational health and safety issues relating to minerals and metals are dealt with on the basis of sound science and in a manner that supports sustainable development.**

With the growing international commitment to sustainable development, many developing countries are in the process of developing legislative and regulatory frameworks designed to integrate environmental, social and economic objectives. The major international sources of advice and expertise tend to be international development agencies like the World Bank, regional development banks, and regional and specialized organizations and agencies of the United Nations. Some developed nations also provide an outreach service, most notably the U.S. EPA.

Canada has, in the past, been approached by some developing countries with significant mineral economies for bilateral advice and assistance. According to the officials of these countries, Canada was approached for advice because of the size, importance and reputation of its mining sector. In addition, Canada's consultative approach to establishing regulatory frameworks was viewed as preferable to other more confrontational approaches.

As a world leader in the production of mineral commodities, and consistent with the concept of sustainable development, Canada should endeavour to share its experience and expertise in implementing sustainable development in the area of minerals and metals with other countries and international organizations.

It is proposed that the Government . . .

- 26) . . . endeavour to share its experience and expertise in implementing sustainable development in the area of minerals and metals with interested foreign governments and international organizations and, in particular, developing countries and international development assistance agencies.**

Trade Liberalization

Countries are implementing policies to dismantle trade barriers that are impeding economic growth. The North American Free Trade Agreement (NAFTA) is an example. Significant reductions to trade barriers have also resulted from the Uruguay Round of trade negotiations. While progress is being made to eliminate or reduce tariffs, import quotas and other barriers, gains may be offset by the erection of protectionist measures in the guise of environmental protection. For example, some countries and NGOs have lobbied for endorsement by the WTO of the use of domestic trade sanctions or restrictions to support environmental objectives. A number of these have the potential to negatively affect Canada's minerals and metals industry.

While the federal government acknowledges the right of governments to enact measures to protect their environment consistent with multilateral trade rules, it is opposed to any international endorsement of *unilateral* action to erect trade barriers in the guise of environmental protection. A principal thrust of its international sustainable development agenda will therefore be aimed "at developing a global framework of legally binding rules and standards as well as voluntary standards, as appropriate, to guide sustainable development."⁸⁶ In the context of trade liberalization, the Government is committed to promoting transparent and open world trade, while addressing transboundary and global environmental problems cooperatively with the international community. The goal will be to ensure that "trade policies do not contribute to environmental degradation or restrict legitimate environmental action, and that environmental policies do not unnecessarily restrict our trading opportunities."⁸⁷ The focus of Canada's efforts in this regard will be the WTO's Committee on Trade and the Environment.⁸⁸

It is proposed that the Government . . .

- 27) . . . continue to pursue improved market access for Canadian minerals and metals and affirm the principle of a rules-based multilateral trade system and the elimination of non-tariff barriers as the preferred option to achieve sustainable development.

Export Promotion

The minerals and metals industry and auxiliary industries present significant potential to improve Canada's export performance. The impact of economic, social and political changes in countries in Eastern Europe, Southeast Asia and Latin America is translating into significant new demands for minerals and metals.

At the same time, in a continuously changing global economy, and because the materials demanded by society keep changing, market and product diversification are important to maintain the international competitiveness of the industry. The entry of a number of countries into the ranks of world mineral producers presents both an opportunity as well as a new challenge for Canada. Canadian mining service and equipment industries provide a range of scientific, technical and engineering support for mineral and metal projects in Canada and abroad. The transfer of such Canadian expertise also benefits less developed countries which often do not have the skills, experience, technology or

financial resources to develop their own mineral-related environmental services and technologies.⁸⁹ The export potential of this expertise has been expressly recognized in the Government's *Mining Agenda*.

EXPORT OF MINING-RELATED EQUIPMENT AND SERVICES

"Suppliers to the minerals and metals segment of the industry are increasingly aware of the need to further expand their export orientation The Canadian Association of Mining Equipment and Services for Export (CAMESE) . . . describes the industry as consisting of a total of 600 companies . . . the industry has total sales of about \$1.2 billion . . . and direct employment of 15,000 Approximately 50 percent of the goods and services created in Canada for this industry are exported"

Source: *Canada's Export Strategy: The International Trade Business Plan 1995/96*, Minerals and Metals, No. 17.

The GSC's standing as one of the world's leading geological organizations places it in an ideal position to showcase Canadian technologies and promote sales in Canada and abroad of Canadian geophysical equipment, geoscience services and geographic information system (GIS) software. Another area with strong growth potential is the new value-added products being developed with industry partners as part of the Canada Centre for Mineral and Energy Technology's (CANMET) advanced materials Program.

It is proposed that the Government . . .

- 28) . . . promote new and expanded markets for Canadian minerals and metals, technologies and related equipment and expertise, including environmental services and technologies, and value-added products.**

SUMMARY

The challenges and proposed policy guidelines described in Part IV highlight some of the key issues facing the Canadian minerals and metals industry. The section also identifies the environmental, social and economic issues associated with each challenge. The following section (Part V) looks at the role that science and technology may play in addressing these challenges.

Part V. Science and Technology

Science and technology (S&T) are fundamental to sustainable development. They allow for a better understanding of natural systems⁹⁰ and permit the addressing of issues in innovative and cost-effective ways. Progress in addressing the challenges raised in the context of minerals and metals and sustainable development will depend in large part on the development and use of S&T as the foundation for decision-making.

ROLE OF GOVERNMENT

Governments play an important role in shaping the direction of S&T. Federal and provincial/territorial governments have complementary roles in this field. This collaboration extends to S&T initiatives with the academic community, industry, and NGOs.

The federal government works with the provinces and territories in order to bring its expertise and national perspective to S&T issues involving minerals and metals. The Government recognizes, however, that the provinces are responsible for their resources and for many aspects of land management. For example, the GSC works with its provincial and territorial counterparts via coordinated annual meetings, or under the auspices of the National Geological Surveys Committee, to ensure optimum use of resources and to eliminate duplication in its research programs. In a similar way, CANMET consults with provincial and territorial governments and incorporates their views and priorities in the design of its S&T programs. For its part, Geomatics Canada cooperates with the territorial governments in the development of definitive legal surveys following the negotiation of comprehensive land claims with the First Nations.

SOUND SCIENCE AND ANALYSIS

Sound science and analysis are necessary for establishing appropriate goals and targets, in forming the preparation of action plans for achieving those goals, determining whether these plans are working and, finally, for finding smarter ways of meeting goals and objectives. Effective sustainable development strategies benefit from traditional and indigenous knowledge about the environment. They are also rooted in an understanding of ecosystems and the linkages between economic development, ecosystem health and human well-being.”

Source: Government of Canada, *A Guide to Green Government*, 1995, p. 12.

At the federal level, NRCan and three other natural resource departments have signed a Memorandum of Understanding that sets out a general framework for S&T in support of sustainable development.⁹¹ NRCan has stated in its strategic renewal document that it is committed “to activities that contribute to the public good. These will include the development of scientific knowledge, standards and regulations, and products and processes that promote health and safety, and environmental protection.”⁹² This focus will help to ensure that NRCan’s S&T activities promote sound environmental practice and offer the greatest

possibility for multiple economic and environmental benefits. NRCan recognizes that to maintain this focus its future S&T efforts will need to be reviewed on a regular basis.

S&T can also be used by governments to promote the harmonization of approaches for environmental management and protection. The Aquatic Effects Technology Evaluation (AETE) program is such an example. The program is a government-industry initiative (three federal departments, eight provincial departments and MAC representing industry) aimed at developing a base of scientific and technological expertise to provide the mining industry and governments with more cost-effective methods of assessing the environmental impacts of their effluents. The AETE program is reviewing appropriate monitoring technologies and will make specific recommendations about their scientific validity, applicability and cost-effectiveness. Greater harmonization of monitoring techniques is likely to emerge from this work.

It is proposed that the Government . . .

- 29) . . . integrate science and policy in the resolution of issues related to sustainable development and minerals and metals. It will ensure that research priorities respond to policy imperatives and that policy and regulatory approaches in turn are founded on sound science.

ROLE OF INDUSTRY

Although governments play an important role in S&T, industry is perhaps the main instrument of change affecting the environmental dimensions of development, both positively and negatively. Greater cooperation among governments, industry and other stakeholders benefits all participants and the public at large.

FOCUS ON: INDUSTRIAL PARTNERS PROGRAM

The Industrial Partners Program (IPP) is designed to enable new cost-shared projects between Canadian industry and the Geological Survey of Canada (GSC). Its objectives are to build stronger links between the GSC and industry and to ensure that GSC expertise is directly applied to problems of mutual interest. Through these ventures, advances in exploration geoscience have been realized in the fields of exploration geochemistry, borehole and airborne geophysics, analytical chemistry and metallogenic studies. For example, a project with BHP Minerals Canada Ltd. led to the development and enhancement of water sampling techniques for hydrogeochemical exploration in permafrost terrain. This new approach is superior to traditional lake sediment sampling techniques as it represents a dramatic savings in both sampling time and field costs while being less invasive to the local environment. In addition to providing Canada's mineral industry with an effective new exploration method, this project is also providing valuable environmental insights regarding the amount and source of heavy metals in Canada's northern regions.

Source: Natural Resources Canada.

Cooperation between government and industry at the early stage of project development ensures that needs are properly addressed, that partners will be committed to the results, and that elements of technology transfer are integrated into all stages of technology development, thereby providing stronger insurance of successful commercialization. This approach is being demonstrated under the MEND program, a volunteer, cooperative research program into AMD. This program is a model of collaboration

currently involving twenty mining companies, eight provinces and four federal departments. It contributes to the long-term sustainability of the industry and the environment. The MEND program is also enhancing the growth of Canada's environmental industry, composed mainly of small and medium enterprises, while reducing Canada's environmental liability related to AMD, estimated at \$3 billion to \$5 billion, by 10 percent. The expertise and knowledge developed by private companies through the MEND program is now sought by many countries, notably in South America and Europe, thereby creating new export opportunities.

NRCan believes that cooperative, cost-shared ventures with industry and other stakeholders (e.g., universities) aimed at developing technologies which enhance international competitiveness, environmental performance, and health and safety must be encouraged.

It is proposed that the Government . . .

- 30) . . . strengthen its partnerships with provincial and territorial governments, industry and other stakeholders to promote the development of commercially viable mineral technologies and processes that enhance environmental performance and health and safety.**

S&T AND MINERALS AND METALS

S&T play an important role in the context of minerals and metals. They help governments, industry and the public make more informed decisions on the nature and scope of a perceived problem, establish goals to address the problem, prepare cost-effective action plans to address those goals, measure success in achieving the desired solutions, and find even better ways of meeting those goals in the future. S&T can also be used to predict and prevent a problem from occurring, thus reducing the need for control technologies.

Fundamental to addressing many of the environmental, social and economic concerns associated with minerals and metals are geoscientific knowledge, an understanding of Canada's land mass, and an understanding of the processes and pathways into the environment associated with minerals and metals.

The size and characteristics of Canada's land mass make it in many ways unique. It is almost entirely covered by glacial drift which has distorted, and in some cases masked, the chemical and geological signature of the underlying bedrock. These characteristics make the analysis and search for mineral deposits and the sources, pathways and sinks of potentially toxic metals much more difficult than in many other countries. While these challenges have encouraged the development of Canada's geoscientific expertise, they have also made it difficult to borrow and apply geological approaches and data developed in other countries. It is therefore important to ensure that regulatory approaches reflect the unique characteristics of Canada's land mass.

Of great economic importance to Canada are methods of exploration for precious metals, base metals and, more recently, diamonds that can succeed in its glaciated landscape in which the visible indicators of mineral occurrences are often buried under a thick layer of till. Research to develop innovative geophysical and geochemical exploration techniques, coupled with a better geological understanding of

mineral deposits, is critically important to extending the life of existing mining camps and leading industry to explore areas hitherto thought to have low mineral potential.

Geoscientific expertise developed to aid mineral exploration and the technical knowledge and expertise available in CANMET play an important role in policy and regulatory decisions concerning water and land use and the protection of the environment by explaining the interaction of metals in the environment. For example, efforts to develop policies for the management of toxic substances under CEPA recognize the need for different approaches in dealing with naturally occurring versus synthetic substances. To apply this strategy requires knowledge and an understanding of geological baseline concentrations and a better understanding of the natural processes that control the distribution of these substances. Equally important are: a good characterization of industrial processes, emissions and effluents of the mining and mineral processing industry, and the linkages between the species of metals emitted, their transformation in the environment and their environmental fate and effects. This understanding is critical if we are to reach a consensus, domestically and internationally, on the role that metals play in the environment and in concerns relating to human health and safety.

The geochemical records established over decades of research by the GSC and the technical expertise and knowledge available in CANMET represent a repository of baseline data and skills for industry and regulators in establishing effluent discharge criteria and permit limits for new mines, and in determining the cumulative impact of mining operations. These data provide the basis against which to measure anthropogenic pollution and for identifying areas which are susceptible to mineral-related stress, such as mineral-depleted or mineral-enriched agricultural soils and land used by livestock. NRCan is providing scientific advice to Environment Canada on CEPA's Priority Substances List and the Strategic Options Processes aimed at recommending control options for substances declared toxic under CEPA.

The sustainable development of our natural resources also requires geographic information for the wise management of those resources through all stages of their life cycle. This may entail surveys on a local, regional (e.g., watershed), national or global scale. Developing an ecosystem approach to the responsible use of our resources, including minerals and metals, and the monitoring and protection of fragile ecosystems, will involve the development of geomatics as a unifying information infrastructure for sustainable development. Geomatics includes a number of disciplines: surveying, mapping, remote sensing, cartography, photogrammetry, and geographic systems. All are associated with gathering, processing, interpreting and disseminating geographic information. This information need not be limited to geophysical data, but may include all economic, social, legal and political data with a geographical pattern. Indeed, the synergy between Geographic Information Systems (GIS) and digital geological databases can be an extremely powerful tool for mineral exploration and addressing environmental and social concerns.

GIS and associated databases are thus a powerful tool to foster improved decision-making and participation by all, including First Nations and NGOs, through their facilitation of the sharing of essential information among stakeholders. They are increasingly becoming the main vehicles to store and analyze the variety of data required for an integrated approach to land-use development decisions.

The federal government is a leader in the field of geomatics, and has helped to create a world-class private sector geomatics industry. The solutions to environmental issues such as habitat loss, soil erosion, permafrost degradation, natural hazards (e.g., earthquakes and landslides) and AMD will all require accurate mapping of surface materials and a detailed understanding of the underlying geology. Geological maps will help to identify sensitive terrain, either physical or geochemical, and help to locate

sources of acid-neutralizing surface sediments for use during mining and reclamation. The federal government's Earth Observation or remote sensing program also provides constantly updated information on ecological systems across Canada, including surficial geology, vegetation cover, drainage basins and wildlife habitats. Because of its ability to observe vast tracts of remote lands, earth observation is a tool of choice for informed decision-making in areas of challenge in mineral exploration, sustainable mining operations, and integrated approaches to land use.

Pollution prevention is a key strategy to sustainable development. Achieving this goal requires an understanding of industrial processes. A thorough knowledge of mineral and metal processes helps in the design of pollution prevention solutions, effective control technologies and remedial measures. S&T play an important role in this endeavour by providing the necessary technology or data, allowing the necessary re-organization of a production process, or both.

Other S&T activities can also make important contributions to pollution prevention, namely: the removal of specific contaminants from effluents, reductions in the volume and toxicity of effluents, prevention control technologies for reactive mine wastes, the development of recycling applications for inorganic waste materials such as fly ash and electric arc furnace dusts, the development of more energy-efficient processes and materials, and the promotion of greater use of recyclable materials in product manufacturing. In addition, S&T are being used to develop and implement technologies that add value to our mineral resources, thereby creating additional economic and social benefits for a resource that has already been extracted.

S&T play an important role in improving health and safety. CANMET, for example, is undertaking R&D in collaboration with industry that focuses on safe mining technologies, automation of mining technologies, ground stability, explosives safety, the certification of mining equipment, and mine air pollutant monitoring and ventilation systems. A major initiative being undertaken together with the Province of Ontario and industry is the Canada Rockburst Research Program, which is developing technologies to design safer mining methods in areas prone to rockbursts. This initiative will not only result in greater mine safety, but also in greater productivity and lower costs.⁹³

It is proposed that the Government . . .

- 31) . . . develop and provide access to the geoscientific expertise and databases needed for sustainable resource development and continue to promote, in partnership with provincial and territorial governments, industry and others, R&D activities that develop and promote technologies to support sustainable development in the Canadian minerals and metals industry.

INTERNATIONAL LINKAGES

The global nature of many of the issues raised by sustainable development and the export-oriented nature of Canada's minerals and metals industry necessitates Canadian participation in international programs and activities that affect the industry. Such participation will further international consensus on scientific knowledge and requirements to support international discussions on sustainable development, facilitate the global diffusion of technology, and leverage S&T at the international level.

The federal government is actively involved in a number of national and international scientific programs related to minerals and metals. For example, NRCan has entered into bilateral agreements to facilitate joint projects and technology exchanges such as the Canada-Russia Exchange and the Canada-Germany Scientific and Technical Cooperation Agreement. NRCan has also signed an agreement with the Commission of European Communities to exchange information on metals recycling, waste reduction and clean mining. Canadian expertise is also being used to help less developed countries address their mining-related environmental concerns. A recent example is a Memorandum of Understanding entered into between NRCan and Brazil as part of a project sponsored by the Canadian International Development Agency to address mining-related environmental concerns in that country. Through these types of agreement, NRCan can act as a facilitator for Canadian companies wanting to export their products and expertise to foreign countries. In addition, Canada has been involved in the International Labour Organization (ILO) since 1919, playing a leading role in Conventions on Occupational Health and Safety, Lead, Asbestos, and, in 1995, Safety in Mining.

The federal government recognizes that promoting these international linkages will foster a more competitive domestic industry and, at the same time, make a Canadian contribution to the solution of global environmental, social and economic concerns related to the industry's activities.

It is proposed that the Government . . .

- 32) . . . promote international scientific and technological linkages to advance scientific expertise, knowledge and the transfer of technology in support of solutions and issues that are consistent with sustainable development.**

SUMMARY

Advances in S&T will play a critical role in determining how successfully the challenges posed by sustainable development are met. Federal natural resource departments, including NRCan, undertook reviews of their S&T priorities. These reviews have highlighted the importance that sustainable development is playing in the establishment of federal S&T priorities.

Part VI. Conclusion

NRCan has developed this Issues Paper for discussion with stakeholders in order to assist the federal government in advancing the concept of sustainable development in the minerals and metals sector. The paper demonstrates how the concept of sustainable development may be applied to minerals and metals, describes the key sustainable development challenges facing the minerals and metals industry, and proposes policy guidelines to incorporate the concept into federal decision-making which affects these commodities.

Over the next several weeks this Issues Paper will be circulated to a wide range of stakeholders. Individuals and organizations will be asked to provide us with their written comments on the issues advanced and on the proposed policy guidelines. NRCan officials will be consulting, for example, with members of IGWG and the WMI Advisory Committee to discuss their views. Following these consultations, NRCan will develop, for consideration by Ministers, a new federal mineral and metal policy based on sustainable development.

For its part, NRCan believes that to address the challenge of sustainable development, it is essential that all of its decisions integrate, at the earliest opportunity, environmental, social and economic considerations.

Sustainable development is not a detailed blueprint for action that can be easily copied and applied to each segment of society in the same manner. Our vision and understanding of the concept will change as we gain more understanding and experience on how to make it operational. The paper assumes that the federal mineral and metal policy that will emerge from this consultative process will not be immutable but, rather, an important step in making this important sector of our economy operate in a manner that meets the goal of sustainable development.

Endnotes

¹ *The Mineral and Metal Policy of the Government of Canada*, May 1987, Cat. No. M37-37/1988.

² Government of Canada, *A Guide to Green Government*, Cat. No. En21-136/1995E, 1995, pp. 1-2.

³ World Commission on Environment and Development, *Our Common Future*, Oxford: Oxford University Press, p. 43.

⁴ *Ibid.*, p. 1.

⁵ *Ibid.*

⁶ *Economic Instruments and Disincentives to Sound Environmental Practices*, Final Report of the Task Force, Cat. No. F2-101/1994E, November 1994, p. 3.

⁷ According to one author, the mining of ores and the smelting of metals “may have started around 5700 years ago, possibly in what is today northeast Iran, with smelting of copper-oxide ores into metallic copper. Recent finds of copper and bronze implements in northeast Thailand, however, raise questions about the dating and the place of origin, since tentative dates of between 7000 and 6000 years ago have been given to the Thailand finds. The spread of metal working into other areas was rapid, and by 2500 BC bronze products were in use from Britain in the West to northern China in the East.” See Andrew Goudie, *The Human Impact on the Natural Environment*, 4th edition, Oxford, Blackwell Publishers, 1994, pp. 23-24.

⁸ *The Whitehorse Mining Initiative Leadership Council Accord, Final Report*, November 1994.

⁹ *Supra*, endnote 3, p. 40.

¹⁰ *Ibid.*, p. 314.

¹¹ Environment Canada, *Government Establishes a Commissioner of the Environment and Sustainable Development*, Press Release, October 19, 1994.

¹² *Department of Natural Resources Act*, subsection 6 (a).

¹³ Canadian International Development Agency, *CIDA's Policy for Environmental Sustainability*, January 1992, Cat. No. E94-29/9-1.

¹⁴ United Nations Conference on Trade and Development, *Fostering Sustainable Development in the Commodity Field: Analysis of National Experiences in the Management of Natural Resources with Regard to Commodity Production, Mineral Resources and Sustainable Development*, September 27, 1993, TD/B/CN.1/16, p. 3.

¹⁵ There are a number of reasons why a mineral deposit may or may not be valuable: the deposit may be very rich, it may be more accessible than other deposits, technological advances, or the commodity may be in great demand. See Ivan A. Given, Editor, *SME Mining Engineering Handbook*, Vol. 1, Society of

Mining Engineers of The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, 1973, pp. 1-8 – 1-9.

¹⁶ Ibid., pp. 1-8.

¹⁷ Natural Resources Canada, *Canadian Minerals Yearbook*, Cat. No. M38-5/43E, 1994, pp. 25.1-25.3.

¹⁸ The World Bank, *The World Development Report 1992*, New York: Oxford University Press, p. 34.

¹⁹ Environment Canada, *Pollution Prevention – A Federal Strategy for Action*, June 1995, Cat. No. En21-137/1995E, p. 4.

²⁰ Ibid.

²¹ Adopted by the Council for Organisation for Economic Co-operation and Development at its 293rd Meeting on May 26, 1972.

²² Organisation for Economic Co-operation and Development, *The Polluter Pays Principle*, pp. 12-13.

²³ Ibid., p. 6.

²⁴ Ibid., p. 17.

²⁵ The Bergen Declaration states that: “In order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.”

²⁶ Commission on Resources and Environment, *Vancouver Island Land Use Plan*, Vol. 1, February, 1994, p. 256.

²⁷ Environment Canada, *Reviewing CEPA: The Issues, #3/The Ecosystem Approach*, Cat. No. En40-224/3-1994, 1994, p. 1.

²⁸ Statistics Canada, *A National Overview*, Cat. No. 93-301, p. 24.

²⁹ A raw material used to make fertilizer.

³⁰ The seniors are those that earn income from producing mines; junior companies do not have producing mines and depend on sales of company shares to finance mineral exploration. See Natural Resources Canada, *The Canadian Minerals and Metals Industry: Aspects of Competitiveness*, June 1994, p. 49.

³¹ See footnote on page 9 for a description of the four stages of the industry.

³² Energy, Mines and Resources Canada, *Mining Industry Employment Update*, September 1991, p. 25.

³³ “Geophysical contracting is a technology-intensive driven industry dependent on advanced skill and knowledge creation. It utilizes electrical, magnetic, radiometric, seismic and gravity methods to collect and compile data on the composition of the earth. These techniques are employed in petroleum, minerals,

environmental, engineering, geothermal, groundwater and oceanographic studies. Canadians are the recognized leaders in the application of geophysical techniques to mineral exploration and development. Canadian airborne survey companies have 70 percent of the world market; Canadian geophysical equipment manufacturers, software developers and data interpretation companies each constitute approximately 60 percent of their respective world markets.” See Michael E. Porter and the Monitor Company, *Canada at the Crossroads: The Reality of a New Competitive Environment*, Business Council on National Issues, and the Minister of Supply and Services, Ottawa, 1991, p. 126.

³⁴ For example, in 1994, mining stocks, both junior and senior, comprised some 20 percent of stocks traded on the Montréal Stock Exchange, 19 percent of stocks traded on the Toronto Stock Exchange, and 52 percent of stocks traded on the Vancouver Stock Exchange.

³⁵ For example, in 1993, total industry expenditures on capital investments and repairs amounted to \$7.25 billion, or 4.5 percent of total investment in Canada. The economic benefits of these expenditures were spread across the country.

³⁶ Natural Resources Canada, *Natural Resources Canada: Strategic Renewal*, February 27, 1995, p. 6.

³⁷ National Round Table on the Environment and the Economy, *Prosperity and Sustainable Development for Canada: Advice to the Prime Minister*, Working Paper Number 1, p. 2.

³⁸ Agenda 21 is considered by many to be the key UNCED document. It is an “inventory of environment and development issues, including action programs and cost estimates for their implementation. It represents an attempt to restructure human thinking and activities in order to integrate the environment and the economy.” See Report of the Standing Committee on Environment, *A Global Partnership: Canada and the Conventions of the United Nations Conference on Environment and Development (UNCED)*, April 1993, p. 8.

³⁹ A study has defined traditional ecological knowledge as “the sum of the data and ideas acquired by a human group on its environment as a result of the group’s use and occupation of a region over very many generations.” See José Mailhot, *Traditional Ecological Knowledge: The Diversity of Knowledge Systems and Their Study*, The Great Whale Public Review Support Office, ISBN 1-895931-20-7, 1993, p. 11.

⁴⁰ *Ibid.*, p. 19.

⁴¹ A review by the NRTEE of the hypothesis in the context of the pulp and paper industry concluded that there was no “convincing evidence to support the hypothesis that strict environmental legislation has promoted competitiveness in the past.” Similarly, a study by the U.S. EPA stated that the hypothesis could not be tested using standard econometric methods, and the “clear presumption running throughout both the theoretical and empirical literature is that environmental regulations in a country that raise the cost of production for an industry will reduce net exports from that country . . .”

⁴² For example, see the report by the Organisation for Economic Co-operation and Development entitled *Environmental Policies and Industrial Competitiveness*, 1993. See also a recent report by the Conference Board of Canada entitled *Governmental Non-Fiscal Measures and the Competitiveness of the Canadian Non-Ferrous Metals Industry*, Report 147-95, 1995. At page 4 of the Conference Board report, the author states that “Although the environmental benefits of regulations are spread across society, the costs tend to fall disproportionately on certain sectors. In general, the competitiveness of resource-based industries likely suffers disproportionately from stricter environmental regulations.”

⁴³ The Economist, *When Green is Good*, November 20, 1993, pp. 19-20.

⁴⁴ “All stakeholders agree that where a sound scientific assessment of ecological effects indicates a need, harmonized control requirements should be based on the best technology that is commercially proven and economically affordable by the sector Monitoring results should be considered when setting both national baseline and site-specific standards,” Control measures should be established taking into account environmental health, ecological effects, technology, costs and competitiveness.” See *Final Report of the Environment Issue Group*, Whitehorse Mining Initiative, November 1994, pp. 11-12.

⁴⁵ Intergovernmental Working Group on the Mineral Industry, *Final Report on Environmental Regulatory Concerns*, September 1993, p. vii.

⁴⁶ *Supra*, endnote 8, p. 12.

⁴⁷ Industry Canada, *Building a More Innovative Economy*, News Release, December 5, 1994.

⁴⁸ Treasury Board of Canada, *Eggleton Announces Measures to Cut Red Tape and Reduce Government Burden on Business*, News Release, December 6, 1994. The regulatory initiative will address seven issues that are important to the industry:

- ! administration of the *Fisheries Act*;
- ! environmental assessment;
- ! land use and related decision-making;
- ! definition of waste;
- ! permitting North of 60°;
- ! regulatory impact analysis; and
- ! toxic management.

⁴⁹ *Supra*, endnote 47, Backgrounder, p. 1.

⁵⁰ *Supra*, endnote 6.

⁵¹ *Ibid.*, p. 22.

⁵² For example, Noranda Minerals Inc., *Noranda Minerals Inc. Environmental Report*.

⁵³ Currently, eight provincial governments, four federal departments, and twenty mining companies are participating in MEND. The Canada Centre for Mineral and Energy Technology (CANMET) acts as the MEND Secretariat.

⁵⁴ The purpose of the ICME is “to promote sound environmental and health policies and practices to ensure the safe production, use, and recycling and disposal of metals.”

⁵⁵ For example, the need to determine the appropriate duration and scope of the consultations, what constitutes appropriate representation, and the cost and allocation of expenses.

⁵⁶ Natural Resources Canada, *McLellan Announces Members of Minister’s Whitehorse Mining Initiative (WMI) Advisory Committee*, News Release, 95/13, March 2, 1995.

⁵⁷ CAMA describes itself as “a private, non-profit organization which seeks to increase the awareness of benefits and opportunities in the mineral industry for Aboriginal communities and individuals. CAMA will act as an instrument for the advancement of Aboriginal community economic development, mineral resource management and environmental protection.”

⁵⁸ Natural Resources Canada, *McLellan Announces Proclamation of National Mining Week*, News Release, 95/30, May 5, 1995.

⁵⁹ Whitehorse Mining Initiative, *Finance and Taxation Issue Group Final Report*, November 1994, p. 18.

⁶⁰ *Ibid.*, p. 20.

⁶¹ Canada Centre for Mineral and Energy Technology, *Report of Results of a Workshop on Mine Reclamation*, Toronto, Ontario, March 10-11, 1994.

⁶² *It's About Our Health! Towards Pollution Prevention*, Report of the House of Commons Standing Committee on Environment and Sustainable Development, June 1995, p. 67.

⁶³ Environment Canada, *Toxic Substances Management Policy*, June 1995, Cat. No. En40-499/1-1995.

⁶⁴ NRCan, through active consultations with both the primary metals and metals recycling industries, worked cooperatively with Environment Canada and other departments to develop the basis for this approach and continues to support this differentiation between wastes and recyclables through active participation in an OECD Review Mechanism whereby individual recyclable materials are assigned to the “Green,” “Amber” or “Red” list based on the respective level of required control.

⁶⁵ The Government/Industry Task Force on the Canadian Mineral Investment Climate tabled its final report (actually three reports and 20 background studies) at the 1993 Mines Ministers’ Conference in Fredericton, New Brunswick. The reader should take note of the following report and background studies prepared by the Task Force: Final Report on *Environmental Regulatory Concerns*; the background study entitled *Duplication and Overlap in Environmental Protection Regulations in Canada*; and the background study entitled *Canada’s Environmental Regulatory Systems: Current Issues*.

⁶⁶ Richard H. Barlett, *The Right to Mine and the Extent of Ministerial Authority*, Mining Law in Canada, Continuing Legal Education, Law Society of Saskatchewan, 1984, pp. 19-20.

⁶⁷ *Supra*, endnote 8, p. 21.

⁶⁸ *The Tri-Council Statement of Commitment to Complete Canada’s Networks of Protected Areas* was endorsed by the federal, provincial and territorial Ministers of the Environment, Ministers of Parks, and Ministers of Wildlife in Aylmer, Quebec, in November, 1992.

⁶⁹ *Supra*, endnote 8, p. 19.

⁷⁰ In the latter stages of negotiation of land claims, new mineral claim staking is often restricted to provide certainty of title for transfer of land to claimant groups. Restrictions are generally limited in time and limited to the area of interest to the negotiators. Once negotiations are finalized, any residual areas are released. After the title of an area is transferred to a native group, mineral exploration and development on that area could be undertaken in much the same manner as in any other area with third-party ownership of sub-surface and/or surface title holdings. However, during negotiations while these areas

are withdrawn from new staking, exploration is allowed to proceed on existing mineral claims within these areas. Indeed, two of the current “hot spots” on the Canadian exploration scene are within areas with outstanding land claims (Lac de Gras, N.W.T. diamond area and the Voisey Bay nickel/copper area).

⁷¹ Current examples are the Northern Land Use Planning Process in the Northwest Territories and the CORE process in British Columbia. As a result of the Sewell Commission Report in Ontario, municipal planning bodies are required to take into account mineral development projects and potential.

⁷² Environment Canada, *Canadian Biodiversity Strategy*, 1995, Preprint Cat. No. En21-134/1995E, pp. 35-36.

⁷³ International Institute for Sustainable Development, *Making Budgets Green: Leading Practices in Taxation and Subsidy Reform*, Winnipeg, Manitoba, November, 1994.

⁷⁴ Robert J. P. Gale, *Environmental Taxation, Revenues and Effectiveness: The Need for Principled Guidance*, National Round Table on the Environment and the Economy, Working Paper Number 28, October 1994, p. 1.

⁷⁵ *Projet de société, Canadian Choices for Transitions to Sustainability*, Volume 5, Revised Draft, January 1995.

⁷⁶ *Supra*, endnote 6, p. 22.

⁷⁷ *Supra*, endnote 75, p. 113.

⁷⁸ A mining operation, by necessity, must be located where the ore deposit is located. This may mean that the operation is located in a more remote area of Canada. A recycling operation or a manufacturer that uses recycled material has more flexibility in terms of its location. For economic reasons, however, it will tend to locate its operations close to its source of supply or its markets. This will often be near urban centres. This means that it is unlikely that you could easily replace a mining operation with a recycling operation.

⁷⁹ *Breaking New Ground: Human Resource Challenges and Opportunities in the Canadian Mining Industry*. Prepared for the Steering Committee of the Human Resources Study of the Canadian Mining Industry, Price Waterhouse. Minister of Supply and Services Canada, 1993, Cat. No. MP43-303-1.

⁸⁰ The Geological Survey of Canada, *New Directions for Geoscience*, 1993-94, p. 12.

⁸¹ “Native legal issues affect mineral activity in several ways. First, on lands controlled by native peoples such as Indian reserves or lands set aside under land claim agreements in northern Canada, special regimes govern title to minerals and the processes of exploration and development The second way that native legal issues affect mineral activity is that native interests may be exercised or asserted by reason of aboriginal title or a treaty on lands not controlled by native peoples. In some cases, it has been mineral development that has precipitated a dispute. Third, native rights such as hunting, trapping, and fishing rights can be relevant when mineral activity impinges on them. Finally, the special relationship of native peoples with the Crown is often significant.” See Barry J. Barton, *Canadian Law of Mining*, Canadian Institute of Resources Law, Calgary 1993, p. 80.

⁸² International Institute for Sustainable Development, *Trade and Sustainable Development Principles*, February 1994, ISBN 1-895536-14-6, pp. 15-16.

⁸³ *Government Response to the Recommendations of the Special Joint Parliamentary Committee Reviewing Canadian Foreign Policy*, February 7, 1995, p. 42.

⁸⁴ *Ibid.*, p. 46.

⁸⁵ *Ibid.*

⁸⁶ *Supra*, endnote 83, p. 42.

⁸⁷ *Ibid.*, p. 45.

⁸⁸ The mandate of the Committee “includes making recommendations on whether modifications to the provisions of the multilateral trading system are required to enhance the positive interaction between trade and environmental policies and to ensure that environmental programs will not be developed for protectionist purposes.”

⁸⁹ Standing Committee on Energy, Mines and Resources, *Sustainable Energy and Mineral Development: A Realistic Response to the Environmental Challenges*, January 1993, p. 162.

⁹⁰ *Supra*, endnote 3, p. 1.

⁹¹ A Memorandum of Understanding between Agriculture & Agri-Food Canada, Environment Canada, Fisheries and Oceans, and Natural Resources Canada, *Science and Technology for Sustainable Development in the Natural Resource Sectors*, January 18, 1995.

⁹² *Supra*, endnote 36, p. 7.

⁹³ CANMET Annual Report 1993-94, Cat. No. M1-11/1994E, p. 15.