MMSD NORTH AMERICA
TASK 1-B SUSTAINABILITY PROFILE: THE STORY OF NORTH AMERICAN MINING/MINERAL

Prepared for:

MMSD North America

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 BACKGROUND

Mining, Minerals and Sustainable Development (MMSD) is an international, independent, collaborative project, to be completed by the Spring of 2002, involving the mining and minerals sector and the many interacting communities of interest. It has been created to develop guidance on the most effective approaches needed to achieve the transition to sustainable development. The specific mandate of the MMSD project is to identify how mining and minerals can best contribute to a global transition to sustainable development. MMSD North America is the North American regional component of the Global MMSD project

MMSD North America was composed of five tasks:

1. development of a profile of the contribution and implications of mining and minerals in North America (to people, their communities, ecosystems, and economies) from the perspective of various communities of interest;
2. development of sustainability guidelines for design, operation and performance monitoring;
3. development of an "Action Plan for Change" Addressing mining and minerals and the implicated communities of interest;
4. development of a range of likely future scenarios for mining and minerals; and
5. preparation of a final report.

This report partially fulfills Task 1. Tasks 2 and 4 has been completed by different working groups. The "Action Plan for Change" Task 3, has been developed through an independent North American Mining Dialogue held by the Centre for Dialogue, Simon Fraser University. Simultaneously, the Centre mounted a project aimed at developing tools for effective engagement in resource-based industries.

1.2 SCOPE OF STUDY

A large number of commodities are potentially implicated in this review including the metals, non-metals, structural materials and energy-related minerals. This project will focus on activities related to metals only. At a later date their may be an opportunity to look at other commodities. Metals include: aluminum (bauxite), antimony, barium, beryllium, bismuth, cadmium, calcium metals, chromium, cobalt, copper, germanium, gold, indium, iron and steel, iron ore, lead,

lithium, magnesium and magnesium compounds, manganese, mercury, mineral pigments, molybdenum, nickel, niobium, platinum group metals, rare earth metals, selenium, silicon, silver, strontium, tantalum, tin, titanium metals, tungsten, vanadium, zinc, zirconium, (plus others).

The mineral life cycle extends from exploration through mining and milling, primary smelting and refining, manufacturing, wholesale and retail trade to end-uses. Recycling occurs throughout. The focus of this project is on the portion of the life cycle that extends from exploration through to and including smelting and refining.

1.3 PURPOSE

The purpose of The Story of North American Mining/Mineral Sector is to create a "living document" which articulates in a fair and balanced way the contributions and implications of mining to people and their communities, to ecosystems, and to economies through the eyes of the various communities of interest. A “living document” is defined as a report which is open to change and refinement so long as new and pertinent information is being presented. The communities of interest engaged in this study are; mining dependent communities and regions, Indigenous People, mining companies, workers and organized labour, non-governmental organizations and government. This report is presented as a written description of the metal mining industry (past and present) from the perspective of different communities of interest in terms of positive and negative implications for both people and the environment; and insights on what and how the industry, along with the various implicated communities of interest, should change to ensure a contribution to the transition to sustainable development. Added to the report is a general discussion of the history of mining, technological advancements in mining, long term and short term societal shifts in values with respect to the environment, and a summary of public perception data with respect to mining.

The articulation of facts and figures with respect to the affect of the metal mining industry on various interests is one important aspect of creating this sustainability profile. However, of perhaps greater importance is articulating how the communities of interest feel about the contributions and implications of the mining industry. In order to accomplish this, information has been collected with respect to people's perceptions both real and perceived; an attempt has been made to “try to speak from the voices of the communities of interest.” This is a very delicate and difficult task. It is hoped that as this living document evolves that each community of interest may take a role in the presentation of their own story whether it be through the provision of comments or additional materials to the authors.

1.3 STUDY METHOD

The information contained in this report represents the experiences of people. In order to derive this information, people who could speak to the collective experience of the different communities of interest had to be identified and interviewed. Such a list of potential contacts was identified in consultation with MMSD North America. For each person on the list an assessment was made with respect to the perspective and information they might bring to the study. Limited resources were available to undertake the study which limited the number of interviews to a maximum of twenty (20) across all communities of interest. It is acknowledged that this small number of interviews does not represent a representative sample of the communities of interest in North America, it is merely a snapshot of how the communities of interest view mining. Every attempt was made to identify interviewees that may have a broad perspective on the issues given a position in a labour union (United Steeleworkers of America), regional NGO (MiningWatch), or broad based quasi-governmental organization (Assembly of First Nations). Individuals were then contacted and interviewed informally. Some people were able to identify studies that would be of assistance in understanding the perspectives of their community of interest and/or other people with whom the study team should speak. This information was then followed up as part of the study. It was recognized from the initiation that we could not speak with everyone we might want to, and that some people may not be willing to speak with us. In this sense we refer to this report as a starting point in understanding the history of mining from the perspective of the various communities of interest. Areas of the report which would clearly benefit from further research and insight have been flagged and are discussed in Chapter 6. It is hoped that in time, the communities of interest will continue to add their thoughts and voices to this report until a complete story was evolved. A list of people interviewed or spoken to for this project is included in Appendix A.

Although the interviews and discussions with key contacts comprised the bulk of the data collection for this report, the team also made use of available literature identified through a limited literature search and by the key contacts. Once again resources available to undertake the study limited the scope of literature reviewed. A list of literature reviewed is provided at the end of the report. A draft report was reviewed by a review team comprised of the client representatives and 10 to 12 people who have been identified as reviewers generally by virtue of their knowledge base with respect to the various communities of interest. Comments and suggestions from this review have been incorporated. Ideally, this report should have been formally reviewed by those individuals who were interviewed as part of preparing this report and those individuals we would have liked to have interviewed prior to the production of the draft report however, were not contacted due to insufficient time. Unfortunately, time did not permit this review to occur. A list of the membership for the review group is provided in Appendix A.

1.4 REPORT ORGANIZATION

This report has been organized to first present a brief, generic history of mining in North America such that an historical context can be created for our discussions of each community of interest (Chapter 2). Also included in Chapter 2 is a discussion of technological advancements in mining, societal value shifts, and a review of public perceptions about mining. Chapter 3 presents an examination of statistics of mining activity over time until today (Chapter 3). Chapter 4 presents the discussion of history, contributions and implications of mining from the perspective of each community of interest. Chapter 5 is an attempt to synthesize the information gathered as lessons learned and directions for change. Finally, Chapter 6 discusses the need for further research.

2.0 HISTORICAL OVERVIEW

2.1 HISTORY OF MINING

2.1.1 Pre-European Contact (Prior to 1500)

"*As long as 6000 years ago, there was trading in North America in native copper that had been mined from excavations in the Lake Superior area…about 4000 years ago, Maritime Archaic Indians mined the chert beds at Ramah Bay Labrador for material from which to fashion implements….there was native trading in silver from the Cobalt area during the period 200 B.C. to 200 A.D.*[1]"

Indigenous Peoples have been mining the land for thousands of years for gold, silver, copper, and gems in order to make jewellery. Some accounts suggest that Indigenous Peoples probably did not use metals for tools and implements but rather the ore was used as a source of pigment for body adornment.[2] This mining activity was viewed as positive by the indigenous communities. It involved little degradation of the environment and produced little pollution. The products of the mining activity served cultural activities. It is evident that the extent of mining prior to European settlement was at a very small scale.

2.1.2 Post Settlement (1500-1900)

"*The first record of mining in Canada by Europeans was in 998 A.D. when the Vikings mined bog iron ore near their settlement at L'Anse aux Meadows, Newfoundland*."[3]

European interest in metals, particularly gold, drove the first explorers towards the shores of North America and progressively into the continent. Christopher Columbus discovered North America in his quest to discover the gold fields of Asia. The first explorers were followed by wave after wave of explorers and settlers in search of the mythical 'El Dorado' and looking for fulfillment of the wealth and promise of life in the new land. In the late 1500's explorers of the new world were finding metals on its shores. Early investigations found gold, malachite, silver, iron and native copper in present day Baffin Island, Quebec and Nova Scotia.[4] Coal was also looked for and mined along the Atlantic coast of North America to be used as a source of heat.

[1] Udd, John, *A Century of Achievement; the Development of Canada's Minerals Industries*, Montreal, Canadian Institute of Mining, Metallurgy and Petroleum, 2000. p.vii.
[2] Ali, p.26.
[3] Udd p.vii.
[4] Udd,p.viii.

The minerals industries developed rapidly as colonization spread westward throughout the nineteenth century. In the last decades of the nineteenth century North America was industrialized and the mines, furnaces, and iron works along the eastern side of the continent fuelled it. Communities were built close to the mines that were being developed. and miners and their families had little choice but to live close to the mine site within communities often created by the mining companies. It was not until the 1860's that railway building was begun and it was not until several years later that the transportation network was in place. Once the railway network was complete communities were linked together and mine owners had a more efficient means of shipping their products to market.

The development of the mining industry in North America coincided with the industrial revolution in the later part of the nineteenth century (1860-1900). As with all industries mining underwent a technological revolution of its own. (see Section 2.2 of this report)

Prior to the middle of the nineteenth century, mining had been a brute-force and dangerous occupation. Drilling was performed by hand methods, blasting involved the use of black powder, and haulage of materials and supplies was often by donkey or horse. Illumination of underground mines was by open flames, or safety lamps in the case of coal mines, and ventilation was limited. Ore sorting was primitive, often by hand, and the means of liberating the valuable minerals from the gangue (the host material) was most often by some primitive form of stamp mill.[5]

New inventions such as dynamite, compressed air for power transmission, the piston-type rock drill, the diamond drill, the Blake jaw crusher, and cyanide leaching changed the character of mining and the risks presented to the miners and their families living in mining communities. This has been viewed as the foundation which transformed mining from a brute-force art to a more efficient and sophisticated science.[6]

2.1.3 The Gold Rushes (Throughout Late 1800's)

From the perspective of metal mining, gold was valued and sought after by explorers and settlers like no other metal. While gold was found on the east coast of North America, its discovery in the west lead to the legendary gold rushes in California, northern British Columbia, the Yukon and Alaska. The gold rushes occurred at a time when the United States and Canada were encouraging expansion into the western region and when the infrastructure and technologies we

[5] Udd,p.xv.
[6] Udd,p.xvi.

now take for granted simply did not exist. The "new" western boundaries of the Americas were lands that lacked European societal architecture such as an elected government, law enforcement, hospitals, schools and churches. In all of the gold rushes, opportunists made quick profits by providing goldseekers with everything from meals and lodging to equipment and brothels. In general, the gold rush era can be characterized by fast, expedient discovery and exploitation of resources, with little regard for the environment, indigenous people, and their existing communities or societal structure.

The historical record shows that in the early days of frontier expansion the decision to mine was determined solely by the perceived potential of minerals on land, quite irrespective of its prior occupancy (hence the term mining "rush"). Over time, the presence of native peoples on the land, and regulatory regimes began to sink in as factors in decision-making on the part of prospectors – but their inclusion was apparently more a cause for pause than much else.[7]

In addition to the luster of gold, metal mining flourished in the late 1800s and early 1900s as advances in metallurgy spurred on new uses of metal in a society that was becoming more and more a consumer of metal in industry, as well as in the building of its infrastructure.

2.1.4 The War Years (1914-1945)

The first and second world wars fuelled the mining industry in North America. Minerals were needed to produce the tools of war and given that the wars were being fought in Europe and southeast Asia, North America was one location from which to gather the materials required. The resource and manufacturing sectors of the economy had to expand in order to meet the needs of the war effort. The mining workforce was rerouted to serve the military or supply the strategic materials drawing labour away from other mining activities such as gold. New mines were brought into production to produce strategic metals required for the war effort. The government assisted in assuring a stable supply of strategic metals. Those metals not considered strategic, such as gold, suffered from a lack of labour and government support.

In Canada, the government played a large role in controlling the production, export and pricing of strategic materials through the Office of the Metal Controller. The government acted to finance the production of critically needed materials from marginal deposits. Some of the materials required for the war effort included; nickel, zinc, copper, lead, asbestos, aluminum, chromium, manganese, mercury, mica, molybdenum, tin, tungsten, uranium, and vanadium.

[7] Ali, Saleem, "Environmental Resistance and Aboriginal Development A Comparative Study of Mining Ventures and Public Conflicts in the United States and Canada," Doctoral Dissertation, Massachusetts Institute of Technology, undated, p.34.

2.1.5 Post World War II (1946-Present)

After the war, fears of a post war depression were unfounded as North America entered into a period of unprecedented growth and development. The unprecedented demand for consumer goods, building materials, and automobiles fuelled the need for mining and metal products and industrial expansion. The onset of the Cold War and the promise of peacetime use of the atom for nuclear energy, drove the exploration for uranium. The opening of the St. Lawrence Seaway in 1959 created the opportunity for increased movement of metals and metal products through the centre of the continent to the Atlantic. The mining industry enjoyed the economic boom that was experienced throughout North America through the 1950's, 60's and into the early 1970's.

Advances in extraction and process technologies continued throughout the latter part of the century resulted in North American mining operations being seen as setting "best management standards" for the global mining industry. Notwithstanding these advances, the years from 1970 to the present have been times of challenge for the industry. For much of the period metal prices were relatively low. Heightened public concern on environmental issues (in all sectors) resulted in the formation of new regulatory agencies and the development and promulgation of new environmental regulations. Mine development now faced extensive scrutiny and lengthy assessment periods, and the concept of designing for closure began to emerge as an integral part of the development cycle. The closure planning process required significant scientific and engineering input, as well as the recognition of comprehensive closure liabilities that had previously been unthinkable in the industry. The key objectives of decommissioning planning were to ensure physical and chemical stability, and return of the impacted land to its former use or acceptable alternative. A major challenge, that emerged in this regard was the issue of acid mine drainage associated with abandoned sites. To address this, and other issues a number of leading, well-funded initiatives were initiated in the late 1980s. These included a substantial programs to investigate potential environmental impacts from mines, particularly in association with the issue of acid drainage. Canada's joint industry and government initiative (MEND) to assess the cause and develop approaches for prediction and prevention of acid mine drainage, was recognized worldwide for its contribution to the understanding of one of the most significant challenges faced by the mining. Throughout the 1990's, additional environmental issues were brought to the industry's attention including social aspects and perceived impacts to air and water, increased environmental assessment requirements, cumulative effects, and human and ecological risks. The metal mining industry, often times working in partnership with levels of government and interested stakeholders, made tremendous advances in many areas. New programs and techniques were also implemented as companies encompassed comprehensive environmental management systems for the day-to-day management of their operations and for the development of emergency preparedness and response plans. Public awareness of these advances is generally lacking however, as news generally only focused on spectacular events

such as failures, accidents or upsets such as facility accidents or tailings dam failures as such events at mines around the world are widely reported by the media.

2.2 SUMMARY OF TECHNOLOGY ADVANCEMENTS –WITHIN THE MINING INDUSTRY

Archaometallurgical investigations have revealed that the earliest mining activities included battering with stone hammers and fire-setting, with metals tools making a debut in the late Bronze Age, and followed by the introduction of blasting by the late 17th century[8]. Since then, mining activities have evolved to include highly efficient, mechanised ore excavation and transportation to plants for ore processing and metal recovery.

Developments in mining and mineral processing sector have paralleled technical and management developments of modern society, moving from the practices employed prior to and in the industrial revolution, to those more recently associated with the information age. Since the mid 1800's, mining and mineral processing has evolved from a highly labour intensive endeavour[9], to one driven by technological advancements in all aspects of its life cycle and all facets of operation. Technological change mirrored industrial growth and transportation revolution of the late 1800s, which provided both the stimulus and the means of making mining economically feasible.[10] Early advances were linked to improvements in crafts and mechanical engineering, followed by advances in physics and chemical engineering, and most recently by information technology. Fundamental advances in these fields were often made outside the mining sector and adapted by the industry (e.g. the steam engine used for water pumping).

Mining and metallurgical processing draws on industrial advances across a range of disciplines including civil, mechanical, structural metallurgical engineering and material sciences in addition to direct advances in mining engineering techniques. Evolution in the necessary infrastructure and support systems have matched those of society at large (water supply and power, environmental treatment systems, housing developments, communication technologies, and advances in transportation) and are part and parcel of the mix of the mineral industry at any stage of its evolution.

Some of the key technological advancements that have spurred on and shaped the industry throughout its life cycle are summarized in Table 2. 1 and detailed in the following sections.

[8]Craddock p.10.
[9] Udd, p.xv., Newell p.13,25, Barnes p.35
[10] Newell p.2.

TABLE 2.1
SUMMARY OF TECHNOLOGY ADVANCEMENTS WITHIN THE MINING INDUSTRY

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
1800 TO 1850								
1800s	At the beginning of the 1800s Copper miners in Cornwall, England started experimenting with ceramic "tea pot" oil lamps	California Mining Journal Dec, 1999		√		√		Safety improvement and aid to productivity
1800s	Steam hoisting engine was developed by Boulton & Watt in 1784 and were in common use before 1850	Gregory, P176		√				Provision of power resulted in significant improvements in productivity through the movement of men, animals, and materials underground
1830	Dr. Robert Hare (a Philadelphia scientist) developed a wire bridge "hot wire" method for electric blasting caps.	Dupont Blasters Handbook 175th. Edition		√		√		The beginning of a more reliable and, therefore, safer means of initiating a blast. Could be the first commercially-used blasting machine, improved productivity and safety.
1831	W. Bickford from Tuckingmill, Cornwall develops and patents the "Miners' Safety Fuse"	Dupont Blasters Handbook 175th. Edn (pg.15)		√		√		Before safety fuse, many individual, unreliable, and often fatal methods of setting off black powder were employed through the early 1800's.
1833	First application of "hoisting" men -Clausthal	Gregory, p176		√		√		Two vertical rods were used to allow men to be raised 12 feet at a time, these machines were replaced with cages by 1890
1835	Exhaust fan invented by W.Fournace in Leeds	Gregory, p184		√		√		The introduction of the exhaust fan became common practice by 1845
1836	W. S. Otis patents steam shovel, in use by 1842	Tipler,p.9		√				Major productivity gains, with its 1.5 m^3 capacity said to be equivalent of 80 men
1842	Geological Survey of Canada established	Gregory, p137	√	√		√	√	Provided support and impetus for mineral development across the country
1846	Nitroglycerine discovered by Ascanio Sobrero in Italy	Dupont Blasters		√		√		Improved productivity - product produced much more power than

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
		Handbook 175th.Edn, p4						black powder – its discovery eventually led to more modern explosives that were less hazardous to use than black powder
1849	Fowle Rock Drill	Newell, p.20		√		√		First practical drill for the industry
1850 to 1900								
1850s	Around this time, a small oil wick lamp was invented in Scotland that attached to a miner's cloth or leather cap by a hook – its use continued well into the 1900'	California Mining Journal Dec, 1999		√		√		Improved safety and productivity in mining
1850s	Introduction of steam stamp mills (1879 Ball, 1879 Leavitt, 1888 Krause)	Newell, p25			√			Allowed crushing of large quantity of materials in small areas
1854	Blake Crusher developed	Newell, p26			√			Became used universally in mining districts for rough crushing before stamping
1856	Development of Bessemer Process	Wertimep 287			√			Low carbon steel replaces wrought iron and spurs major expansion in the use metal
1859	Suez Channel construction starts (1859 – 1869) Steam Navvies shovels used in excavation	Tipler, p11		√				Construction of the Suez Channel spurred the creation of manufacturers of large shovel excavators (e.g Marion,. Bucyrus,etc.)
1860s	Krom rolls	Newell, p26			√			Improved grinding of ore materials
1860	Koepe friction hoist invented in Europe	Gregory. P176		√				The precursor to the modern friction hoist, was not installed in N.A. until 100 years later
1860s	Compressed air use for mining power	Udd, pxvi		√				Provides power to a range of underground mining equipment including drills, locomotives, etc.
1864	Leschot develops first practical diamond drilling	Newell, p14, Gregory 236	√	√				Improved exploration and mine productivity
1865	Burleigh combined air powered	Newell,		√				Improved productivity in drilling of

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
	piston action and drill automatic rotation, becomes predecessor of piston type drills	P20						blast holes
1866	A.Noble discovers dynamite for safer blasting	Dupont Blasters Handbook 175th. Edn (pg.15)		√				Improved productivity and safety – This was an important step in the development of modern commercial explosives; and showed the importance of initially detonating a high explosive with a shock wave – heat combination to achieve maximum energy.
1869	Holt & Severance portable steam powered core drill	Newell, p16	√	√				Early efforts to replace manual drilling of blast holes
1871	Ingersoll & Rand brothers develop compressed air powered piston drill	Gregory, P178	√	√				Although heavy these drills provided improved drilling performance, and were the forerunners of the hammer drills
1872	Mineral Location Law	Gregory, P193	√	√	√	√	√	Provides framework for US mining activities both with respect to mining proper and related surface activities
1872	the first miner's candlestick was patented in the united states; and a few years later, a hook was added to the early designs	California Mining Journal Dec, 1999		√		√		Provided additional light for safer and more productive working
1874	Fure developed Vanner slime separator	Newell, p28			√			Improved recovery (90%) from slimes
1875	A. Nobel discovers "blasting gelatin" by dissolving nitrocellulose in nitroglycerine – gelatin dynamite is introduced	Gregory, p180		√		√		Improved productivity and safety
1870's (late)	Fine platinum bridge wires for electric blasting caps introduced which allowed testing of the cap circuit	Dupont Blasters Handbook 175th. Edn (p17)		√		√		This development along with dynamo-electric blasting machines eliminated most of the drawbacks of electrical blasting.
1880s	Gates rotary crusher	Newell, p26			√			Refinement on jaw crusher, provides additional options in preparing ores
1887	Cyanide Leaching patented by MacArthur and Forrest	Habashi-A history of			√			Significantly improved recovery allowed processing of low grade gold

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
	MacArthur and Forrest	Metallurgy, p298						allowed processing of low grade gold ores and became the standard for future gold mills
1880	Open pit Mining at Bisbee, Arizonaa	Temple, p134		√				Manual surface mining using hand labour
1880s to 1910s	Period of most use of candlesticks candlestick lamps with a pick to stick in the hat or a crack in the rock, , oil lamps also in use were referred to as "sunshine lamps"	from the Michigan Historical Museum website)		√		√		Safety and productivity improvements
1890s (mid)	James Morehead and Thomas Willson developed carbide which formed acetylene gas when mixed with water – the ensuing lamp was called "the lamp that put daylight underground" – the use of carbide lamps continued into the 1940's	California Mining Journal Dec, 1999		√		√		This development allowed for a more portable, longer lasting, and cleaner form of illumination. Miner's could also use the flame for marking the rock face.
1891	First U.S Federal statute governing mine safety passed	From MSHA web site				√		Introduction of legislation prohibiting employing children under 12 years of age
1895	The first delay caps are introduced			√		√		Additional improvement in blasting safety
1897	First hollow stem hammer drills	Udd, pxvi	√	√		√		Most significant advance in drilling
1890s	Steam Hoist			√				Productivity gains
1900 to 1950								
1900s (early)	carbide lamp manufacturers produce candlestick to hold carbide lamp	From Technology and Engineering website		√		√		First step in weaning miners away from using candles, (Note - the introduction of electric lighting was slow prior to WWI due to its cost - Temple p82)
1900	Wet pneumatic drill introduced by Leyner	Gregory, p236		√				Improved productivity and safety
1901	First geophysical find of an orebody	Udd, p9	√					Proves new means of exploration using Dip Needle Surveys

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
1901	froth floatation process by Potter and Delprat in 1901	Habashi A History of Metallurgy, p273			√			Allowed processing of low grade sulphide ores, one of the major improvement in processing
1904	First application of froth flotation in mining (Broken Hill Australia)	Habashi, p Gregory, p140			√			Forerunner to its application in North America
1904	Calyx drills developed for medium hardness rock	Gregory, p181	√	√				Improved productivity
1904	J.W.Page patents dragline excavator	Tipler, p11		√				A major step towards lareg scale earthmoving
1904	Holt and Best introduce first commercial crawler tractor	Tipler, p13		√				Hold & Best form Caterpillar which evolves into a world giant in the creation of large scale equipment
~1910	Open pit mining at Bingham Canyon, Utah, United States	Waszki, p239		√				The application of steam shovels and open pit technology to extract low grade porphyry copper
1909	Tri-cone rotary drill bits replace Calyx drills	Gregory, p181	√	√				Improved drill speeds, and able to drill harder rock
1910	Introduction of Outboard Motors	Udd, p	√				√	Vastly improved water access to remote locations
1910	First petrol powered dragline, and from 1911 onward mobility provided through addition of tracks	Tipler, p12		√				Increased power, mobility and productivity
1910	U.S. Bureau of Mines established	from MSHA web site	√	√		√		Provides oversight and support to industry
1912	Koehler introduces methane gas detector, the flame safety lamp introduced	The Marmon Group website		√		√		takes the first steps towards replacing the canary as a method to detect –
1914	First Froth Flotation In Canada	Udd, p.18	√		√			The application of a major metallurgical advance
1914	Industrial Hygiene Section of the American Public Heath Association established	A.JPH Vol. 56,July 1966				√		Established bodies that provided leadership in the area of industrial health and safety
1914	Ontario's Workers' Compensation Board Established	Gibbs& Pintus				√		Established bodies that provided leadership in the area of industrial health and safety

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
1916	Mack introduces specialized dump tuck	Tipler, p15	√	√				The beginning of equipment advances in the haulage of surface materials
1917	G. Wheat was issued a US patent for the battery-powered electric miners' cap lamp	The Marmon Group website		√		√		Led to the more modern cap lamps in use today and eliminated the dangerous open flame means of illumination.
1920	The Canadian Institute of Mining and Metallurgy formed	Udd, p30	√	√	√	√	√	Provides forum for exchanging industry developments
1920s	Air Travel Initiated		√	√	√	√	√	Although in its infancy, provided access to remote sites at much greater speeds
1920s	Electric hoists	Gregory, p176		√		√		Electric hoists introduced and evolved from this point onward using a.c. & d.c. systems, electronic controls and safety systems
1920s	Wheeled loaders evolve from tractors	Tipler,p 14		√				The evolution of flexible and powerful mobile equipment provides additional productivity gains
1925	Ethylene glycol dinitrate with nitroglycerine solves the problem of dynamite freezing	Dupont Blasters Handbook 175th. Edn (p9)		√				Improved productivity and safety
1926	Electromagnetic prospecting method introduced by H. Lundberg	Udd, p29	√					Improved exploration
1930s	Electric cap lamps begin to gain popularity	California Mining Journal Dec, 1999		√		√		Improved safety and productivity
1931	First Borehole gyroscope	Udd, p40		√				Improved productivity
1930s	Introduction of underground mechanical scrapers	Congress Vol. #6		√				Eliminated the manual handling of broken ore in underground mines
1930s	Cost reduction in diamond drilling	Congress Vol. #6		√				Allowed drilling of long blast holes
1930s	Improved percussion drilling including detachable bits, power-feed mounting, tungsten bits, and development of airleg drills	Congress Vol. #6		√				Resulted in improved productivity across all levels of mine operation

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
1930s	Emergence of backhoes	Tipler,p14		√				Improvements in surface earthworks
1933	Euclid introduced the Model Z off road dump truck	Tipler, p121		√				This became the precurser to modern large capacity off road dump trucks
1934	Euclid introduces first off-road dump truck	Tipler,p16		√				Increased versatility and haulage capacity
1935	Development of "Cut and Fill Mining Method,	Udd, p40		√				More selective mining method resulted in cleaner ore
1937	Introduction of modern detonating cord	Dupont Blasters Handbook 175th. Edn (pg.17)		√		√		Improved productivity and safety as detonating cords allowed more flexibility in blasting under rugged mining conditions
1938	Dupont announces invention of nylon	Dupont website				√		Nylon eventually replaced natural fibers (subject to rot and breakdown by sour mining gases) in things like miner's belts, lifelines and lanyards
1945	Front end loader shovel introduced by Caterpiller	Tipler, p15		√				Improved versatility and productivity
1946	Chemox breathing apparatus certified in U.S.	NIOSH, Kyriazi, p9				√		Replaced the very bulky and elaborate McCaa apparatus as the choice for mine rescue operations and is still in use today.
1947	Introduction of automatic transmission in off road vehicles	Tipler, p121		√				Improved productivity
1948	Invention of transistor	Udd, p 90	√			√	√	Opened up new areas of communication
1948	Introduction of hydraulic ram in dump trucks	Tipler, p121		√				Allowed construction of large load carrying vehicles and major improvements in productivity resulted
1950 to present								
1950s	Introduction of hydraulics	Tipler, p16		√				Hydraulic power for tipping allows major increases in load capacity (growth in capacity from less than 30 t up to 150t)
1951	Hydraulic shovel introduced	Tipler, p12,35,36		√				Hydraulic shovels displaced many of the early cable shovels due to their versatility

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
1951	First airborne electromagnetic survey	Udd, p78	√					Expanded exploration horizons
1954	J.C.Bamford introduces wheel loader that becomes forerunner for modern loaders	Tipler, p15		√				Improved productivity
1955	Akre developed use of Akremite, ammonium nitrate combined with various combustibles	Gregory, P180		√		√		This development very quickly led to the development of modern water gel explosives. Ammonium nitrate explosives had the advantage that it could be mixed at the blast site while the ingredients could be shipped as non-explosive materials,
1957	The first successful field demonstration of water gel explosives under the sponsorship of the Iron Ore Company of Canada	Dupont Blasters Handbook 175th. Edn (pg.15)		√		√		Improvements in blasting safety, water gels are a much less sensitive product that could be handled in bulk by a variety of methods.
1957	Alimak method of raising introduced	Udd, p78		√		√		Improves productivity, safety, and spurs new techniques
1957	Case introduces first wheel loader backhoe combination	Tipler, p15		√				Improved versatility and productivity
1960	A. Cook of the U. of Utah introduced ammonia nitrate slurries	Gregory,p 181		√		√		Forerunner to modern manufacture of bagged and large diameter water gels
1960	LeTourneau introduces diesel-electric power train at Berkley pit	Tipler, p125		√				Enabled the development of extremely large haul vehicles that grew to beyond 250 t capacity
1960s	Ion Exchange for uranium recover	Flemming P71			√			
1970	Introduction of smaller diameter water gels	Dupont Blasters Handbook 175th. Edn (pg.15)		√				Improved safety, and was the beginning of the end for "powder headaches"
1970s	Activated Carbon and Heap Leaching Processes applied at gold mines In Leach	Flemming , p54			√			The application of carbon to recovery gold and silver from solution was a major breakthrough that allowed processing of low grade ores

Date	Advancement	Reference	Exploration	Mining	Milling	Health & Safety	External	Comments and Implications
								(Homestake mine, first large scale CIP plant in north America)
1970s	Application of heap leach technology to gold ores	Flemming , p54			√			The application of heap leach technology coupled with carbon recover allowed processing of large low grade ore deposits
1972	U.S. launches the Earth Resources Technology Satellite	Udd, p100	√				√	Introduces new era of technology use
1972	Ion Exchange processes for leaching	Udd, p101			√			Improved recoveries
1980s	Bioleaching for gold recovery	Flemming p68,			√			Allows treatment of low grade refractory ores
1980s	Introduction of Microprocessor		√	√	√	√	√	Provides computing power at all levels of the organization across all activities
1980s	Ion exchanges (Resin in pulp) evolving for gold industry	Flemming p72			√			Additional approaches available to process ores
Rapid and ongoing evolution in engineering, material and manufacturing and computer technology continues on all front in the 1990s, some example areas include:								
1990s	Advanced computer hardware and software		√	√	√	√	√	Provides improved computing power at all levels of the organization across all activities
1990s	Expanded Communications Capacity including Internet and Satellite		√	√	√	√	√	Allows sharing and integration of data and information
1990s	Advances in video and sensor technologies		√	√	√	√	√	Allows real time control and management of unit and continuous process operations
1990s	Automation and Robotics			√	√	√	√	Allows continuous processes, workforce reduction, and safety
1990s	Increased scale of all equipment		√	√	√	√	√	Larger equipment provides means to efficiently mine and process extremely large volumes of materials

2.2.1 Exploration:

Mineral exploration historically relied on finding surface evidence of buried deposits, either through geologic skills or oral traditions. Access to remote exploration areas was often difficult and arduous, and assessing the potential of a geologic prospect took significant time and effort. Advances in the ability to search for deposits, both across large areas of remote terrain and at depth, as well as the ability to assay them quickly were key to spurring on mineral exploration. Key technological advancements in exploration included:

- Development and refinement of the diamond drill, in the 1860s (piston type)_through to the late 1800s.[11]
- Introduction of geophysical survey methods, magnetometer (dip-needle surveys).[12]
- The advent and use of the outboard motor (1909/10) changed prospecting significantly in many parts of north America.[13]
- The advent of air travel significantly enhanced access and supply to remote areas, commencing in the 1920s.[14]
- Aerial (Aeromagnetic) surveys, in the 1950s
- Introduction of the micro computer, in the early 1980s.
- Introduction of micro based software for reserve estimating, mid to late 1980s
- Global positioning and mapping systems, 1990s.
- Wireless telecommunications for data transmission, mid to late 1990s.
- Geologic mapping using satellite images, late 1990s and 2000s. [15]

2.2.2 Mining and Milling:

As noted above, prior to the mid 1800s mining was to a very large degree dependent on manual labour; mining was by hand methods, blasting by powder, lighting by open flames, ore sorting primitive, and infrastructure and support systems limited. To the degree that industry depended on steam power which could be applied on for surface activities such as hoisting, hauling, and pumping, its application was limited in underground mining since it could neither be generated in or vented from underground, nor could it be transferred efficiently over long distances.[16]

[11] Udd, p.29.
[12] Udd, p.29.
[13] Udd, p.18.
[14] Udd, p.20.
[15] CIM Bulletin, Vol. 94 #1046, January 2001.
[16] Newell, p.18.

The second half of the 1800s was the period of "professionalization" of the mining industry.[17] Commencing in the mid 1800s, significant technological advancements were made both in mining directly, as well as in related field such as tunnelling and in society at large, that transformed how mining was carried out. In essence, this period was the first wave in the large-scale industrialization of mining in North America. Advances of the period included[18]:

- 1866 A. Nobel discovered means of making dynamite, a new and safer means of blasting.
- 1860s and 70s compressed air, inefficient but first power.
- 1854 diamond drill invented by Herman.
- 1860s to 80s drills developed and refined and refined by Leschot, Holt and Severance.
- 1897 hollow stemmed drills flushing with water, this has been identified as perhaps the most significant advance in the drilling.
- First schools of mining were opened in US (Columbia University in New York, 1864) and Canada (McGill University in Quebec, 1870).

The beneficiation of the rich ores mined in the mid-1800s often only required hand-picking to separate rich ore from host materials, or the use of simple stamping and or gravity separation methods. As mining moved into the professional stages, advances in milling and the understanding of metallurgical made great strides in the mid to late 1800s. Some of the significant equipment advances included the mechanized and steam power driven stamp mill to break down the ore and host rock, followed by the invention of jaw crushers in the mid 1850s, and subsequently the development of rotating mills in 1850s and 60s.[19] The discovery of the large near surface iron deposits added to the momentum generated by the precious metal and copper findings paved the way for the development of large scale mechanized [20], and set the stage for the emergence of North America as a premier mining area.[21]

In the metallurgical arena, progress was being made in both base metal and precious metals processing. The discovery of the cyanide leaching process in the 1880s is credited with the doubling of global gold production within 20 years of its introduction,[22] while the development of the Bessemer Process in 1856 resulted in the production of low-carbon steel which displaced wrought iron which had been "man's most important metallic material for 1000 years".[23]

[17] Newell, pp.43-44.
[18] Udd, p.xvi
[19] Newell, pp.24-26.
[20] Gregory, p.133.
[21] Temple, p.58.
[22] Habashi, pp.78-79.
[23] Williams, p.63.

Significant metallurgical discoveries included development of steel alloys such as Hatfield's discovery of manganese steel – an extremely tough, abrasion and wear resistant steel that was used in all manner of applications in the mining, equipment and transportation industry. It is argued by some "that the year 1890 can be seen as a critical date in the history of metals, marking the transition from old metallism to new metallurgy" as by that time, all but seven of the elements o\f the periodic table had been discovered, and of those remaining only radium affected the course of future metallurgical development [24]. It is also worth noting that Henri Bequerel discovered the phenomena of radioactivity in 1896 when he established that at least two elements, uranium and thorium, continuously emitted measurable quantities of energy, and that the Curries discovered radium in 1898.

The first half of the 20th century was ushered in with electric power replacing steam power and the introduction of the internal combustion engine. Mining expanded across the continent fuelled by the needs of the industrial age, supported by the advancements in rail and others means of transport (the outboard motor dramatically changed prospecting) allowed, and stimulated by the advances in metallurgy that included advances in a wide range of mineral treatment processes, including the initial development of the froth floatation process by Potter and Delprat in 1901[25] for the separation of sulphide minerals from gangue which changed the industry for ever.[26] The application of new metallurgical process methods such as flotation at the turn of the century, represented a major milestone in metallurgy as it allowed lower grade and complex metallic ore deposits to be mined. At that time, the selective flotation process for mineral separation was termed "one of the greatest process discoveries ever made for the betterment of our standard of living".[27]

Additional improvements in the mine and mill process continued throughout the first half of the 20th century as mining expanded to meet the needs of the two wars and an ever growing industrial world. e.g the global demand for nickel tripled as the world prepared for World War I.[28] Advances in mining included the commercial use of the airplane, the introduction and growing use of mobile automotive equipment, advances in shaft sinking, development of the cut-and-fill mining method,[29] and new metallurgical processes such as ammonia leaching - new hydrometallurgical processes to chemically leach some copper ores, and cyanide-leach of gold and silver ores Mining had spread throughout the continent and mining and mineral output of all kinds of metals had expanded dramatically, to the point that by 1929 north America produced

[24] Aitchison, pp.570-572.
[25] Habashi, p.273.
[26] Udd, p.9.
[27] Dennis, p.7.
[28] Howard-White, p.143.

nearly one-half of the world's basic materials (coal, oil, steel, copper, lead, and zinc).[30] Infrastructure expansion proliferated as towns and communities were established, either directly at the mines sites, or as regional centres, and transportation routes to serve the industry and these communities were expanded dramatically.

The second half of the 20th century was one of significant advancement and change for the North American metal mineral industry. The buoyant economy of post WWII demanded raw materials to feed the economic expansion and improvements in engineering and planning, tools and materials, mechanization and instrumentation led to the establishment of many truly "large-scale" mining and milling operations throughout the industry. The numerous advances in engineering, materials sciences, and manufacturing techniques gained through the war years resulted in the numerous improvements to mining equipment.[31] Mineral processing included refinements in existing processes (capacities and efficiencies) as well as the development of new recovery processes such as "carbon in pulp" leaching, roasting and pressure oxidation for refractory ores, heap leach and solvent extraction and electrowining, etc., which allowed mining of ores and grades previously uneconomic. The advent of the semi and fully autogenous grinding millsresulted in increased capacity and reduced power requirements. Mining operations were also often integrated with metal smelting and refining operations. Fuelled by the combination of high metals demand associated with the economic expansion in the 1950s and 1960s, advancements in metal product lines using historic or more recently discovered materials (high strength/temperature alloys, etc.) to meet new demands of existing industries such as the flourishing automotive sector, and in emerging industries such as air transport and space. Advances in human resource, technology and management development practices helped the North American metal mining industry become a world leader in resource development practices for much of this period.

Notwithstanding this position, significant challenges arose in the 1970s and 1980s that stimulated the next wave of technology development including the emergence of strong public environmental awareness and concern associated operational and closure impacts, and broad based declines in metal prices. Based on these concerns the most recent technology advancements have focused on improvements in productivity and on environmental management through the continued improvement of equipment and processes, as well as through the application and integration of information technology. With the emergence of the microprocessor in the early 1980s, the role of information technology slowly expanded from the traditional MIS administration function to take on more operational and management functions.

[29] Udd, p.40.
[30] Gregory, p.121.
[31] Tipler, p.35.

Since the late 1980s, the emergence of fast reliable and inexpensive communications systems, and the Internet, the role of information systems been enlarged to the point where it is pervasive in today's industry. The recent use of information technology across all aspects of the industry could be considered the most important advancement in the mining industry in the 2nd half of the 20th century. Some of examples the advances made in the sector during the latter half of the 20th century are noted below.

- Mine Planning:
  In keeping with the quantum leaps associated with the broad introduction of the microprocessor in the early 1980s, planning tools have advanced dramatically allowing mine plan development and modification in keeping with metal price fluctuations and mining reserves, emerging use of spatial and 3 D GIS information to revolutionize mine planning;

- Explosives:
  Advances in explosive use of dynamite were followed by the introduction of ammonium nitrate based explosives in the 1950s (e.g. ANFO) contributed to productivity gains and safety improvements;

- Equipment Design and Construction:
  Underground – from the late 1950s onward, continuous engineering and manufacturing production improvements resulted in increased capacity and versatility of drills, loaders, scope trams and a range of other underground mining equipment,

  Open Pit –ongoing and continuous improvements in engineering and manufacturing production capabilities, as well as in instrumentation and controls technologies has resulted in dramatically increased size and capacity of mining equipment including shovels, drills, loaders, haul trucks and conveyors,

- Equipment Maintenance Systems:
  Information management systems for warehousing and maintenance have evolved significantly since the 1980's ranging from material management systems to just in time management systems and for real time automatic maintenance notification;

- Surveying and Control Systems:
  Laser technology has been in use for surveying and control both above ground and underground since the early 1980s, and over the years has become interfaced with mine mapping and grade definition programs, etc.

- Automation:
  Since the early 1990s, continuous development in the integration of systems to the point that U/G mining now possible without sending miners underground. Emerging initiatives include such efforts as SMART (Sensori-Motor Augmented Reality for Telerobotics), FAMOUS (Flexible Automation Monitoring and Operations User Station), GINGER, MALTA (Mining Automated Loader Technology Application), REMOST (Remote Monitoring Station)

- Productivity and Management:
  In the second half of the twentieth century, productivity growth resulted from a combination of advancements in equipment and technology (post WWII, tremendous gains from technologies evolved during war years), and automation and integration commencing in the 1980s and 1990s respectively. Emerging initiatives from 2000 onward include enterprise-wide integrated applications of technology linking management, operations, engineering, suppliers, clients and stakeholders and communities of interest through application and communication systems and the Internet. Cross industry initiatives, alliance with the space industry, new equipment (visual anthropomorphic telepresence in ore mucking), drill automation, advanced robotics, geological imaging for environmental applications (GEM Geological and Environmental Mapping), geological mapping, machine vision technology, etc. are helping move the industry towards achieving additional productivity gains.

- Process Technologies:
  Metallurgical advancements in the second half of the 20th century focused on gaining improved understanding of metallurgical reactions in various circuit components and in the mill circuit as a whole. Efforts to reduce costs included development of new approaches to recovery (e.g. heap leaching 1960s and 1970s) and unit processes (e.g. pressure or biological leaching, solvent extraction, etc.), optimization of reagent use and designs to reduce power consumption (1970s and 1980s). Engineering design and construction of "massive" milling components and circuits designs increased milling capacity dramatically, while at the same time advancements in numerical controls and information systems allowed major reductions in the work force (1960s to 1980s). Advances in the power, capacity, and ease of communication and integration of computer systems and shop floor microprocessors has allowed new initiatives in process control that include expert systems that not only used programmable logic control (PLC) feedback, but also use visual monitors to assess process performance (1980 and 1990s).

- Smelting:
  Smelting has evolved from open air roasting (circa 1930s), to multiple hearths (circa 1940s), to fluidised bed technology (circa 1970s), to flash furnaces and flash converters with sophisticated atmospheric emission controls. Technological improvements benefited the operations by reducing materials handling requirements, improving the working environment, reducing costs, and improving metal recoveries and revenues, and vastly reducing atmospheric emissions.

- Environmental Impact Assessment, Mitigation, Control and Management:
  Major improvements have been made throughout the latter half of the century in the understanding of environmental impacts associated with mining and its related activities.

  Scientific and engineering technology advancements have been made in all aspects of contaminant detection, emission control, environmental monitoring, waste and effluent treatment, and in waste minimization reuse, recycle (1970s,1980s,1990s). Through the power provided by recent computers, sophisticated models can now be developed and applied to predict potential impacts and assist in their management (mitigation and monitoring) both in the short term and for future generations (1990s).

2.2.3 Health and Safety

The evolution of safety in mining advanced as a result of a host of reasons including, technical advances in mining methods and equipment, the "professionalization" and growth of the industry, the introduction of a regulatory framework for the industry, advances in health sciences, and the organization of labour to name just some of the drivers.

From a technical perspective, some of the advances included introduction and the evolution of explosives and detonators, the miners cap and lighting, ventilation systems, wet drilling, and the use of mechanical systems and equipment across a wide range of mining operations that resulted less risk to workers and a safer work place. The initial advances occurred post 1850, and initiated a transition in which mining started to move away from an era that relied primarily on manpower and animals to carry out all activities. These advances continued as refinements were made to include new materials, new approaches and new sources of power.

Although the driving forces for many of these advances were based on economic motives, the ancillary result was often improvement in work place health and safety. Not withstanding these improvements, significant health risks and hazards existed at the turn of the century (1900 to

1910 –coal mine fatalities in the U.S. exceeded 2000 annually)[32] that remained to be addressed. The establishment of regulatory frameworks including federal and regional laws (1891, first U.S Federal statute governing mine safety passed[33]) and the establishments of government branches responsible for mining activities (U.S Bureau of Mines 1910[34]) including inspections and health and safety provided additional impetus to advancement in health and safety in the industry. The establishment of industry associations (e.g. the Canadian Institute of Mining and Metallurgy in 1920)provided a means by which technology advances could be broadly disseminated including advances on health and safety. The establishment of workplace unions provided a framework for collective bargaining from which health and safety concerns and issues across the industry could be articulated and promoted. As a result of these collective forces, workplace health and safety became incorporated in the management structure of mining.

The post war period saw major advances in work place safety equipment, management and training. Commencing in the 1970's industry took an even more proactive role in the development in health and safety practices (e.g. modular training programs systems and common core trainings systems, etc.,), and additional regulator legislation was passed that included the creation of the Mining Enforcement & Safety Administration (MESA) in 1973, and the US Federal Mine Safety and Health Act is passed by Congress in 1977. A driving force in Canada was the 1974 Royal Commission on Health and Safety led by James M. Ham which brought in the internal responsibility system, joint health and safety committees, etc. to mining, as well as Ontario's 1978 passage of the right to refuse work.

2.2.4 Conclusions

While perhaps unknown to most members of the public, the mining industry has undergone profound changes over the last century and a half. During the period from the mid 1880s to the present, it has moved from an industry relying on manual labour to a professional industry that utilizes some of the world's most technology-advanced machinery, processes, and technologies. Technological changes have occurred in every aspect of the industry, including changes in exploration, production, management, maintenance systems, health and safety practices, environmental controls, and management systems. In addition to the direct changes within the industry, broad societal advances in technology and its application (e.g. electrification, etc.) have played a significant role in shaping the current North American mining industry.

[32] MSHA website
[33] MSHA website
[34] MSHA wesite

Since the mid 1800s, a broad range of shifts have occurred over time in the direction of the North American Mining Sector (NAMS), some of the most predominant of which relate to:

- Health and Safety – Perhaps the single most significant improvement related to health aspects of underground mining was the invention and use of wet drilling in the late 1890s. Significant advances have been made in the understanding of potential health effects related to work place exposures, and health and safety programs have been established that address all aspects of occupational exposure. Starting in earnest in the 1970s, driven by a host of factors including cost of insurance, regulatory pressures, and worker demands, major advancements have also been made with respect to development and implementation of mine safety and rescue programs (Noranda's modular training program).

- Productivity Improvements through Technology - The application of technological advancements and innovation in the mineral production and processing sector has progressed significantly to the point where the NAMS now makes extensive use of integrated process systems, is developing remote operations capability, and is embarking a paradigm shift in which the information system is becoming pervasive in all aspects of the operation as former independent efforts are integrated within and outside of the operation using open architectures and communication enabled business technologies.

- Work Force Changes – As a result of the application of advanced technology, engineering, and equipment at all levels in the sector, there has been a marked shift towards a smaller, more skilled workforce.

- Environmental Performance. - Albeit mostly only within the past two decades, the metal mining has made advances in improving its performance in protecting the environment. Technology improvements have ranged from "in plant" source reductions, through to treatment technologies, environmental monitoring and reporting, and include sophisticated modeling for the prediction and management of mine waste impacts.

2.3 VALUE SHIFTS WITHIN SOCIETY OVER TIME

How North American society has valued and viewed the environment, and social issues has changed over time. The changes or shifts can be examined with respect to the how society now perceives and values changes with respect to environmental and social issues. With each change or shift only certain parts of society are affected; generally these changes are not universally felt. With each shift the values of some parts of society change and evolve while others remain the

same. As within any evolutionary process change occurs at different rates which are influenced by culture, and experience. In order to evaluate value shifts within society and the impact they may have on societal views of the mining industry it is best to speak with respect to catalysts of value change within North American society; 'original' values, the first wave of the environmental movement (late 1880's), Aldo Leopold (late 1940's), the second wave of the environmental movement (1960's &1970's), the introduction of sustainable development (late 1980's), and finally, the information age (present).

Original North American societal values, particularly with respect to the environment, can be traced back to the Judeo-Christian ethic that finds its origins in the Book of Genesis.

> Genesis 26-28
> *Then God said " Let us make man in Our image, according to Our likeness; let them have dominion over the fish of the sea, over the birds of the air, and over the cattle, over all the earth and over every creeping thing that creeps on the earth." So God created man in His own image.....Then God blessed them, and God said to them, "Be fruitful and multiply; fill the earth and subdue it; have dominion over the fish of the sea, over the birds of the air, and over every living thing that moves on the earth.*

From this was born the Judeo-Christian ethic of man as a special act of creation, outside and superior to nature, the master and subdoer of the earth. This ethic represented the common perception of the environment held by most people up until the middle of the twentieth century. In fact, sectors of North American society continue to express this ethic today although as time goes on fewer and fewer members of society are expressing this ethic. The influence of the Judeo-Christian ethic can be examined historically by reviewing how society has treated the environment in the past; the virtual extinction of the Buffalo across the great plains as a result of overhunting, the overhunting of whales in all oceans of the world, near extinction of the beaver as a result of the fur trade, etc. From a cultural perspective, parallels can be drawn with the conquest of North American Indigenous cultures and populations through war, disease and the influence of religion.

Beginning in the late nineteenth century, the predominance of the Judeo-Christian ethic in North American society was challenged by the first wave of the environmental movement. The writings of people like George Perkins March, Henry David Thoreau and John James Audubon highlighted the negative environmental effects of human economic activities, the virtues of living closely with nature, and the beauty and importance of nature. The first wave of the environmental movement manifested itself within society with the establishment of national parks in both Canada and the United States. It was also at this time that some of the oldest environmental/conservation groups in North America were founded including the Sierra Club.

The first wave of the environmental movement was split between those that believed in "wise management" and those that believed in "preservation or righteous management".[35] Wise management implies that; resources are to be used and not preserved, conservation must work together with the dominate values of society not against, primary value of natural areas lies in their value to modern society, and conservation is equated with sustainable exploitation.[36] Preservation or righteous management implies that; the universe is the sum of its parts interrelated and interlocked, the biotic community and its processes must be protected, nature is intrinsically valuable, human activities must work within the limitations of the planet's ecosystems, and preservation works against the dominant values of society. In many respects these two viewpoints continue to dominant within society although the relative acceptance or support for each has changed.

In 1949, the Sand County Almanac written by Aldo Leopold was published. This book is accredited with having significant influence on the emergence of environmental ethics since its publication. Of particular significance is Leopold's discussion of the land ethic. Leopold suggested that ethics should be extended to include the environment. Starting with the idea that ethics evolved on the premise that the individual is a member of a community of interdependent parts, he suggested that "the land ethic simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively; the land."[37] "The land ethic of course cannot prevent the alteration, management, and use of these resources, but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state. In short, the land ethic changes the role of Homo sapiens from conqueror of the land community to plain member and citizen of it. It implies respect for his fellow member, and also respect of the community as such."[38] Leopold discusses the impact of human activity on nature and nature's ability to respond. "Evolutionary changes are usually slow and local. Man's invention of tools has enabled him to make changes of unprecedented violence, rapidity and scope."[39] The land recovers, (from man's violence) but at some reduced level of complexity, and with a reduced carrying capacity for people, plants and animals."[40] Leopold also suggested that responsibility for stewardship of nature rests with the individual citizen. "A land ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity."[41] At the time of publication

[35] Draper, D. Our Environment; a Canadian Perspective, Toronto; Nelson, 1998, p.38.
[36] Ibid.
[37] Leopold, A. The Sand County Almanac, New York; Oxford University Press, 1949,p.204.
[38] Ibid.
[39] Ibid.p.217.
[40] Ibid.p.219.
[41] Ibid.p.221.

these ideas were considered radical by mainstream society however, the ideas expressed by Leopold would be reflected in the environmental movement which began in the 1960's and are considered to be mainstream by most of North American society today.

The second wave of the environmental movement began in the 1960's and has undergone evolution and change to its present state today. The beginnings of this wave of the environmental movement can be discussed by looking at increased awareness of environmental issues on the part of the general public and the emergence of new, organized environmental interest groups in the form of the political environmental movement. The post world war two era was one of incredible economic growth and development for North American society and an era of environmental degradation - as a result of rapid growth, development, and use of resources in the absence of environmental legislation, land use controls and a clear understanding of the impact of these activities on the environment. The 1960's became an era within which the ills of society's labours, environmental degradation, would affect everyday people and become a point of concern. "The increasingly tangible evidence of environmental ills and, more particularly, the crises that finally erupted from this degradation played a part in the mounting environmental concern"[42] Many people point to Rachel Carson's book Silent Spring (1962) as the catalyst for environmental consciousness. Rachel Carson opened the eyes of everyday people to the damage being brought to bear on the natural world through society's use of chemicals and the importance of the natural world in general. "In 1962, when Silent Spring was first published, 'environment' was not even an entry in the vocabulary of public policy……Silent Spring came as a cry in the wilderness…..she was writing against the grain of orthodoxy rooted in the earliest days of the scientific revolution: that man was properly the center and master of all things, and that scientific history was primarily the story of his dominion".[43] Other influential catalysts were events like the Santa Barbara oil spill and air quality problems in Birmingham Alabama. These events affected not only local people but others through the television and press media. Television played a large role in the creation of awareness of environmental issues throughout the general public; for the first time people could see environmental problems for themselves in other areas or learn about the latest scientific findings. The "rising national consciousness of environmental problems can be attributed partially to the education of public thinking by ecologists and public officials proclaiming the need for environmental protection, and partially to growing evidence of environmental degradation itself."[44]

The second wave of the environmental movement represented organized political opinion and political force that sought to change how decisions were made which effect the environment and

[42] Rosenbaum, W.A., The Politics of Environmental Concern,New York; Praeger, 1973,p.56.
[43] Carson, Rachel, Silent Spring, Introduction by Al Gore, New York; Houghton Mifflin, 1994, p.xv-xvi.
[44] Rosenbaum,p.12.

how society valued the environment. It represented a collective set of ideas, interests and values about the environment with which people could identify and act on if they were unwilling to act individually. The general public let its views be known through general opinion polls and to a lesser extent by its actions. The environmental movement was the action-forcing mechanism by which the message of public fear about the environment was brought to the attention of the decision makers. The high degree of awareness by the public of the environmental and the organized and vocal protests by the environmental movement assisted in solidifying the political perceptions of the environmental crisis and thus, the political commitment to do something about it. The evolution of political awareness of environmental degradation and the desire to do something about it can be thought of as a snowball. The environmental movement began to act to try to change decision-making and by virtue of its activities more people recognized the severity of the problem. The growth in awareness and the depth of concern of increasing numbers of people put pressure on politicians to solve the problem of environmental degradation. This stimulated attempts to capture the values of concern and internalize them in decision-making. Thus, the rise of environmental awareness in the 1960's fostered many of the environmental policies, regulations, guidelines and legislation which were created in the late 1960's and 1970's.

Since the early 1970's the salience of environmental issues to the general public has grown. This has been the result of the early efforts at environmental education and further evidence of environmental degradation at the hands of our industrialization.

Since the later part of the 1980's, concern for the environment has ceased to be a public issue peripheral to our consciousness. Rather, concern for the environment has become a social issue and an integral part of our consciousness - much like drinking and driving or fitness and low fat eating. The majority of citizens in the United States and Canada participate in recycling programs, and are involved in issues related to water quality, quality of life, diminishing habitat, and air quality.

In 1987, the concept of sustainable development was introduced to the world by the Bruntland Commission. Sustainable development was defined by the Bruntland Commission as development which meets the needs of the present without compromising the ability of future generations to meet their needs. The ramifications for sustainable development and the desire on the part of many sectors of society to embrace sustainable development once again shifted environmental ethics and values within North American society. This concept has created a new filter through which many ordinary citizens, corporations, academics and professionals within the environmental field now examine their own efforts to facilitate environmental management and the efforts of others. Many industrial sectors and individual companies have internalised the concept of sustainable development, developed green products, or created environmental policies. There is a rise in popularity of 'natural' and 'sustainable' (for example fish caught using

sustainable techniques) products including concern with respect to ethical and environmentally friendly investing. Furthermore, there is an increasing incidence of environmental education in schools and environmental content in children's television programming and books. This has lead to an increasingly more environmentally literate public with the skills, understanding and knowledge to challenge the environmental practices of individual corporations, industrial sectors, and government.

The final influences on societal values are the information age, which started in the 1990's, and the increasing societal debate with respect to globalization. The information age, the emergence of the internet and satellite communications, has once again enhanced the ease with which individuals can access information with respect to a specific issue or event. Society has never had such easy access to information nor such ability to disseminate and influence ideas with relatively little effort. This enhanced access to information coupled with a society which is educated with respect to social and environmental issues and a growing societal disconnect with large institutions including government and corporations, has led to increased societal interest in and opposition to proposals which may create, what are perceived to be, undesirable results. This is evident in looking at the current societal debate with respect to globalization and genetically modified foods. Although these are very popular examples, the same processes are influencing the activities of industrial sectors, such as metals mining, and individual companies. "The proliferation of almost instantaneous electronic communications, especially via the Internet, has created surprising and powerful connections that come to bear on virtually all activities …… and should continue to influence mining in the foreseeable future. Mining for metals and many other commodities is clearly a global enterprise. The conjunction of global enterprise with surveillance by people engaged in global environmental and natural resource policy making serves to call into question whether (a mining project) can ever be considered as being under purely local jurisdiction."[45]

2.4 PUBLIC PERCEPTION AND MINING

The following is a summary of information presented in a report prepared for the Government of New Brunswick by George Miller. Although the information is based on a number of surveys untaken in Canada between 1989 and 1997 it is conservative to assume that some of the same trends in public perception would be occurring in the United States. Unfortunately, similar information and analysis for the United States was not identified.

[45] Personal communication Bill Brown USGS.

2.4.1 Overview

The purpose of this section of our report is to review available data on public opinion regarding the mining industry. The basis for this analysis is a series of national and provincial polls which have been sponsored in the past ten years by industry and government in Canada to assess public opinion with respect to mining. These surveys were made available to the original author by The Mining Association of Canada, the New Brunswick Mining Association, and Natural Resources Canada. In chronological order, the surveys are as follows:

1. "Canadians' Perceptions and Attitudes Towards the Mining Industry and Related Policy Issues", prepared for The Mining Association of Canada by Angus Reid Associates Inc., June 1989. This survey sampled the Canadian public generally but, unlike other surveys, it added a special sample of 200 individuals living in mining communities.

2. "1993 National Public Opinion Survey on Natural Resources", prepared for Energy, Mines and Resources Canada by Corporate Research Associates Inc., 1993. This survey, as well as surveys mentioned under items 4 and 7, covered forestry and energy sources (including oil and gas) in addition to minerals.

3. "Public Opinion on Key Mining Industry Communications Messages", prepared for The Mining Association of Canada by Decima Research, August 1993.

4. "New Brunswick Mineral Policy Public Opinion Survey, 1994", prepared for the Canada-New Brunswick Agreement on Mineral Development Opportunities Program by Corporate Research Associates Inc., May 1994

5. "A Survey among Opinion Leaders on Mining Industry Issues", prepared for The Mining Association of Canada by Compas Inc., March 1995. This report compared its findings with those of a corresponding 1989 Compas survey.

   In 1989, and again in 1995, The Mining Association of Canada commissioned Compas Research (Compas) to carry out an "elite" survey of Canadian decision leaders. The respondents were selected from the following groups: senior federal and provincial civil servants and political advisors, journalists (including parliamentary reporters), consulting academics and other media influencers, business leaders (including financial institutions), and members of labour, native and environmental groups. While only the 1995 survey is referenced (as item No. 5) in this study, the Compas 1995 report contains comparative data from the 1989 survey.

6. "A Qualitative Research Report on the Keep Mining in Canada Campaign", prepared for the Mining Association of Canada by Decima Research, February 1996

   The industry communications program called Keep Mining in Canada and its successor, Mining Works for Canada, were designed to ensure that opinion leaders were kept informed about the industry and about the views of those, such as residents of mining communities, whose present and future livelihoods depend on the industry.

   After the Keep Mining in Canada program had been in existence for about 3 years, another elite survey, a qualitative study of the program's effectiveness, was carried out by Decima research. This consisted of a survey of a limited number of federal legislators and their assistants (referenced as study No. 6).

   The issues covered by these two "elite" surveys are similar in many respects to those covered by the national surveys cited. Accordingly, their findings will be discussed under individual topics such as the economic impact and future prospects of the mining industry, environmental impact, technology, etc.

7. "Tracking Survey of Canadian Attitudes Towards Natural Resources Issues, 1997", prepared for Natural Resources Canada by Corporate Research Associates Inc., 1997

   According to the previous analysis, there were a number of differences in the design of these surveys regarding the target publics covered, the number of individuals polled, the geographical scope of the survey, the nature of the questions asked, etc. As well, the methodology of analysis varied to some extent among the consultants' reports.

   The surveys also exhibited certain important similarities. A number of common themes (e.g., environmental issues) were dealt with by all surveys. Other issues were discussed in two or more surveys. In some cases (items 2, 4,and 7 and item 5) direct longitudinal or geographic comparisons are possible because surveys were directly modelled on each other.

   As a result of these similarities, therefore, and despite the differences, the analysis of the survey data can offer some fairly robust generalizations about the public perception of mining in Canada and the way it has evolved over time. Some findings regarding the opinion of Canadians on a number of issues connected with mining are discussed below.

2.4.2 Overall Impressions of the Mineral Industry

What is the first image of mining that pops into the Canadian mind? Three surveys asked respondents to give their overall impression of mining without suggesting particular issues.
The 1989 Angus Reid study asked respondents to state what they believed to be the important strengths and achievements of the industry, and also its major weaknesses or shortcomings. Only 43% of Canadians were able to find something good to say (61% in mining communities), whereas 54% (64% in mining communities) were able to come up with a weakness. The three leading top-of-mind strengths were: "develops and markets natural resources" (14% nationally, 12% in mining communities), "creates jobs" (11% and 21%), and "good for the economy" (8% and 7%). The three most significant top-of-mind criticisms were: "harms environment" (20%, 21%), "poor worker safety" (10%, 8%), and "foreign-controlled" (5%, 4%). The relative ranking of these strengths and criticisms did not differ among the three attitudinal segments (pro-industry, antagonist and non-committed).

The Decima 1993 report asked respondents to what degree their opinion of the mining industry was favourable or unfavourable. Some 52% have a somewhat or very favourable opinion as compared with 15% having a somewhat or very unfavourable opinion and 29% neutral.
The 1994 New Brunswick study carried out by Corporate Research Associates (CRA) asked respondents to name (unprompted) one or more of the mining companies operating in the Province. Over one-third could not name a single one, while the largest (Brunswick) was named by only 31% of residents. When asked to give a general impression (favourable or unfavourable) of these companies, on average 42% of respondents gave a favourable opinion as compared with 10% unfavourable and 47% who could not give an opinion.

This evidence suggests that Canadians do not think often about mining. When prompted to do so, most have a relatively balanced view of the mineral sector. They appreciate the economic contribution of the industry, and substantially more report a favourable impression than an unfavourable one. However, they are not blind to perceived shortcomings in the areas of environment and worker safety.

2.4.3 Segmentation of the Canadian Public into Like-Thinking Groups

Only one report, the 1989 Angus Reid study, contained a segmentation or "cluster analysis", in which subgroups within the public are identified according to the consistency of their responses. This multivariate technique is designed to isolate particular groups of persons who think very much alike about mining, almost regardless of the issue being considered in a given question. This feature is particularly valuable in shedding light on consistent currents of opinion. In some ways it is more informative than an analysis which simply considers all responses to be independent of each other.

The 1989 survey "identified three distinct groups within the Canadian population which hold distinctively different opinions and attitudes towards the Canadian mining industry." The "pro-industry" group (35% of the population) hold generally favourable attitudes towards the mining industry. The "antagonists" (20%) hold consistently negative attitudes. The largest group (at 45%) hold differing opinions on different mining issues. Reid labelled this group the "concerned".

The pro-industry segment amounts to:

- 35% of the population, consisting of individuals who are generally sympathetic to the industry, regardless of the issue.
- They recognize the economic contribution of the industry and they feel that the industry has made great strides in both environment and treatment of employees.
- They tend to trust industry spokesmen and accept that the intentions of the industry are good.
- Demographically, this group contains a disproportionate number of men and persons over the age of 35. Members generally have higher levels of education and higher household incomes than members of the other attitudinal segments.
- A majority (58%) of the residents of mining communities surveyed belong to the pro-industry segment.

The anti-industry segment, or antagonists;

- 20% of the population.
- They are consistently negative in their attitudes to industry.
- They give poor ratings to the industry's environmental record and its treatment of employees and communities.
- They consider mining industry executives untrustworthy. Women are slightly more likely than men to be Antagonists.
- Antagonists are also over-represented among NDP supporters.

The third segment, the "non-committed";

- Represent the largest group at 45%.
- Tend to give the industry a mixed report card, depending on the issues presented to them.
- They are concerned about the environmental record of the industry, but feel that mining companies are good employers.
- They tend to trust industry executives and believe that the industry is generally responsible in its community relations.
- This group contains a disproportionately larger number of women than men. Age composition is similar to that of the population as a whole.

- This is the least well educated of the three segments with over half never having attended university.

Both the pro-industry sympathizers and the antagonists can be expected to maintain their attitudes over time, because they are relatively impervious to new information. The non-committed individuals have their doubts about the industry's performance, but they are prepared to listen and are open to objective information about the mining industry.

Other surveys, while not consistently emphasizing attitudinal segmentation, noted at various points that the highest degree of knowledge about and sympathy with mining tends to be concentrated among older Canadians, men, the better educated and anglophones.

2.4.4 Regional Differences

In the Angus Reid 1989 study;

- BC showed the highest proportion of pro-industry respondents (43%), while Quebec showed the lowest (24%).
- The antagonists were strongest in Quebec (25%) and weakest on the Prairies (12%).
- The largest proportion of non-committed was in the Prairies at 51%, and the smallest in BC at 35%.
- Residents of mining communities (who are likely more knowledgeable than the general public) have a more favourable opinion of mining than Canadians generally.

In the Decima 1993 survey a majority of Canadians (52%) had a favourable opinion of mining. Only 15% were unfavourable. The remainder (29%) had not made up their mind. Quebec showed the smallest approval rating at 45%, while Atlantic Canada showed the largest, at 59%. Other results: BC (54%), the Prairies (54%) and Ontario (55%).

Other surveys such as the CRA studies did not give a consistent breakdown of regional attitudinal differences, but rather mentioned significant geographic variations in the responses to certain issues. These indications are generally consistent with the regional trends identified by Angus Reid and Decima.

2.4.5 Economic Contribution of Mining, Present and Future

Canadians are generally cognizant of the economic contribution of mining, though it is somewhat undervalued in comparison to other resource industries, notably forestry. The resource industries' contribution, including that of mining, to the provincial economy is well appreciated in resource-dependent regions, and even more keenly in rural communities.

Opinions are mixed regarding the future growth prospects for mining. These are consistently rated lower than for other resource sectors such as agriculture and oil & gas, but above fisheries. Even so, around half of the Canadians polled in 1997 projected better prospects for mining. While lower than for other sectors, this result represents a substantial improvement since 1993. Opinion leaders are not so sanguine: only around 25% project better times for mining, as compared with 43% for oil & gas.

2.4.6 Credibility of the Mining Industry in Canada

The believability or credibility of the mining industry is an important factor. If an industry is working for a more constructive policy climate, its credibility is a vital consideration. In communicating with opinion leaders and the public, the industry must present credible messages through believable spokespersons. Who are these credible spokespersons?

The 1989 Angus Reid survey asked respondents how credible they found several groups when making statements about the mining industry;

- The only group which a majority of Canadians (60%) said they would tend to trust (scoring 6 or more on a ten-point scale) were environmental groups. Fewer than half would trust any other group.
- Second to environmental groups were the news media (48%), followed by union leaders (47%) and industry associations (44%). Next came provincial (40%) and federal (35%) governments, with mining industry executives in last spot (34%).
- Mining communities agreed that environmentalists were most credible, followed by industry associations (53%) and union leaders (49%).
- The concerned group's views reflect those of the general population.
- The pro-industry segment gives higher believability ratings to all groups.
- For a majority of the Antagonists, only environmentalists, the media and union leaders are credible.

In 1993, Decima asked Canadians who would be the most believable spokespersons on mining industry issues. The results vary substantially from those of the earlier Reid study. Such startling differences may be due more to methodological differences than to a shift in opinion. (Decima used a 7-point scale and required a score of 6 or more to count as believable: all scores between 3 and 5 inclusive were designated "depends on the issue"). In the Decima study, mining professionals were rated most believable, followed by mine workers, mining town community leaders, environmental groups, mining association spokesperson, Native groups, news media, mining company executive, union leaders, and government officials.

Compas in both 1989 and 1995 asked opinion leaders to rate the believability of individual industries or institutions. Universities rated highest in both surveys (69% in 1995, 75% in 1989, for a loss of 6%), followed by the computer/telecom industry (56, 36, +20), banks (42, 31, +11), auto manufacturers (41, 28, +13), oil & gas (42, no 1989 data), mining (40, 26, +14), forestry (39, 25, +14), and federal government (29, 22, +7). While all sectors except universities are more highly rated than in 1989, the earlier ranking is maintained. In 1995, the mining industry is still rated very similarly to banks, autos, oil & gas, and forestry.

Available surveys differ in the believability rankings given by Canadians to various interest groups when discussing mining issues. Those who appear to be independent (universities, environmental groups, mining professionals) have fair to good credibility. Mining industry executives and government officials (particularly federal) rate fairly low.

2.4.7 Environmental Performance

Canadians have a deep-seated concern about the environmental impact of the mining industry. It is the most frequently-cited weakness of mining. The impact of mining on the environment is relatively more important to younger people and to those with a higher level of education. Some 67 percent of Canadians were ready to agree strongly or moderately with the statement that mining is a major source of pollution, whereas only 54% agreed that the industry's environmental record has improved in recent years.

Canadians are equally divided on whether or not the environmental impact of mining is acceptable, given the industry's economic contribution. Slightly over half of Canadians believe that the industry is committed to environmental improvement, though opinion leaders single out mining as the industry with the highest degree of commitment, slightly above forestry.

Canadians do not believe that improved environmental protection will harm competitiveness or cost jobs: in fact the majority believe the reverse. The two CRA surveys showed a substantial margin of those who believe that reducing impacts will make resource industries **more** competitive over those who believe the reverse (45% to 17% in 1993, 49% to 16% in 1997). By an even wider margin, Canadians believed that reducing environmental impacts will provide more jobs, rather than decreasing employment. Over time, opinion leaders have come largely to share this perception. In the 1989 Compas survey, only 16% felt that better environmental protection would boost the economy, while 27% said it would slow down the economy and 57% expected no real change in the economy. By 1995, 44% voted for boosting the economy, 27% for slowing it down, and 25% for no change. Canadians are not willing to accept environmental/economic tradeoffs, nor to believe that reducing environmental damage will make

industry less competitive. These "no-tradeoff" findings are consistent with those of many other polls done over the last few years, quite unrelated to mining or the resource industries.

Environmental concerns extend to land use. Half of Canadians would expect mining activity to cause major disruption to wildlife and fish habitat, and a majority would advocate abandoning a mining project that did interfere with wildlife.

2.4.8 Technology, Production Methods, and Worker Safety

Contrary to expectations, mining is consistently rated as a leader in the development and use of new technology by a majority of Canadians, including opinion leaders. Similarly, while Canadians are concerned about mining workers' health and safety, the industry is given credit for working to protect them. By a small margin, more Canadians find the industry's safety record "good or very good" than "poor or very poor", though mining is rated behind other industries such as manufacturing and construction. A majority of Canadians accept that protecting workers is an industry priority, and opinion leaders single out mining as the industry that has made the most strides in emphasizing employee training and safety.

2.4.9 Summary

The survey results outlined above provide a snapshot of public perceptions of mining in Canada from the late 1980's to the early 1990's. Although it is difficult to extend the survey results to the United States or comment on their validity today without more recent survey data, the information does provide one of the few glimpses of how 'Joe Public' views mining. The following points may be distilled from the data; the general Canadian public……

- Generally does not think much about the mining industry in Canada;
- Has an understanding of the economic benefits of mining with respect to job creation and marketing of natural resources;
- Has an understanding of the negative consequences of mining with respect to worker health and safety and environmental issues;
- Does not believe that the mining industry is a credible source of information and are more likely to believe the information put forward by environmental groups or the news media; and
- Are not willing to accept environmental/economic tradeoffs, nor to believe that reducing environmental damage will make the industry less competitive.

The information presented in this section with respect to public perceptions of mining assists in creating an understanding of how the general public views the contributions and implications of

mining in the present. Although the public was not a community of interest identified as part of this research, one could argue that the public is integral to the function of the industry in the raising of capital and to the function of government. The views outlined in the above sections influence and are influenced by the other communities of interest. Thus, an understanding of the public perceptions with respect to mining provides a context within which all other community specific information may be examined.

3.0 HISTORICAL AND CURRENT STATE OF MINING IN NORTH AMERICA

It should be noted that the statistical summary presented within this section represents a compilation of existing information from published sources. These sources are the governments of Canada and the United States and their respective national mining associations. It became apparent in discussions with the communities of interest that these statistics are not viewed as a representative reflection of what is happening in the industry by some members of the communities of interest. Time and resources allocated to this project did not allow for a comprehensive review of the statistics to be undertaken. It is recommended that one method of improving transparency and trust with the communities of interest may be to create a monitoring or statistical reporting format in partnership with these communities.

Discussions with NGO's identified that Mining Watch is just initiating a study of the "full cost" of mining. Mining watch indicated that their study will look at subsidies and tax benefits to mining and the costs of reclamation and closure in assessing the "full cost" of mining. The study will also include a critical analysis of the benefits claimed by industry. Mining Watch expects it will take approximately a year to complete this study. An understanding of the "full cost" of mining would have benefited the information contained within this report as much of the criticisms we have heard relate to the devaluation of communities and the environment.

Table 1 in Appendix B presents a number of statistics for the mining industry in Canada from 1858 to 2000. Table 2 in Appendix B presents a number of statistics for the American mining industry from 1792 to 2000. As noted in MacDonald, no single source of comprehensive statistical information exists for the industry. The type of information has changed considerably with time. Records initially reported the quantities and values of metals – mostly gold, silver, copper, lead and zinc. The type of information has progressively grown to include in some instances figures on labour force and payrolls attributed to mining activities, investment levels, and recently information with respect to environmental effects, however, for many of the years, statistics were not collected or available. It should also be note that many of the definitions used in reports have changed over time, as have the reporting formats. Reports produced more recently (within the last 10 years) contain a great deal more information than those of previous years.

In at least one way, the lack of or changes in information collected is informative. A review of the information reveals the time periods through which different types of information become available or relevant for stakeholders and governments. This would explain the emergence of environmental statistics in the last 10 to 20 years.

Figures 3.1, 3.2, 3.3, and 3.4 outline some of the key indicators of mining activity.

FIGURE 3.1
DIRECT EMPLOYMENT IN MINING IN CANADA

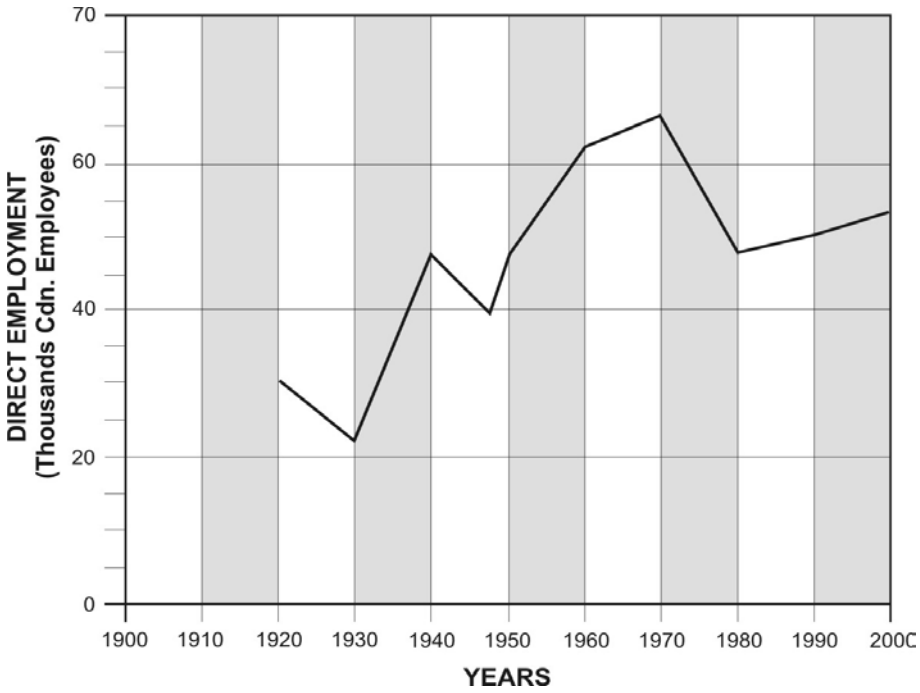


FIGURE 3.2
VALUE OF MINERAL PRODUCTION IN CANADA

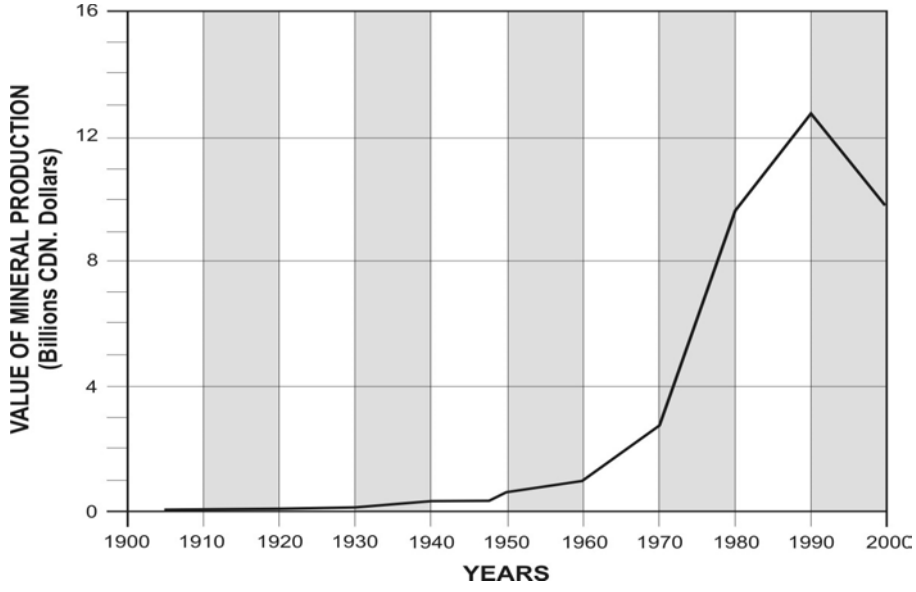


FIGURE 3.3
DIRECT EMPLOYMENT IN MINING IN THE UNITED STATES

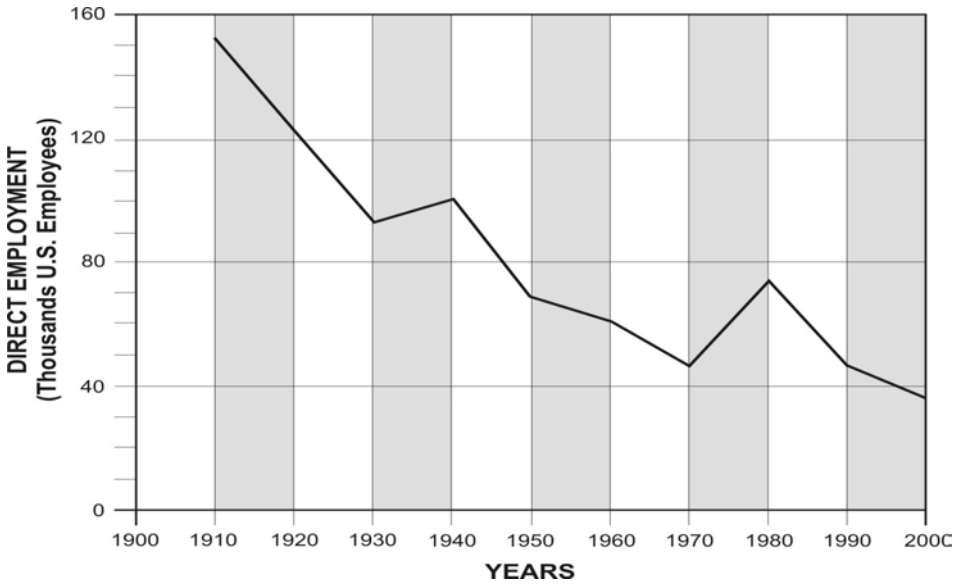
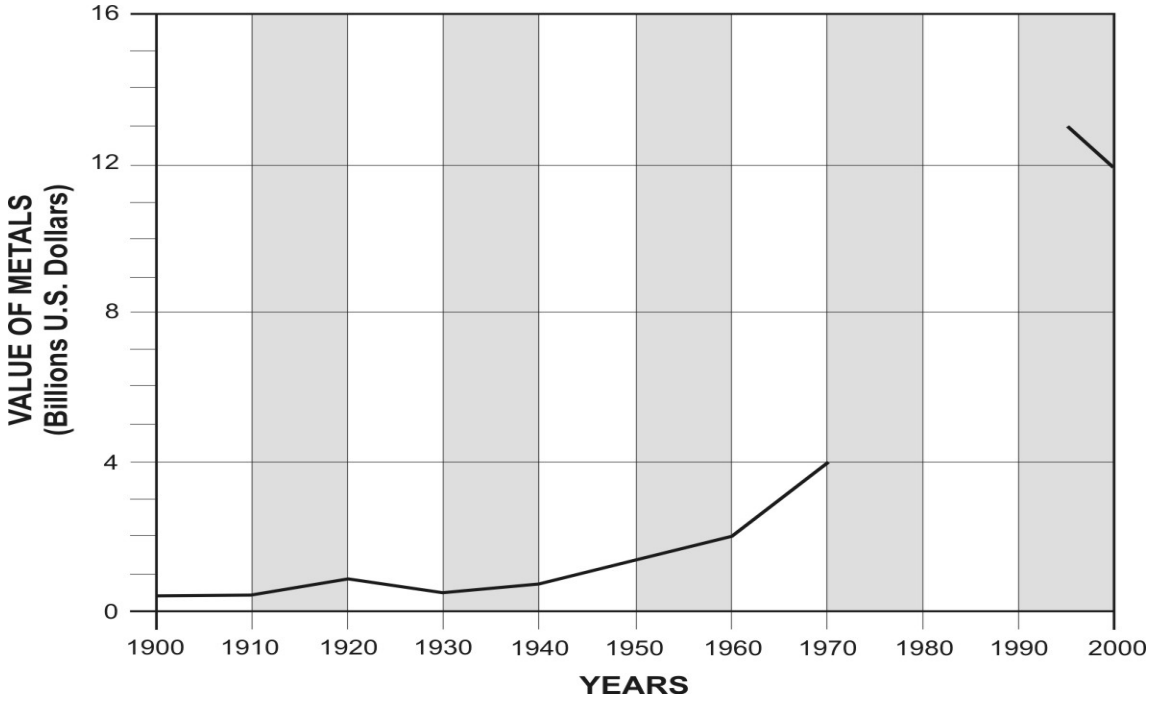


FIGURE 3.4
VALUE OF MINERAL PRODUCTION IN THE UNITED STATES



Generally the following conclusions can be drawn;

- Metal mining has contributed significantly to the economy in both Canada and the United States over time however, the relative contribution is weakening in recent decades;
- Direct employment in mining activities is declining substantively over time in the United States while the decline in Canada is more recent; and
- Historically mining was of greater importance to the economy of North America than it is today.

4.0 PERSPECTIVES OF EACH COMMUNITY OF INTEREST

4.1 RESIDENTS OF MINING DEPENDENT COMMUNITIES AND REGIONS

4.1.1 Who is the Community of Interest?

This community of interest represents those people who live in communities or regions who are dependent on mining for their economic stability.

In Canada, there are 113 mining dependent communities in eight provinces and two territories. If metal fabricating is added to the activities of the communities the number of communities dependent on this sector increases by 12 to 125. The determination of community dependence is justified if over 50% of the income received in the community is derived from any one sector.[46] There are also a number of communities dependent on a combination of resource sectors; energy, forestry and mining. There are 169 of these communities. Tables 4.1 and 4.2 present the distribution of mining dependent communities and mining dependent communities with metal fabrication across Canada.

TABLE 4.1
DISTRIBUTION OF MINING AND
MINERAL RELIANT COMMUNITIES BY SIZE, 1996

Province	Population Range of Community				Total CSDs
	Less Than 1000	1000-4999	Greater Than 4999	Total	
	Number of Communities				
Newfoundland	3	1	1	5	381
New Brunswick	0	2	2	4	283
Quebec	13	18	9	40	1599
Ontario	1	5	8	14	947
Manitoba	1	4	2	7	298
Saskatchewan	17	3	0	20	970
Alberta	1	2	1	4	467
British Columbia	0	12	3	15	713
Yukon	0	2	0	2	35
Northwest Territories	2	0	0	2	68
Total	38	49	26	113	5761

Source: Natural Resource Based Communities in Canada; an analysis based on the 1996 Canada Census.

[46] White W., and D. Watson, Natural Resource Based Communities in Canada: An Analysis based on the 1996 Canada Census, Northern Forestry Centre, Canadian Forest Service

TABLE 4.2
DISTRIBUTION OF COMMUNITIES DEPENDENT ON MINING AND MINERALS (INCLUDING METAL FABRICATING)

Province	Population Range of Community			Total
	Less Than 1000	1000-4999	Greater Than 4999	
Newfoundland	3	1	1	5
New Brunswick	0	2	2	4
Quebec	17	21	10	48
Ontario	1	7	10	18
Manitoba	1	4	2	7
Saskatchewan	17	3	0	20
Alberta	1	2	1	4
British Columbia	0	12	3	15
Yukon	0	2	0	2
Northwest Territories	2	0	0	2
Total	42	54	29	125

Source: Natural Resource Based Communities in Canada; an analysis based on the 1996 Canada Census.

Unfortunately, analysis of resource based or resource dependent communities within the U.S. was not available. Based on literature review activities and discussions with agencies it would appear that research and analysis similar to that undertaken by NRCAN has not been done for communities in the U.S. However, a list of some mining dependent communities has been assembled based on available secondary information and is presented in Table 4.3.

TABLE 4.3
MINING IMPACTED COMMUNITIES IN THE US
A SUBJECTIVE LISTING PREPARED ON THE BASIS OF THE LOCATION OF PRECIOUS METAL AND BASE METAL MINES

STATE	COMMUNITY	STATE	COMMUNITY
Nevada	Elko Carlin Crescent Valley Battle Mountain Golconda Valmy Winnemucca Lovelock Eureka Round Mountain Hawthorne Silverpeak	*Arizona*	Bagdad Wickenburg Sahuarita Morenci Clifton Globe Miami Kearney Hayden
California	Ridgecrest	*Colorado*	Divide Victor
Idaho	*Pinehurst* Kellogg Osburn Wallace	*Utah*	Magna Copperton
Montana	Red Lodge Billings Nye	*New Mexico*	Silver City Hurley Questa Red River
Alaska	Fairbanks Juneau		

4.1.2 History

Historically the mining population was very transient. The Indigenous People, the explorers, and those involved in the rushes only stayed in the mining area for a very short period of time. It was not until the start of large-scale mine developments and production, approximately the middle of the 19th century, that mining communities were developed alongside mine sites and furnaces. The purpose of these communities was to provide a captive workforce to the mine site. Often times these communities were created by the mining companies. They started out as work camps for the workers themselves but as sites of longer potential were developed it became necessary to create communities which would house labourers, their families and the services they would require over the longer time. This included health care, schools, stores, and infrastructure.

For many individuals and communities there was a historic belief that mining was part of 'nation building' and as such a patriotic activity. For many others mining represented a well paying, long-term job when no one else was offering employment. For others it represented a reason to immigrate to the United States or Canada as mining companies attracted migrant workers to work in the mines and, in some cases, break strikes. Many people built their lives and raised their children within resource dependent communities. When the mines closed people who had previously enjoyed a good standard of living were left without an income and without other economic opportunities within their community. Mine closures also negatively affected surrounding businesses within the community.

Mining, forestry, agriculture and other resource extractive industries created the United States and Canada in the late 1800's and 1900's. American policy was to push the frontiers and to this end they gave land away particularly for resource extractive industries which were perceived to be 'nation building.' Over time industry developed a sense of entitlement.

In the 1960's, cultural and social change, the emergence of environmentalism, and the changing public perspective of National Security changed human consciousness. The conflict in the articulation and priority of national interests generated conflict on a local level. This was compounded by the increasing evidence within resource dependent communities of environmental contamination and health effects to workers which could be linked to mining activities. The industry was serving the public good by providing metals to fuel production and increasing wealth while the public was beginning to question whether these public goods were worth the environmental and social costs and the impacts on human health. This created a divergence with respect to the perceived importance of mining that continues today.

4.1.3 Contributions and Implications

Table 4.4 provides a summary of contributions and implications of mining to residents of mining dependent communities.

TABLE 4.4
SUMMARY OF CONTRIBUTIONS AND IMPLICATIONS OF MINING TO RESIDENTS OF MINING DEPENDENT COMMUNITIES

	Past	Present
Contributions/Benefits of Mining Industry	- community building; - nation building; - job security; - good income; - migrant workforce.	- well paid jobs.
Implications/Costs of Mining Industry	- economic/ environmental legacy; - community stability at whim of mining industry.	- loss of communities upon mine closure; - loss of jobs; - loss of business; - exodus of youth; - community stability at whim of industry. - conflict with non-company community residents; - mistrust.

The mining industry is shrinking in the U.S. and to a lesser extent in Canada. Some resource dependent communities have relied on exploration and discovery of new ore bodies to sustain them. When new ore bodies are not discovered many resource dependent communities struggle to find economic opportunities to sustain them. Often times, they must abandon the community. Resource dependent communities in Northern Ontario have tried everything from turning abandoned mines into attractions and museums, to turning the community into a retirement community, to proposing to fill abandoned mines with garbage from large cities. The communities of Kirkland Lake, and Elliot Lake in Ontario are examples of this. Some attempts at economic diversification have been successful while others have not been successful. Not finding a new revenue source within these communities means the exodus of young people, and an ongoing population at the same time that infrastructure, health care and community services are deteriorating. For the people living in these communities to leave means to leave a family home; which may be difficult or impossible to do depending on the age and skill sets of the family.

Resource dependent communities recognize that it was often mining companies who set up town sites, and provided infrastructure and community services in the first place. However, it was the well-paid mining jobs and promises of a community that attracted the workforce to the area and

encouraged them to raise families. When the mine and its refinement and processing facilities close, and if there is no long term economic development program in place, the town may also disappear. This is a similar experience to other single industry towns. This represents a significant social and cultural impact to the residents of the town and their children particularly if the town has existed for a long period of time (at least one or two generations).

4.1.4 Lessons Learned and Directions for Change

Many of the lessons learned and directions for change emerging from the discussion of resource dependent communities are similar to what has emerged from the discussion of Indigenous People and labour. In general, the resource dependent communities suggested a lack of trust for the mining industry. Many view the industry as a "one night stand" pretending not to be. The trend over decades is for the industry to manipulate research, take advantage of workers and communities, close down industries as prices collapse, and leave catastrophic environmental messes. Some people in communities of interest view MMSD as one more attempt on the part of industry to manipulate research and control the flow of information.

At least one interviewee had an interesting perspective on directions for change with respect to the role of the community in collective bargaining in communities where mines are operating. The argument starts with the idea that new types of multiparty dialogue are required today. In traditional collective bargaining it is very clear who speaks for who, and with what rules. The union has historically been able to speak for the whole community but particularly the employees. The corporation speaks for the shareholders. The community owns property, provides governance and collects taxes. Today there are new players such as NGO's and new community structures, necessitate a very different type of dialogue, but the union has limits on what it can pressure corporations to do. Community members do not have limitations; they will be the force of change in the new mining era. "The community must be put at the centre of its own development process. The company then becomes a facilitator or collaborator in the development plans of the community; the community must drive the process as much as possible"[47]

The nature of the community has changed the rules of engagement for dialogue. No longer is mining about corporations and the people who work there. Many of these mining communities are drawing people who enjoy the aesthetic amenities of a community; people who do not work in the mines but rather people who use technology to "commute" back to urban areas. These people want a voice in mining operations and are legitimate stakeholders.

[47] Rader, Jim, "Community Engagement in the Resources Sector," 2000 p.2

As was suggested that, the mining industry must think about the changing nature of people's attitudes to the environment, and communities wanting to have a greater voice in decision-making.

4.2 INDIGENOUS PEOPLE

4.2.1 Who is the Community of Interest?

Indigenous people are referred to by different titles in Canada and the United States. In Canada they are referred to as First Nations, and in the United States they are referred to as Tribal Nations. The authors of this report tried to use a title which would be respective and representative to all nations in choosing to use "Indigenous People."

The Indigenous People community of interest includes all peoples of North American aboriginal descent in Canada and the United States. It should be noted that Indigenous People in Canada and the United States are organized quite differently. In Canada, there is a centralized structure for Indigenous People's centred around the Assembly of First Nations (AFN) and the election of the Grand Chief to lead the organization. The AFN functions is a political body representing all of the First Nations in Canada in terms of National and political issues. There are also a number of other national organizations for Indigenous People's working on issues throughout Canada. In the U.S., there is a very disaggregated structure with the organizing unit generally being the tribal nation. There is a lack of organizations representing indigenous people's in the U.S. at the National level.

First Nations populations are found in every province and territory in Canada living both on and off reserve. Tables 4.5 and 4.6 outline First Nation populations regionally and with respect to living on or off reserve. It should be noted that there is not an accepted set of definitions for first nations people and there are discrepancies between the Canadian Census data and the Indian Registrar due to these definitional differences. These definitions are described after Table 4.5. This explains the differences in the numbers.

TABLE 4.5
POPULATION BY ABORIGINAL GROUP, 1996 CENSUS

Definitions and Notes	Total Population	Aboriginal Population (see definition)				Non-Aboriginal Population
		Total[1]	North American Indian [2,3]	Métis[2]	Inuit[2]	
			Number			
Canada	28,528,125	799,010	554,290	210,190	41,080	27,729,115
Newfoundland	547,155	14,200	5,430	4,685	4,265	532,955
Prince Edward Island	132,855	950	825	120	15	131,905
Nova Scotia	899,965	12,380	11,340	860	210	887,585
New Brunswick	729,630	10,250	9,180	975	120	719,380
Quebec	7,045,080	71,415	47,600	16,075	8,300	6,973,665
Ontario	10,642,795	141,520	118,830	22,790	1,300	10,501,275
Manitoba	1,100,295	128,680	82,990	46,195	360	971,615
Saskatchewan	976,615	111,245	75,205	36,535	190	865,370
Alberta	2,669,195	122,835	72,645	50,745	795	2,546,360
British Columbia	3,689,755	139,655	113,315	26,750	815	3,550,100
Yukon	30,650	6,175	5,530	565	110	24,475
Northwest Territories[4]	64,120	39,690	11,400	3,895	24,600	24,430
Northwest Territories	39,460	19,000	x	x	x	20,460
Nunavut	24,665	20,690	x	x	x	3,975

Notes:
1 The sum of North American Indian, Métis and Inuit is more than the total Aboriginal population because 6,415 persons reported identifying with more than one group.
2 Single and multiple responses have been combined.
3 Users should note that depending on the geographic area under study, the counts for North American Indian may be affected by the incomplete enumeration of 77 Indian reserves and settlements in the1996 Census.
4 Includes Nunavut.
x Data unavailable, not applicable or confidential.
Source: Statistics Canada, 1996 Census.

Aboriginal population: There are different ways to define the Aboriginal population. Data presented in this table are for those who identified with one or more Aboriginal groups (North American Indian, Métis, or Inuit). Also included are those who did not identify with an Aboriginal group but who reported that they were Registered/Treaty Indians or Band/First National members. The 1996 Census also provides information on those who reported Aboriginal ethnic.
North American Indian population: Includes persons who identified as North American Indian and/or those who reported being a member of an Indian Band/First Nation and/or those who reported being a Treaty Indian or a Registered Indian as defined by the *Indian Act* of Canada.

TABLE 4.6
REGIONAL POPULATION DISTRIBUTION ACCORDING TO SIZE

Province/ Territories	Total Population Figures	Living on Reserve or Crown Land	Living Off Reserve	Number of Bands
Ontario	146,113	74,790	71,323	126
British Columbia	106,370	55,808	50,562	197
Saskatchewan	100,719	51,829	48,890	70
Manitoba	100,527	66,081	34,446	61
Alberta	80,390	53,377	27,013	43
Québec*	61,026	42,935	18,091	39
Atlantic Region	25,186	16,467	8,719	31
Northwest Territories	14,650	10,641	4,009	26
Yukon	7,433	3,799	3,634	16
Total National Population	642,414*	375,727*	266,687*	609**

Notes:

* Figures as of December 31, 1998, Indian Registrar DIAND. Canada total excludes Cree and Naskapi bands in Quebec as they are covered under terms established in the James Bay Agreement.
** AFN includes 24 First Nations who are not recognized by DIAND, to bring this total up to 633.

Source: Assembly of First Nations Fact Sheet, First Nations Population in Canada May 2001.

Tables 4.7, 4.8 and 4.9 illustrate some of the involvement of indigenous people in mining activities both directly and indirectly; unfortunately complete listings were not available. In general more mining activity is occurring on reserve in the United States but there is a high potential for this activity in Canada. It should also be pointed out that these tables do not reflect the number of indigenous communities located near or downstream of an abandoned mine site. In Canada, the Assembly of First Nations suggests that more than 36% of First Nation communities are located less than 50 kilometres from one of the primary mines developed in Canada.[48]

[48] AFN, Fact Sheet: Exclusion of First Nations from Mining Industry, August 2001

TABLE 4.7
INDIAN TRIBES IN THE U.S. WITH MINERAL ACTIVITY

Reservation (Tribe)	Energy Mineral Potential	Trust Acreage (% Alotted)	Resident Indian Population	Government
Blackfeet (Blackfeet)	Coal, oil and gas	937,701 (68)	7,000	IRA
Crow (Crow)	Coal, oil and gas	1,516,005 (73)	5,500	Non-IRA constitution
Fort Berthold (Mandan, Hidatsa, Arikara)	Coal, oil and gas	419,198 (83)	3,100	IRA
Fort Peck (Assiniboine and Sioux)	Coal, oil and gas	904,683 (57)	5,200	Non-IRA constitution
Hopi (Hopi)	Coal, oil and gas	1,561,213 (0)	9,000	IRA
Jicarilla Apache	Oil and gas, coal	823,580 (0)	2,500	IRA
Laguna Pueblo (Keresan)	Uranium, coal	461,099 (0)	6,700	IRA
NAN Corp., Alaska	Zinc, Copper	Non trust, Alaskan Corporation lease		Alaskan
Navajo (Dineh)	Coal, uranium, oil and gas	436,947 (27)	170,000	---
Northern Cheyenne (Cheyenne)	Coal, oil		3,300	IRA
Osage (Osage)	Oil and gas	168,794 (100)	6,200	-----
Southern Ute	Oil and gas, coal	309,970 (1)	1,200	IRA
Spokane	Uranium	130,180 (9)	2,100	-----
Uintah and Ouray (Ute)	Oil and gas, coal, oil shale	1,0231,556 (1)	2,500	IRA
Ute Mountain Ute (Ute)	Oil and gas, coal, uranium	597,288 (1)	1,700	IRA
Wind River (Araphahoe and Shoshone)	Coal, uranium, oil and gas	1,887,262 (5)	5,500	-----

Source: Saleem Ali, Environmental Resistance and Aboriginal Development A Comparative Study of Mining Ventures and Public Conflicts in the United States and Canada. Undated.

TABLE 4.8
CANADIAN FIRST NATION RESERVES WITH MINERAL ACTIVITY

Band Name	Province	Material Extracted	Population on Reserves	Area (hectares)
Big River	Saskatchewan	S&G	1638	12129
Blood	Alberta	S&G	7442	134293
Cheam	British Columbia	S&G	180	458
Clearwater River Dene	Saskatchewan	S&G	535	9510
Cowichan	British Columbia	S&G	1850	2254
Cree (Bigstone)	Alberta	S&G	1864	21014
English River	Saskatchewan	S&G	595	13100
Fond du Lac	Saskatchewan	Metallic Exploration	805	15520
Joseph Bighead	Saskatchewan	S&G	462	4700
Kamloops	British Columbia	S&G	N/A	N/A
Kwakiutl	British Columbia	S&G	326	420
Lac La Ronge	Saskatchewan	S&G	4195	43294
Matsqui	British Columbia	S&G	83	165
Montreal Lake	Saskatchewan	S&G	1592	8270
Pavilion	British Columbia	Limestone	165	2126
Penticton	British Columbia	S&G	496	18532
Peter Ballantine Cree Nation	Saskatchewan	S&G	3157	15067
Saik' uz First Nation	British Columbia	S&G	540	2578
Saulteaux	Saskatchewan	S&G	482	11820
Six Nations of the Grand River	Ontario	Underground Gypsum Mine	8323	18265
Skyway	British Columbia	S&G	52	680

Source: Saleem Ali, Environmental Resistance and Aboriginal Development A Comparative Study of Mining Ventures and Public Conflicts in the United States and Canada. Undated.

TABLE 4.9
OTHER MINING OR REMEDIATION PROJECTS IN WHICH NATIVE COMMUNITIES ARE INVOLVED

Mining Project/Area	Tribe or Band Affected	Status
Carlotta and Gentry Metal Mines, Arizona	White Mountain Apache Tribe	Proposal for an open pit copper mine by Canadian mining company Cambior, near the reservation.
Coeur D'Alene Mines, Idaho	Couer d'Alene	DOJ lawsuit against Asarco mining and area near the reservation has been declared a Superfund site.
Colville, Washington	Colville	Tribe passed a referendum to oppose mining by Battle Mountain Gold and Santa Fe Pacific.
Crandon Mine	Mole Lake Chippewa, Menominee	Rio Algom has purchased the property from Exxon but there is currently a moratorium on mining in WI.
Crescent Valley, Nevada	Western Shoshone	Oro Nevada Resources has begun exploration work despite tribal requests to stay clear of the area.
Crownpoint Uranium Mine, NM	Navajo	Proposal for several uranium mines using in-situ leaching process. EIS process is underway.
Dawn Uranium Mine	Spokane	Under reclamation negotiations.
Diavik Diamond Mine	Dogrib and Yellowknives	Diamond mine located in area of land claims being settled. Operation has been OKed by Canadian government.
Ekati (BHP) Mine, NWT, Canada	Dogrib and Yellowknives	Agreement signed in 1999 – mining commenced soon thereafter.
Picurus Project near Taos, NM	Picurus Pueblo	Summo, a Canadian mining company is conducting exploratory work adjacent to the reservation.
Raglan Mine, Quebec, Canada	Makavik Corporation	Nickel and copper project commenced in 1998 after an agreement was signed.
Zortman-Landusky Gold Mine, MT	Fort Belknap	Mine is in operation and located adjacent to reservation. Civil cases have been won by the tribe for damages.

Source: Saleem Ali, Environmental Resistance and Aboriginal Development A Comparative Study of Mining Ventures and Public Conflicts in the Untied Stats and Canada. Undated.

4.2.2 History

Indigenous People have been mining the land for hundreds of years for gold, silver, copper, and gems in order to make jewellery. Some accounts suggest that Indigenous Peoples probably did not use metals for tools and implements but rather the ore was used as a source of pigment for body adornment.[49] This mining activity was viewed as positive by the indigenous communities. It involved little degradation of the environment and produced little pollution. The products of the mining activity served cultural activities. It is evident that the extent of mining prior to European settlement was at a very small scale.

European interest in metals, particularly gold, drove the first explorers towards the shores of North America and progressively into the continent.

Lucrative prospects for mining drew more and more settlers toward Indian lands in Appalachia, the Southwest, and the extreme Northwest (Alaska and the Yukon). The promise of mineral wealth clearly provided a great impetus for European settlers to encroach upon Indian lands as early as the seventeenth century. While the fur trade involved reciprocal arrangements between Indians and Europeans and revolved around a commodity with which the Indians were familiar, mining activity occurred on a much more ad hoc basis and involved a commodity with which the Indians were not too familiar. Therefore, mining activity was regarded with far more suspicion in the eyes of tribes during the early years of the frontier expansion.[50]

In western Canada, the gold rushes in the 1800's drew the first major influxes of European miners. The reaction of the Indigenous People of this region was to believe that the Europeans were crazy and not to show them where the gold was located.[51] The Indigenous People found the actions of the European miners hard to comprehend. History shows that the early European miners appeared to have left their normal responsibilities and sensibilities at home, and once involved in the gold rushes they generally acted indifferently towards the land and others.[52] When the miners left the region after the rushes ended, the Indigenous People believed they would not come back.

Experiences changed with second influx on miners particularly concerning mines from the 1940's, 1950's and 1960's. These mines were there to stay. The new influx of miners built

[49] Ali, p.26.
[50] Ali, pp26-27
[51] Personal Communication. Jerry Asp
[52] Holliday, J.S. *Rush for Riches: Gold Fever and the Making of California*, Co-published by the Oakland Museum of California and the University of California Press Ltd.

towns and the ethnic European settlement was problematic in that the value sets were different from the Indigenous People, which lead to problems with game hunting and social upset.

4.2.3 Contributions and Implications

Table 4.10 provides a summary of the contributions and implications of mining to indigenous peoples.

TABLE 4.10
SUMMARY OF CONTRIBUTIONS AND IMPLICATIONS OF MINING TO INDIGENOUS PEOPLES

	Past	Present
Contributions/Benefits of Mining Industry	- First Nations mining was cultural in use-little impact on environment.	- employment; - economic opportunities.
Implications/Costs of Mining Industry	- European settlement; - little involvement by Indigenous Peoples in trade; - social and cultural implications to communities; - in beginning mining transient then communities become permanent; - bush economy to wage economy; - racism; - mistrust; - low-paying jobs; - economic, cultural, social and environmental legacy; - lack of respect for agreements and accountability; - lack of empowerment to level playing field; - industry must feel threatened to take action; - lack of respect for cultural/social/economic values and differences; - years of negative experiences.	- short lived economic opportunities distract youth from traditional lifestyle; - myth of transferable skills; - bush economy to wage economy; - racism; - communities still dealing with effects of legacy; - mistrust; - lack of empowerment to level playing field; - industry must feel threatened to take action; - lack of respect for cultural/social/economic values and differences; - years of negative experiences.

The Indigenous People of this continent recognize that mines brought employment but ask, what happens when mines close? If there are no other major employers the people have no potential for employment. This was referred to during one interview as the myth of transferable skills. Since few Indigenous People travel beyond their traditional territory, skills are only good if they can be used within the traditional territory. It has been indicated that mines change the Indigenous People's way of life from bush economy to wage economy with all its inherent problems including drug and alcohol use. This is a change in lifestyle that is difficult to reverse. It represents a significant impact on the ability to sustain and pass on a traditional way of life. Communities often derive few benefits from the mines; training programs that never happen, racism for those working at the mine, and low paying jobs.

Indigenous People and Europeans have different time perspectives which are inherent in their value sets and approaches to decision making. "We were here before the mine and we'll be here after the mine closes; tell me what you are going to leave me – what is the legacy you will leave." [53] Many Indigenous People are looking for a legacy that includes enhanced education, social services, hospitals, and opportunities for local businesses.

In the past, problems have arisen when written or verbal contracts are made with mining companies. When the company sells its interest in a mine or the company dissolves there is no recourse for the Indigenous People with respect to fulfillment of the contract. Indigenous People need clauses in contracts which make the deal with the property rather than the company. Some interviews suggested that junior companies will promise you anything but won't deliver. Senior companies are more likely to honour promises, but all companies are generally interested in the bottom line – money. They implied that mining companies hate dealing with people and would rather deal with money - mining companies do not meet the needs of Indigenous People or any other communities adjacent to the mines, they are only obligated to their shareholders and not the communities within which the mines and smelters are located. Many of communities of interest we spoke with shared the sentiment of Indigenous People that companies must feel threatened to take action.

In the late 1980's the participation of Indigenous People in mine development started to take the form of "Impacts and Benefits Agreements" particularly in western Canada. Indigenous People were able to negotiate controls on road access and environmental monitoring. These agreements have helped the communities protect their people and traditional lifestyle. One example of where these agreements have been used is the Diavik Diamond mine in the Northwest Territories.

[53] Personal communication, Jerry Asp.

Of particular significance to Indigenous People across the continent is the issue of abandoned and orphaned mines. There are a large number of these abandoned sites across both countries with no one taking responsibility for monitoring, reclamation, and on-going contamination issues. Some of these sites are located on land belonging to Indigenous People but, many more sites are located on lands of aboriginal interest. Indigenous People frequently find themselves downstream from abandoned mines and are unable to assess the risk or potential damage which may be caused by the abandoned mine as a result of the continued contamination to the environment long after mining activity has ceased.

In Canada there is debate with respect to the number of abandoned mine sites and the potential hazards associated with these sites. According to one report by the Assembly of First Nations and Mining Watch Canada, the government took little action to ensure mining companies cleaned up their mess. In many cases the mining company that caused the pollution no longer exists. The formidable costs of these clean-ups mean that nothing was done, and when it is begun it is often inadequate. Many Indigenous People lack resources to effectively participate in the development of clean-up plans and many mining companies lack the capacity and resources to effectively engage Indigenous People in their decision making processes. There is a need to build the capacity of Indigenous People to deal with the clean-up and security problems created by abandoned mines.

4.2.4 Lessons Learned and Directions for Change

"In what was once a community (Innu Nation in Schefferville) that generated a lot of wealth for the mining company and for the mining employees; now the situation has changed. They shut the mine down about 20 years ago, and we can see that the Innu children and the families are left with nothing. Fifty years ago the Innu people were self-reliant, like most indigenous people, and able to survive on the land with the resources from the land; but with mining activities, it has been totally disrupted – the relationship to the land, between the parents and the children, the learning system. Innu children used to rely on their parents to learn about what was a good way of life; now the whole scheme has changed over the years, and there are schools, institutions like churches and government who have become involved in the Innu way of life. Mining has fully disrupted the community."[54]

Many of the lessons learned and directions for change emerging from the discussion of Indigenous People correspond with the ideas emerging from the resource dependent, labour and the NGO communities of interest. In general there is a significant lack of trust for the mining companies by the Indigenous People that has been breed from years of negative experiences. A

[54] AFN p.10.

participant in the AFN Workshop suggested that, "most of the social and environmental costs are not taken into account by the mining companies, what is taken into account is the right to get the benefits at the lowest costs; this is what they will do, and they will do what it takes to achieve that."[55]

This lack of trust has lead to a disconnect of spiritual and cultural values between the mining companies and Indigenous People. "Companies have to realize that there are real legitimate costs associated with their entry for Indigenous Peoples"[56] In many ways these costs, in terms of loss of traditional lifestyle, are unrecoverable for the Indigenous People and their future generations. "While it is commendable when corporations reinvest in community well-being, the investment is frequently delivered carelessly, paternalistically, and with little knowledge or concern for local realities and values…this leads to wasted investments from both the viewpoints of profit maximization and social responsibility."[57] Establishing trust with Indigenous People is a long process. One of the first steps is to acknowledge that mining companies created the existing set of problems and must accept responsibility for assisting the resolution of those problems. A second key step is to try to understand the Indigenous People and make them a partner in any and all decision-making processes. Indigenous People appear to express greater trust in firms that treat them as the rightful owners of their knowledge.[58]

Much of the literature suggests that part of the responsibility for these problems rests with governments because of their inability to protect Indigenous treaty, human and territorial rights. In Canada, for example, there is a need to reconcile Indigenous use or right to the land with government of Canada sovereignty over natural resources. This is not a new problem, but one which has not been dealt with for over one hundred years.

4.3 MINING COMPANIES/SUPPORT INDUSTRIES

4.3.1 Who is the Community of Interest?

This community of interest includes the companies involved in the exploration, development, mining, smelting and refining of metals, and the professional and political associations that represent these companies. A detailed profile of the mining industry in North America has been created for the MMSD North America project and is entitled "Task 1A Final Report: North

[55] AFN p.10.
[56] Anon, " Report from the Roundtable: Canada, Indigenous Peoples and the Hemisphere," March 22-23 2000, Winnipeg, p.5.
[57] Chartrand Paul, "Canada and the Indigenous Peoples of the Western Hemisphere: Putting Principles into Action in Trade and Investment" p.6.

American Mining Sector Profile." This document should be referred to for an in depth understanding of the industry. For the purposes of this report we have excerpted a few key points from the profile.

The United States is the world's leading mining country, when measured by production value however, the number of mining companies based in the United States is relatively small compared to that of Canada. The difference in competitive strength can be attributed to the following factors:

- Economic – access to vibrant venture capital pools; Canada is home to more publicly listed companies than the rest of the world combined;
- Political – mining plays a much more important role in the Canadian economy than it does in the United States;
- Historical and Geographic – Canada has a long mining tradition and a multitude of different mineral types distributed across the country and Canada, more so than the United States has retained strong resource-based economic roots over time;
- Corporate Culture – strong corporate culture of mining in Canada creates its own momentum.

In fact, the domestically controlled corporate sector of the Canadian mining industry is a much larger and more internationally competitive mineral production system than that of the United States. Table 4.11 illustrates the 10 largest metals mining firms in Canada and the United States.

However one looks at the characteristics of the mining industry in North America, it is important to note that mining is an increasingly global industrial sector with companies engaged as much overseas as on home ground and with events and activities overseas colouring perceptions at home. These perceptions influence the ability to raise capital and social/environmental issues with respect to mining. It is also important to note that the interconnecting structures of mining companies, joint ventures, partnerships etc. make it difficult to distinguish the players and thus, the mining industry itself is often coloured with a common set of perceptions.

[58] Chartrand, p.6.

TABLE 4.11
TOP 10 METALS MINERS, CANADA VS. U.S. (2000 US$)

Ranking in Country	Canadian Mining Firms (Assets: 2000 US$)	United States Mining Firms (Assets: 2000 US$)
1	Noranda (7.8 B)	Phelps Dodge (7.8 B)
2	Inco (6.5 B)	Freeport-McMoran (4.0 B)
3	Teck Corp (5.4 B)	Newmont (3.5 B)
4	Falconbridge (3.2 B)	Homestake (1.6 B)
5	Barrick (3 B)	Stillwater (679 M)
6	Placer Dome (2 B)	Battle Mountain (569 M)
7	Cominco (2 B)	RTI (386 M)
8	Cameco (1.9 B)	Coeur d' Alene (354 M)
9	Franco-Nevada (900 M)	Hecla (195 M)
10	TVX Gold (740 M)	Meridian Gold (171 M)

Source: MMSD Task 1A – North American Mining Sector Profile.

4.3.2 History

Minerals exploration and mining in North America commenced in earnest following the arrival of European explorers. Mineral discoveries, often times by accident, led to a range of initial development from small mines for the extraction of copper, iron ore, coal and other minerals for local use to the historic gold rushes. In many cases, initial mining activities were carried out by individuals or partnerships.

By the late 1880's, the need for mining increased due to the scope and complexity of exploration and mining activities and increased capital investment. Mining companies brought access to capital which in turn fostered additional exploration and mine development. The fortunes of many of these companies rose with the opening of their mines and fell when the mines closed. As a general observation, the vast majority of the mining companies in business between the late 1800s to WW1 eventually went out of business. The remaining few were taken over, or joined with others to, in several instances, become integrated mining and metallurgical companies. Their facilities served their countries well by producing desperately needed metals in both world wars.

Following the end of WW2, several integrated metal producers had attained dominant roles relative to their competitors. These integrated companies undertook a range of large developments in the 1950s and 1960s that resulted in new mines, smelters and associated planned communities. Whilst these companies enjoyed growth, they also faced a range of challenges including fluctuating metal prices. Advancement in equipment and technologies commencing in the 1960's helped to increase productivity and reduce operating costs. Vast

improvements in health and safety, stating in the 1970's, significantly improved performance in these areas.

Environmental issues began to come to bear in the 1970's, and arrived on the forefront in the 1980's. Mining companies were on average slow to respond to these pressures. By the late 1990's, environmental legislation affecting mining had been passed in almost all jurisdictions, and opposition to proposed mining projects was often times formidable and fierce.

Environmental concerns and community issues are all too often a major impediment to implementation of mining projects; increasingly becoming a cost consideration for mining companies[59]

Leading mining companies have formed associations with one another since about the 1930's. These associations provided venues for lobbying and responding to government. Mining industry associations have however in the past decade been expanded to included multi-stakeholder input initiatives.

Although the vast majority of the general public view the mining industry as a single organized body, in reality, the industry is comprised of mining companies that are at times competitors with each other for mineral resources and markets. Industry associations provide a degree of cohesion for leading mining companies.

Offshore mine developments such as those that have occurred recently in Latin America require tremendous capital investment. This demand, as well as the desire on the part of lenders to deal with professionally managed and financially sound companies have contributed to the ongoing conglomeration of mining companies. Many mines are owned by several mining companies. Today "ownership and control of world mining is heavily concentrated in a small number of multinational mining firms (most of which are privately owned) and in state mining enterprises (SME's)"[60]

4.3.3 Contributions and Implications

"Much of the discontentment with corporations is premised on the environmental and human rights records of companies. The argument is often made that the modern corporation, and indeed the greater neoclassical economic framework, regards environmental and human rights

[59] Ali,p.85
[60] Ali,p.75

concerns as externalities, that should only be addressed as a means to an end – the end being profitability."[61]

Table 4.12 provides a summary of the contribution and implication of mining to the mining industry.

TABLE 4.12
SUMMARY OF CONTRIBUTIONS AND IMPLICATIONS OF MINING TO MINING COMPANIES/SUPPORT INDUSTRIES

	Past	Present
Contributions/Benefits of Mining Industry	- creator of wealth for; • shareholders; • communities; • regions; • countries. - community and nation builder; - driver of economic engine; - means of production of modern commodities; - foundation for societal development and wealth; - economic opportunities for spin-off industries.	- On-going conglomeration of mining companies; - community and nation builder; - driver of economic engine; - means of production of modern commodities; - foundation for societal development and wealth; - economic opportunities for spin-off industries; - greater transparency and accountability; - embracing principles of sustainable development; - environmentally sound management.
Implications/Costs of Mining Industry	- environmental worker health; - waste production; - legacy though not as significant as suggested by others.	- linking sustainability with financial success and shareholder values; - sustainable development will cost money which will be difficult to raise on the market.

As has been discussed throughout this report, mining companies see their contributions to society in terms of their ability to produce wealth, drive the economic engine, provide the means of production for modern commodities and creating the foundation for societal development and wealth. Mining companies state that they provide commodities that drive the industrial engine of our economy. They provide the metals that make up our planes, trains, and cars, the steel for our buildings, metals used in computers, gold, silver, precious gems, and the energy that drives

[61] Ali, p.71.

industry. In providing these commodities the companies have created wealth for themselves, their shareholders, and in the communities that house their operations. They have created economic opportunities and wealth in a number of spin-off industries which assist mining or are supported by mining. Mining companies and the mining industry suggests that mining has been instrumental in 'nation building' in that the ability to supply ourselves with strategic metals during times of crisis has assisted in the protection of sovereignty in North America.

However, the mining industry acknowledges that historically some companies have had negative implications on the environment, Indigenous People and worker health as a result of their activities. The industry is also quick to point out that many of the harmful technologies and/or practices are no longer in use and that significant progress has been made with respect to improving worker health and safety, relations with adjacent communities, and with respect to minimizing impacts on the environment.

4.3.4 Lessons Learned and Directions for Change

A worldwide survey of mining and mineral organizations conducted for MMSD looked at perceptions, policies and progress relating to sustainable development. The survey found these organizations believe that:

- Addressing sustainable development is critical to their long-term survival, and to the delivery of enhanced shareholder value.
- Over 80% of respondent organizations say they have "taken steps to embed" the principles of sustainable development throughout their organization.
- Investment decisions are also being influenced by the need to consider sustainability related issues such as community attitudes, human rights, and biodiversity.
- Implementation of environmental management appears to be more developed than the management of social issues and wider economic impacts.
- Respondents' key socio-economic concern is how to engage more effectively with stakeholders, in particular with local communities affected by a company's operations.
- Most respondents do not consult formally with stakeholders on a Group wide basis. Formal consultation was most prevalent with government stakeholders, employees and local communities.

- The future for the industry is seen as involving greater transparency and accountability, with increased focus on cleaner technologies and more efficient use of resources.[62]

Many respondents had not yet set out the precise meaning of what sustainable development means for their operations and nearly 70% of respondents stated that a lack of understanding or agreement about the issue was one of the challenges to embedding the principles of sustainable development within strategic and operational policies and processes. Enhanced shareholder value was cited as the primary driver for sustainable development and as many as 80% of respondents cited the ability to link sustainable development to financial success as one of the key obstacles to embedding the concept within their organization. Many senior executives noted that they were unable to measure how sustainability affects shareholder value.

The results of this survey will assist in support of some of the ideas raised throughout the data collection for this report. The corporate mining companies seems to be engaged in the dialogue of sustainable development but the messages and actions are being compromised by the company's inability to link sustainable development to financial success and their inability to share decision-making power with the other communities of interest.

It is felt by some people within the industry that mining is an unappreciated industry; people don't know what industry does and why it is important. There is no appreciation for the value of mining.[63] When the mining industry looks back 10-15 years they point to how far the industry has come improving practices that affect the environment or local communities, improvements to reclamation, and positive changes to technology. The public has a different view of mining as "a survey conducted by Praeger (1997) for the Engineering and Mining Journal, found mining to be the least favoured industry by the American public – even less favoured than the much reviled tobacco industry."[64] In the minds of many communities of interest and the general public actions speak louder than words and they hear about the accidents, contamination, and health and safety problems rather than advances in technology or state-of the-art reclamation projects.

Evidence is growing that the industry is starting to look towards leaving a long-term legacy for communities; addressing the future in a far better way than the past has been dealt with. Some mining companies are pushing the environmental envelope but their ability to do is often dependent on financial markets. This seems to be the greatest barrier to companies taking a more proactive stand on communicating their success stories and engaging in more proactive

[62] Price Waterhouse Coopers, *Mining & Minerals Sustainability Survey 2001*, Executive Summary
[63] Personal Communication
[64] Ali, p.74

environmental and community planning and management. Mining companies are at the mercy of the financial markets for obtaining capital to fund the high upfront development costs of their facilities. There is a concern within the industry that they do not want to set their own precedents with respect to environmental cleanup and community benefits which can become too costly at times when market prices for commodities are low. "Companies are fearful that by involving the community in defining its own long-term vision of what development is, and in the design and implementation of the development programs themselves, it is opening up a Pandora's box of wishes and expectations that will be impossible for the company to close."[65]

4.4 WORKERS AND ORGANIZED LABOUR

4.4.1 Who is the Community of Interest?

This community of interest includes unorganized and organized labour that is or has been employed in the mines, smelters and refineries engaged in the bringing metals to market. An attempt was made to distinguish between what percentage of the metals mining labour force is organized versus unorganized. Several agencies and organizations (United Steelworkers of America, MITAC, National Labour Congress (Canada), NRCAN) in Canada and the United States were contacted in an attempt to obtain this information. In every instance the indication was that this information does not exist. Rough estimates by these agencies and organizations seem to suggest that approximately 25-30% of the Canadian metals mining labour force is organized while 13-18% of the United States metals mining labour force is organized.

The views presented in this section of the report are those of organized labour. The primary labour union contacted with information for this study was the United Steeleworkers of America as they are the predominant union involved in metal mining. There was an attempt to gather information with respect to unorganized labour but none was found.

4.4.2 History

Mines, smelters and refineries have always required human involvement to succeed. The history of mining is also the history of thousands of workers in many communities across North America. Prior to the 1870's most labourers within mines, refineries and smelters were not unionized. Working conditions during the 1800's included a six-day work week, twelve hour days, child labour and no health and safety provisions.

[65] Rader,p.3.

Despite the threat of physical harm and economic ruin, miners have constantly struggled against great odds to achieve their goals: the eight-hour day in 1898, collective bargaining rights in 1933, health and retirement benefits in 1946, and health and safety protections in 1969.[66]

Hard rock mining unions should be distinguished from coal mining unions however, coal mining unions and their history have had an impact on labour relations with respect to metal mining. One of the most influential unions within metal mining is the United Steelworkers of America (USWA). Much of the process of industrial relations dispute resolution comes from the mining industry.

Historically, the unions grew and labour rights were gained through a number of strikes and conflicts on both sides of the border. The history of the labour movement in metal mining is laced with long strikes, deaths, and finally advances with respect to labour or workers rights. Historically migrant workers were used to bust unions and to scab strikes. Depending on which side of the border you are on the labour community speaks about Copper Crucible, the Homestead Strike, the Memorial Day massacre in Chicago, and the Long Strike. All of these are hallmark events for the labour movement with respect to metal mining. However, these events and others have left a climate of distrust between the labour unions and the mining companies. There is no trust within the labour unions that mining companies would do anything to protect health and safety unless forced to.[67]

4.4.3 Contributions and Implications

Table 4.13 provides a summary of the contributions and implications of mining to the labour community of interest.

[66] www.umwa.org/history/hist1.shtml, 09/17/2001
[67] Personal communication.

TABLE 4.13
SUMMARY OF CONTRIBUTIONS AND IMPLICATIONS OF MINING TO WORKERS AND ORGANIZED LABOUR

	Past	Present
Contributions/Benefits of Mining Industry	- jobs-direct and indirect in mining towns; - victories against Mining industry responsible for rise and success of labour movement; - miners generally well paid; - profits often reinvested in towns.	- working conditions have improved with improvements in technology; - where labour has good bargaining relations with industry problems are not as bad. - miners generally well paid;
Implications/Costs of Mining Industry	- long work hours; - child labour; - no health and safety provisions; - mistrust; - once mine closes; towns are left in economic void with high unemployment and lost revenues; - environmental legacy; mine tailings, contamination; - health and safety problems; - mining industry does not take responsibility for problems they cause.	- mistrust from past problems lingers; - lack of accountability by industry; - once mine closes; towns are left in economic void with high unemployment and lost revenues; - environmental legacy; mine tailings, contamination; - health and safety problems; - mining industry does not take responsibility of problems they cause
Perception of Others	- Need for government to set better environmental and health and safety standards for mining. - Need for government to work with labour on health issues. - Government needs to pay more attention to long-term monitoring and maintenance of contaminated sites. - Government seems reluctant to enforce standards on mining activities.	- Need for government to set better environmental and health and safety standards for mining. - Need for government to work with labour on health issues. - Government needs to pay more attention to long-term monitoring and maintenance of contaminated sites. - Government seems reluctant to enforce standards on mining activities.

Traditionally, mining communities were dominated by mining companies affecting all aspects of life. Many communities were single industry or resource based with the mine operation being the basis for direct and indirect employment in the community. There is a spectrum over time of mining companies taking no responsibility to variable responsibility. Generally, miners are well paid, working conditions have improved with improvements in technology, and, in good times, profits were often reinvested in the communities. But positives are temporarily coinciding with

the operation of the mine. Once the operation of the mine has ceased the mining dependent communities are often left in an economic void with little or no economic opportunities to replace lost employment and revenues. This is true for all single industry communities. The negatives are continuous: silence on harmful contamination, mine tailings, lack of public admission of guilt for contamination and health and safety problems, and loss of economic opportunities. Companies try to say this is not so bad or to blame problems on other factors beyond their control. In the opinion of the labour community the mining companies are not forthcoming with admissions of responsibility when problems have occurred.[68]

A major implication in the minds of the labour community are lingering contamination, and resulting health effects. According to the labour community of interest most companies have had a less than impressive response to occupational disease and contamination and company responses to efforts to gather information and present independent data were disappointing and difficult to understand. The labour community believes that environmental contamination is leading to disease and deaths amongst workers and their families. The unions believe that workers and residents of resource based communities face cumulative risk of contaminants from numerous pathways; people living and working in a contaminated environment. There are large numbers of cases of disease now recognized by workers compensation claims but originally denied by companies. The labour community would like to see the mining companies recognize the impact of workplace and environmental contaminants on health of workers and their families.

Where labour have good bargaining relationships with companies things have been done but there is a need for government to set good standards. For example, the construction of the big stack at INCO Sudbury had a tremendous impact on working conditions and the nearby community (biggest improvement in years) but worsened regional air pollution issues.

Labour's experiences with government have been a concern. Labour has had to force the government to look at independent monitoring results and recognize their validity. Some of the tailings reclamation work is very good but they feel the government is not paying enough attention to long term monitoring and maintenance to make sure sites are safe and risks are minimized. It is the belief of the labour community that government is reluctant to enforce tough standards on mining activities and that companies and government don't do anything unless they are pushed to do so. An example of this that was cited was the Westray Coal mine. There is a general sentiment within the labour community that there is a climate of mistrust between the mining industry, government and the labour community of interest.

[68] Personal Communication.

4.4.4 Lessons Learned and Directions for Change

As indicated in previous sections the lessons learned and directions for change for the labour community of interest are similar to those for resource dependent communities, Indigenous People, and NGOs. Generally speaking, they relate to distrust, and a lack of accountability.

Interviewees believe that one of the most important things that can be done to re-establish trust with the labour community and the mining industry is to create the climate and opportunity to openly discuss to past actions. There is a great frustration within the labour community that the burden of proof with respect to linkages between working conditions, contamination and occupation disease rests with labour. Labour needs to push for collaboration with the mining industry to become more proactive in identifying contamination and health problems, and quickly working to resolve problems in consort with the local community, and NGOs.

The greatest opportunity for change is more effective partnering between the industry and its workforce. Having conflicts with the workforce is ineffective. There is a need to keep the unions engaged. They have as much at stake in building a sustainable industry as the mining industry. Mining needs to work with all communities of interest. Some would suggest that this reflects a holistic or lifecycle approach. Labour has the link to the environment because miners live in the community and what the miners feel first is felt by the community soon after. The community is interested in creating a sustainable livelihood into the future. Generally, these are the goals of the mining companies however, what is missing is the linkage to the shareholders and profitability. Labour and the mining industry may also consider working together to identify mining dependent communities where a new emphasis might be placed on recycling and reclamation. This would help to better position the mining industry to embrace the principles of sustainable development.

4.5 NON-GOVERNMENTAL ORGANIZATIONS

It should be acknowledged that some of the environmental Non-Governmental Organization (NGOs) focused on mining have expressed a reluctance to participate in the MMSD; NGO's question whether or not they will engage in the process. The NGOs have been critical of what they perceive to be a top down approach to defining MMSDs agenda and keeping key questions off of the table. It is their impression that Industry doesn't want information portrayed for them – they want to control it. The NGO's are interested in real change rather than a PR exercise. Some of their issues are; reducing mining, creation of sustainable mining, and life-cycle analysis. The NGOs would like to see a governance structure for MMSD that embraces communities of interest as equal partners.

Input from the NGO community was prefaced by the fact that they are reluctant and reserved participants in the MMSD project.

4.5.1 Who is the Community of Interest?

The NGO community of interest includes all organized groups which are not governmental nor private in nature. "NGOs can be thought of as buffers between the classically defined public and private domains."[69] For the purposes of this study we are looking at NGOs whose interests are mining as it relates to the environment and social justice. Generally, mining NGOs are numerous already existing NGOs who have come together in a coalition to create a formal face to confront mining issues. NGOs may be local, regional, national or international in focus. NGOS are "largely funded through private contributions from interested donors. Not only are they opposed to mining because of its immediate ecological impact but also because it encourages the use of non-renewable resources, and in the case of uranium mining, adds to the risk of nuclear weapons proliferation. There is also a critical element of anti-corporatism in this movement: an overt rebellion against what is perceived to be capitalistic aggrandizement of wealth and resources."[70]

The NGO community can be thought of has representing a three dimensional continuum of interests. The first dimension defines the type of issues or geographic scope of the NGO; some groups are broadly interested in environmental issues and will seek to have input into a wide variety of proposals or issues (such as Greenpeace or the Sierra Club) while others are focused on a single issue or a small, well defined geographic area (such as Save the Oak Ridges Moraine). The second dimension describes the age or relative longevity of the NGO. Some groups have been around for a long time and are considered to be the "establishment" of the NGO community. These groups have a considerable web of influence and respect within society. Examples of these groups would be the Sierra Club and the Audubon Society. Other groups arise to address single issues and then disappear; this may diminish the respectability of the organization or respectability may accrue to the individuals involved rather than the NGO. The third dimension describes the internal organizing structure of the NGO and therefore, its accountability. Some NGO's have boards of directors, elections, and annual meetings which suggest a relatively high degree of accountability to the membership while other groups function on an ad hoc basis creating policy and positions on issues with the input and support of only a small portion of the membership. Within this dimension is also the consideration that some NGO's are top down in their operations and functions while others are very grassroots oriented. A fourth dimension that could be considered is the degree of professionalism within the NGO.

[69] Ali,p.51
[70] Ali,p.65

By this professionalism means does the NGO employ staff to run its operations and provide research or is the organization run by volunteers. Some NGO's have staff who raise money and conduct research while other groups are run by volunteers. In addition, the environmental NGO community in North America is relatively small and very well integrated. People who may belong to one NGO probably are a member of or are involved in the activities of other NGO's on perhaps unrelated issues. This multidimensionality creates an NGO community that has the capability of quickly creating support for an issue across and within interest groups. For example in the case of the Crandon mine one of the interest groups who has intervened in the approvals process is Great Lakes United (GLU). GLU was created as a watchdog for the International Joint Commission which manages water quantity and quality issues with respect to the Great Lakes between Canada and the United States and is an umbrella organization for all of the environmental groups around the Great Lakes and in both countries. GLU became involved in Crandon Mine through one of its member groups in Wisconsin.

It is very difficult to quantify this support as for many issues the concerns about mining are interrelated with concerns for other issues. For example in Ontario, the Partnership for Public Lands was created as a coalition of NGOs (World Wildlife Fund, Federation of Ontario Naturalists, Wildlands League, etc.) in response to the government of Ontario's efforts to allocate crown land in the province as available for resource development or placed in protection as provincial parks (the Lands for Life process). Access to protected spaces for mining exploration was only one of the issues that concerned this NGO and support for this NGO was quite good. It is impossible to decipher what part of the membership only supported the issues with respect to mining versus forestry or hunting issues.

A review of mining NGOs was undertaken on the web by examining the sites of the key organizations and their links. There are several large organizations that are concerned with mining issues in general and numerous smaller organizations that are dedicated to a single issue region, or a single mine site. Some key mining related environmental NGOs in North America include; the Mining Policy Center, the Environmental Mining Council of British Columbia, MiningWatch Canada, Montana Environmental Information Center, Project Underground, and the Western Organization of Resource Councils.

4.5.2 History

The history of NGOs in mining is relatively short. The growth of environmental and social justice NGOs was spawned with the changing North American value set with respect to environmental issues and civil society. These changes have only occurred in the last 10 to 15 years as society has started to take a harder look at the activities it engages in and the affect of those activities on the environment and people. This is consistent with the general change in

focus of the general public with respect to environmental issues. As discussed in Chapter 2, public concern with respect to the environment began with an interest in conservation and protection which characterized the conservation movement. This then was translated into a concern about individual activities and decision-making with respect to the environment which characterized the environmental movement of the 1960's and 1970's. More recent articulations of environmental values concern the interrelationships between the environment and economic goals, health and human rights. For example, the catalyst for the NGOs with an interest in mining may be the publication of Our Common Future and the popularization of the term sustainable development.

NGOs play a relatively new role in decision-making with respect to mining activities. They represent the organized voice of interests that are not necessarily represented by government, the mining industry, labour, Indigenous People, or resource based communities.

4.5.3 Contributions and Implications

Table 4.14 provides a summary of the contributions and implications of mining to the NGO community of interest.

TABLE 4.14
SUMMARY OF CONTRIBUTIONS AND IMPLICATIONS OF MINING TO NON-GOVERNMENTAL ORGANIZATIONS

	Past	Present
Contributions/Benefits of Mining Industry	- fulfill societal need for products of mining-however concerns relate to how mining has been carried out, company and government decision-making; - short-term improvement in quality of life.	- fulfill societal need for products of mining-however concerns relate to how mining is carried out, company and government decision-making and the emphasis on primary production rather than recycling; - new mines more responsibly developed and managed.
Implications/Costs of Mining Industry	- ecological impact; - encouraged use of non-renewable resources; - health and safety problems; - contamination from tailings, processing and smelting; - land access issues; - lack of monitoring of	- ecological impact; - encouraged use of non-renewable resources; - lack of monitoring and enforcement. - talk about change but want business as usual creating mistrust.

	contaminated sites; - mistrust and lack of accountability	- lack of accountability of industry.
Perceptions of Others	- Mistrust of government created by lack of enforcement of standards, lack of long-term monitoring and maintenance of contaminated areas.	- Mistrust of government created by lack of enforcement of standards, lack of long-term monitoring and maintenance of contaminated areas.

It is difficult to distil from the interviews and literature what this community might believe to be contributions of the mining sector. The NGO community of interest understands the societal need for the products of mining but has significant concerns with how mining is carried out, company and government decision-making with respect to mining and the emphasis on primary production rather than recycling.

It is much easier to gain an understanding of how the NGOs view the implications from mining. They have concerns about mining because of its immediate ecological impact and because it encourages the use of non-renewable resources.[71] Some of the issues presented by the NGO community include; land access, exploration, waste rock, high pollution producing processing and smelting, high accident rates, and health and safety problems.

Generally speaking, NGOs believe that mining represents a short-term improvement in quality of life. The industry focuses on those who moved to participate in mining, but there is a need to look at what happened to original people displaced by mining versus the people who came to participate in mining. In selling new mine sites and facilities to communities mining companies take advantage of people desperate for cash/jobs.

Where there is pressure from NGOs and local communities, they feel new mines are more responsibly developed and managed. There is a lack of monitoring if there is no pressure and vigilance on the part of NGOs, Indigenous People and local communities. Once again this community of interest believes that the industry responds to pressure; the industry will only do something if they have to.[72]

In the NGO's view, the mining industry talks about change but very little action is seen. They also feel that the mining industry wants business as usual and MMSD is only lip service. The NGO community hears talk of change, but feel that when government support is stable the mining companies take advantage by getting rid of the web of regulation and policy around

[71] Ali, p.65
[72] Personal communication.

mining. For example, in Ontario in the 1980's permitting for exploration was introduced, and in 2000 all of this was undone.

4.5.4 Lessons Learned and Directions for Change

"Just because an ore body is discovered does not mean that it has to be mined. Mining companies and governments have to realize that just as a mining deposit under New York City would certainly not mean that mining will go forward, the same may be true for other places as well. This is where environmental justice arguments start to creep in, despite the geological determinism of mining in general."[73]

There are similarities between the lessons learned and directions for change for the NGO community of interest and the resource dependent communities, labour, and Indigenous People's communities of interest. The issues relate again to distrust, accountability, and the reluctance of the mining industry to embrace environmental protection and sustainability in a proactive manner.

Once again the trust issue will require that the NGO community work with the mining industry and other communities of interest to acknowledge past failures and problems and create a framework for resolving or laying to rest past issues that inhibit progress forward. There are a small number of examples of NGOs jointly working with industry to design monitoring programs, discuss the siting of select facilities and footprints, and design and implement reclamation projects. Greater opportunities for all communities of interest to work together must be encouraged and facilitated and some parts of the NGO community may be able to embrace this role.

The environmental NGO community in particular would like to see the mining industry place more emphasis on recycling and conservation of metals. There is a thought that metals will need to be more costly before this will happen. Many NGOs suggest that the environmental and social costs of metal mining are already too high and more resources should be put towards conservation and recycling. This may be one issue through which NGOs may facilitate the involvement of a broader cross section of the communities of interest on a few pilot studies.

Finally, as with the Indigenous community, the idea of no-go areas for mining is important to the NGO community. The mining industry must open itself up to the idea that geologic determinism must not be the only or prime factor in deciding on the location and footprint of mines. Issues such as ecological value, community value, and traditional and spiritual values must also be part

[73] Ali p.303

of the decision-making process. This will involve trade-offs for all groups involved. A similar process was successful with the forestry companies and the NGOs in Ontario in the Lands for Life process.

4.6 GOVERNMENTS: LOCAL, PROVINCIAL/STATE, FEDERAL

4.6.1 Who is the Community of Interest?

The community of interest includes local, provincial/state, and federal levels of government in the United States and Canada. Governments serve many roles with respect to the mining industry which include; a setter and enforcer of rules, a revenue collector, a service provider; and a monitor of conditions in the broader community and ecosystem. The government role in mining is very complex and often contradictory but, ultimately government is the arbitrator of whether or not a mine site may proceed to development and operation as they are responsible for the careful balance and assessment of costs and benefits.

Canada

In Canada responsibility for resource exploration is set out in the definition of provincial and federal powers inherent in the Constitution Act of 1867. "Within their political boundaries, Canadian provinces have full power over mineral exploration, development, conservation and management. This means provinces have the legal power to control virtually all aspects of mining: exploration and prospecting, claim staking, environmental assessments, approvals, waste management, environmental monitoring and closure, remediation and post-closure monitoring."[74] At the provincial level the government often serves as proponent for mine development through provincially sponsored exploration programs and incentive programs. All province's mines departments are involved in the promotion of mining and with permitting and monitoring of health, safety and environment. Additional permitting requirements are also established by other agencies such as the ministries of the environment in various provinces.

The Canadian federal government has powers that may apply directly or indirectly to mining activities. The federal government may legislate sea coasts and inland fisheries, navigable waterways, criminal law, inter-provincial and international trade and commerce, and Indians and lands reserved for Indians. The federal government retains responsibility for resources on federal lands found within provinces and in the Yukon and Northwest Territories while resources within

[74] Canadian Institute for Environmental Law and Policy, Mining's Many Faces Environmental Mining Law and Policy in Canada, 2000, p.14.

Nunavut are controlled with resource management agreements under the Nunavut Agreement.[75] It has authority to engage in any form or mode of taxation and to spend federal funds.[76] All aspects of uranium mining regardless of location, are subject to the regulatory authority of the federal Atomic Energy Control Board now know as CNSC (Canadian Nuclear Safety Commission).[77] At the federal level there are departments dedicated to establishing standards, monitoring and control with Environment Canada being the lead agency. Other federal agencies involved with permitting and regulation include CNSC and DFO. In the Canadian context mineral resource development is advocated through Energy Mines and Resources, with groups such as CANMET specifically focused on technology advancement within the resource industry.

In Canada 90% of Canadian land is owned by the Crown; the federal and provincial governments. Mineral rights belong to whoever owns the land therefore, the Crown owns most of the mineral rights in Canada which may be transferred to miners through the processes of exploration and claim staking.[78]

United States

Federal lands in the United States have been an important source of minerals since the early part of the nineteenth century. Although most of what were once federal lands between the Appalachian and Rocky mountains are now under non-federal ownership, the remaining federal land in western states, including Alaska, continue to produce a large share of metals for the market. The federal lands available for mineral exploration are now under the management of the Bureau of Land Management (BLM), an agency of the Department of the Interior, and the Forest Service, an agency of the Department of Agriculture. Land administered by the BLM and Forest Service comprise 38% of the combined land area of the 12 western states which represents a range of about 76% of Nevada to about 23% of Washington.[79] These lands also serve other uses such as National Parks and wildlife refuges, military lands, and lands managed by the Department of Energy.

Mining on federal lands is governed by the General Mining Law of 1872. The law defines the system of open access to hardrock minerals on federal lands of the western United States that are not withdrawn from mineral entry. The law allows any person to stake a claim on these lands and thereby to obtain the exclusive right to extract the minerals thereon without payment of royalty

[75] Ibid.
[76] Ibid.
[77] Ibid.
[78] Ibid,p.19.
[79] National Academy of Sciences, p.8 of Chapter 1.

to the United States and without acquiring title to the land itself. A mining claimant may also obtain title to (patent) the lands by proving of the location of the deposit, among other requirements, and paying the federal government the statutory price.[80] The result of this legal framework is a "patchwork of intermingled privately owned lands; state-owned lands; and federally owned lands, including unpatented mining claims. A large mine may occupy a mixture of these land ownerships, each subject to different regulatory and land management requirements."[81]

The BLM and Forest Service are both landholders and regulators with respect to their role vis-à-vis mining. "The BLM and Forest Service have public responsibilities that go beyond those of the state regulatory agencies seeking to protect specific environmental media. The federal agencies as land managers on the public's behalf stand in a different relationship to the land and its resources than simply as regulators of impacts; they have a mandate for long-term productivity of the land, protection of an array of uses and potential future uses, and management of the federal estate for diverse objectives."[82]

The U.S. has several other federal agencies involved with the guidance and control of the mining industry that include for example the Environmental Protection Agency (EPA), the Department of the Interior, the Department of Agriculture, the Corps of Engineers, the Nuclear Regulatory Commission (NRC) and Department of Energy for the uranium industry. The roles of these federal organizations vary from promoter, regulator, licensor and enforcer, to custodial care agent. As mine developments are mostly on federal lands, mine development proposals usually trigger environmental assessments at the federal level. The state regulates the operation of mine facilities. If the state is an "agreement" state, federal environmental regulations are simply adopted by the state as the standard, if they are not then the state applies its own regulations which must meet or exceed federal standards.

4.6.2 History

The history of government involvement of mining dates back to the early explorations of the continent as the explorers were looking for the new world to find minerals to enrich the government and heads of state. Government involvement in mining generally occurred after mining activities had begun. In some instances the government did not exist in the territory until after mining began and in other instances the government did not have a specific role to play in regulating mining until problems arose.

[80] Ibid, p.2 of Chapter 1
[81] Ibid, pp. 2-3 of Chapter 1.
[82] Ibid, p.3.of Chapter 2.

In the United States, the Mining Law goes back in time to early mining development. The purpose of the first federal mining law (1872) was to facilitate the orderly discovery and development of minerals in the west and to regulate. It also lead to the inexpensive transfer of lands on which discoveries were made. There was a strong mindset that land should be transferred from government to the people and the law effectively facilitated the transfer of subsurface rights and land from the government to private interests. The metals industry had no requirement to pay royalties according to Mining Law Act 1872. People who were exploring areas that had not been settled in frontier settlements formed their own laws. Prior to statehood, each mining district had laws based upon old Cornish mining laws. After the California Gold Rush, the US wanted to solidify and codify the intent of mining laws. That was the start of the 1872 Mining Law. A parallel law (balancing) to the 1872 Mining Law established Yellowstone National Park and both laws gained passage. The Mining Law is a source of controversy and conflict in the U.S. today.

Prior to the 1960's neither country had significant environmental legislation and there was little understanding and interest about the true environmental effects of mining. This era saw the creation of the USEPA and state level departments of environmental protection in the United States, and Environment Canada and provincial Ministries of the Environment in Canada. In the 1970's, environmental assessment legislation was passed in both countries as were laws concerning emissions to air and water from industrial processes. In the last 35 years both countries have experienced a trend towards more comprehensive and stringent environmental legislation. This has had a significant impact on the mining industry in terms of cost of production, decision-making, and the opportunities available for other communities of interest to intervene and delay the development of a mine site or refinement facility.

4.6.3 Contributions and Implications

Table 4.15 provides a summary of the contributions and implications of mining to the government community of interest.

TABLE 4.15
SUMMARY OF CONTRIBUTIONS AND IMPLICATIONS OF MINING TO GOVERNMENTS: LOCAL, PROVINCIAL/STATE, FEDERAL

	Past	Present
Contributions/Benefits of Mining Industry	- tax revenue; - wealth creation.	- tax revenue; - wealth creation.
Implications/Costs of Mining Industry	- need to regulate mining activities; - need to mange impact of miners on indigenous culture; - problems with regard to access and subsurface rights.	- problems with regard to access and subsurface rights; - need to establish approach for dealing with abandoned mines; - need to regulate mining activities; - need to mange impact of miners on indigenous culture.
Perception of Others	- historic settlements/treaties and ongoing land claims influence mining.	- historic settlements/treaties and ongoing land claims influence mining.

There are significant differences in the legal and policy frameworks governing mining activities in the United States and Canada. These differences are as fundamental as what level of government controls the various aspects of mining, and the ownership versus leasing of subsurface rights. There are also differences with respect to how territorial and treaty rights for Indigenous People are dealt with, the rights of the individual and the community with respect to damages done, settlement history, and differences in environmental law. These differences represent some of the root causes for issues of conflict between the communities of interest. It must be recognized that some issues and conflict are systemic in that they relate back to how treaties were negotiated, foundational law, and historic values. These issues must be identified and dealt with differently from those conflicts which relate to behaviours and values that continue to this day which may or may not reinforce the systemic problems inherent with mining in North America.

One key issue not governed or regulated prior to recent times was the fate of abandoned and closed mines. The communities of interest point to a failure on the part of government to ensure that someone takes responsibility for these sites, cleans up environmental problems and monitors their long term impact on the surrounding ecosystem. Many people commented that abandoned mines, who was responsible for them, what constituted cleanup, and when is a site clean was the basis for much of the conflict between the mining industry and the communities of interest. Many abandoned and inactive mines present environmental problems and risks, and on-going water quality problems.

4.6.4 Lessons Learned and Directions for change

"While democratic governments are, in some ways, a mediating force for conflicting interests in a polity, they must inevitable make choices and hence become an embedded stakeholder. By 'embedded' I mean that they express interests of their own, but they do it in less visible ways than other stakeholders and have 'divided loyalties.'[83]

The lessons learned and directions for change for the government community of interest and for the mining industry with respect to their relationship with government can be summarized by stating that there is a perception that government and industry is working together to create the wealth from mining without taking responsibility for the full environmental or social costs of mining.

The communities of interest point to a lack of available resources within government to effectively monitor on-going mining activities and abandoned mines. They also point to a lack of coordination between and across agencies and levels of government. Some efforts to create coordination are ongoing but more needs to be done. Some communities of interest suggest that cross border agreements and treaties are absolutely necessary for nations and for companies to ensure a common standard of protection for the environment. This issue manifests itself in cross border emissions from smelters or tailing ponds through air and water resources.

There is a need to establish better relationships between mining companies, government and all communities of interest. During one interview an American commented that Canada has a much better relationship with industry; their technical advisory body has produced huge volumes of information. Some point to MMSD as a great start in this regard. They view MMSD as an opportunity to listen to local voices and committed people.

[83] Ali p.92.

5.0 LESSONS LEARNED

There are six key lessons learned that have come out of this research.

1. The **first lesson learned** is the realization that each community of interest expresses time scales and time values differently; or in other words they talk about time differently. This conclusion was not directly articulated by the communities of interest rather, it is an observation gained from talking to different people within each community of interest.
   For example:
   - Mining companies might speak of progress over the last 10 years or the outlook for the next 10 years;
   - Indigenous peoples speak of their ancestors and the effects of mining on past generations, and the protection of traditional values for future generations; and
   - The labour community speaks about health problems created by exposure or practices 40 years ago.

   Currently, the communities of interest are not speaking with respect to the same time scale; their frames of reference are beginning and ending at different places. Some of these differences are cultural while others relate to the lack of resolution of some issues or past problems between the mining industry and communities of interest. These differences should be acknowledged and reconciled before meaningful dialogue can begin. It must be remembered that, "the point at which a storyteller chooses to begin is the first step in the intentional construction of meaning."[84] The communities of interest have some control over how they discuss time scales and how they communicate these scales. While it may be true that a certain mining practice has changed in the last 10 years, if a community of interest is still fighting for recognition of the damage done by that practice 30 years ago that is where the dialogue should begin if communities of interest are to feel heard and if trust and respect is to be established between the communities of interest.

   > "What happened generations ago is often fresh in the minds of community members through the constant repetition of oral history from one generation to the next. It is extremely important for the company to hear what the community has to say about its previous experiences, even if those experiences have been negative. It gives the company an opportunity to affirm the validity of what the community is saying, even if it doesn't necessarily agree with it……..By hearing what the community has to say regarding its previous experiences, by affirming (not arguing with) the experience of the

[84] Ali, p.288

community, the company is actually being given an opportunity to distinguish itself from past practice, to map out its own program for engaging communities in a more responsible way."[85]

2. The **second lesson learned** relates to the issue of trust or the lack of trust. Many of the interviewees and much of the literature reviewed suggest that there is a significant perception of mistrust towards the mining industry on the part of the Indigenous Peoples, Mining Dependent Communities, Labour and NGO Communities of Interest. This mistrust is also extended by these groups to the government community of interest. This mistrust seems to stem from the notion that past actions are acting as a barrier to trust building and future progress.

   Most prominent for these groups is the "legacy issue". The "legacy issue" refers to the social, cultural and primarily, environmental legacy left behind by the mining industry after a mine closes and the lack of responsibility being taken by the mining industry for the legacy or its resolution. This issue drew significant debate at the Mining Dialogue in Vancouver as the various Communities of Interest sought to articulate their perception of the "legacy issue", its significance, and what might be done on the part of the mining industry and government to resolve it. It was clear from these discussions that for some communities of interest, actions continue today which continue to undermine trust. There is a sense that the past is being repeated and consequently, the notion of present "change" is highly contentious. Some communities of interest believe that there has been no meaningful break between past and present industry practices or the influence of the mining industry over the policy decisions of government.

3. The **third lesson learned** is that the perception of mining held by the different communities of interest has become more negative and cynical over time. This is especially true for the Indigenous Peoples, Labour, and Resource Dependent Communities of Interest. Each of these communities of interest started with a different perception of the mining industry historically however, overtime it can be generalized that these perceptions have become increasingly negative and cynical. This change can be attributed to several factors including; the role of the "legacy issue", changing societal values with respect to quality of life and the environment, increased knowledge of both science and law, and recently, the information age. With respect to the ENGOs, their emergence as a stakeholder is a direct result of the environmental movement of the 1960's and they are sustained by the rise of the information age such that there cause is sustained by the unrestricted flow of information to vast numbers

[85] Rader, p.5.

of people via the internet and television. Their perception of mining has been critical from the outset.

4. The **fourth lesson learned** relates to the importance of understanding historic and current governance and institutional arrangements with respect to mining and the communities of interest and the continued impact of these arrangements on issues related to mining. The legal framework of mining, the historical settlement of treaties and land claims for Indigenous People, changing societal values, and changing scientific knowledge with respect to the impact of mining and how to manage it are all systemic or historical problems for which there may be no current solution and may take a long time to change. However, all of these play a role in how the various communities of interest perceive mining and the mining interests ability and/or responsibility to respond to the concerns of the communities of interest.

5. The **fifth lesson learned** relates to the need to understand the speed and direction of change into the future in order to move with them rather than after them. A tension exists between slow moving institutions, both public and private, and the speed with which societal values are changing. Traditionally, government regulations represented societal values but, today values change faster than regulations and government is more likely to be in a position of reacting to societal change rather than directing it.

6. The **sixth lesson learned** relates to the lack of respect and/or appreciation for the variety of values that are articulated in any discussion of sustainability. This has lead to a lack of understanding in what terms such as "what is sustainability", "what is a sustainable community", "who is responsible for the maintenance of a sustainable community" really mean. Within the mining industry, sustainability often refers to the sustainability of the industry; its ability to continue into the future. For the environmental NGO's sustainability refers to the ecosystem or biosphere and for indigenous people or resource dependent communities it refers to the sustainability of their communities. The communities of interest are not speaking from a common frame of reference. The communities of interest are expressing their views from dramatically different sets of values which do not seem to be recognized or understood by all of the other communities of interest.

6.0 NEXT STEPS

This report represents a starting point with respect to understanding the history of metal mining from the perspective of the six identified communities of interest. As discussed in the introduction the scope of research undertaken for this project was limited by the time and resources available. The information contained in the report is based on a limited literature review, a limited number of interviews (19), and attendance at the Mining Dialogue in Vancouver. Thus, the initial step that could be undertaken would be to broaden the scope of research with respect to both the interviews and literature review to enhance the information contained in this report in order to strive for a more complete picture. This could be done in a couple of ways.

First, each community of interest may seek to articulate the **history of mining from their perspective** in a more robust manner so that this information is available and can inform future debates and dialogues. This effort would depend on the ability of the community of interest itself or with the assistance of outside facilitation to organize to undertake this effort and secure the necessary funding. Most of the histories of mining are told from an industry perspective rather than from the perspective of other interests so this would be a valuable exercise. In this example the impetus would exist for each community of interest to take ownership of the creation of the history of mining from their perspective thus, the community of interest would also raise the necessary funding and engage expertise to facilitate this task.

Second, it would be helpful to create a **profile for each community of interest** as was done in Task 1A for the North American Mining Sector. This research could be undertaken by academics or consultants as opposed to the communities themselves as was discussed above. This profile should include a detailed definition of who comprises the community of interest, the history of the community of interest, how they interact with the North American Mining Sector, a discussion of their issues and concerns with respect to mining, and an indication of where in North America their interests conflict with those of the mining sector. Again funding would need to be found to support such an exercise. Funding for this may be sought from the mining industry (companies or associations), the government, or academic research grants.

Third, this research would benefit from a **detailed examination of 3 to 5 key case studies from across North America.** Each case would be examined from the perspective of each of the six communities of interest. A synthesis of the history of the case would be developed from each of the six perspectives with a goal to understanding how each community of interest perceives the relative success or failure of the case and why. It would be important

to choose cases that are successes and failures, and those that represent past practices and future practices. Two cases which have been repeatedly mentioned are the Crandon mine in Wisconsin and the Diavik Diamond mine. Others include; Equity Silver, Morenci Copper, Golden Sunlight, and the Sullivan mine. Again funding would need to be found to support such an exercise. Funding for this may be sought from the mining industry (companies or associations), the government, or academic research grants.

Finally, the research undertaken for this project has reinforced the need for a more **co-operative form of decision-making**. There is a shift within natural resource and environmental decision making to more transparent and open forums for decision-making. This is being fuelled by societal shifts and change across a number of sectors. A prime example is the display of public opposition towards the World Trade Organization and the G7 Summits. All aspects of the mining cycle should move towards a more participatory decision-making model within which affected communities of interest have a greater say in setting agendas, asking questions, defining problems, and evaluating and implementing solutions. Within the last 10 years, the use of co-operative decision-making has had great success across different sectors where a range of stakeholders have been invited to participate in decision-making. Co-operative decision-making means that some communities of interest will have to reduce their decision-making power while other communities of interest will need to take responsibility for their role in decision-making. Co-operative decision-making does not imply an absence of conflict or tension. Rather, it requires us to find and utilize communication tools which will make conflict constructive and tension creative. A research project should be created around developing skills within the mining industry and its communities of interest to engage in these types of processes. Again funding would need to be found to support such an exercise. Funding for this may be sought from the mining industry (companies or associations), the government, or academic research grants with assistance from the other communities of interest as available (ENGO's and Labour in particular).

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APPENDIX B STATISTICAL TABLES

Selected References for Canada Metal Mining Table:

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Table 1
Summary of Selected Statistical for Metal Mining in the United States 1790 – 2000
(Values expressed in US Dollars of the day unless indicated otherwise)

Year	1790	1800	1850	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
1.0 Value of Mineral Production Excluding Fuels														
• Copper			728 tons (a)	303,059 tons (a)	544,119 tons (a)	612,275 tons (a)	705,074 tons (a)	878,086 tons (a)	909,343 tons (a)					1,760,000 tons (d)
• Lead			16,800 tons (in 1853) (a)	367,773 tons (a)	382,692 tons (a)	496,814 tons(a)	558,313 tons (a)	457,392 tons (a)	430,827 tons (a)	246,669 tons (a)	571,767 tons (a)			553,300 tons (d)
• Zinc			-	123,886 tons (a)	324,444 tons (a)	587,524 tons (a)	595,425 tons (a)	665,068 tons (a)	623,375 tons (a)	435,427 tons (a)	534,136 tons (a)			888,800 tons (d)
• Gold	677,000 oz. (1792 – 1834)		2,419,000 oz. (a)	3,830,000 oz. (a)	4,585,000 oz. (a)	2,383,000 oz. (a)	2,139,000 oz. (a)	4,870,000 oz. (a)	2,394,000 oz. (a)	1,667,000 oz. (a)	1,743,000 oz. (a)			10,963,491 oz. (in 1999) (c)
• Silver			39,000 oz. (a)	57,647,000 oz. (a)	57,597,000 oz. (a)	56,537,000 oz. (a)	47,725,000 oz. (a)	70,436,000 oz. (a)	42,459,000 oz. (a)	30,766,000 oz. (a)	45,006,000 oz. (a)			62,694,450 oz. (in 1999) (c)
2.0 Direct Employment • Average No. working daily in Metal Mining					152,086 (in 1911) (a)	122,815 (a)	92,671 (a)	110,340 (a)	68,292 (a)	60,595 (a)	46,108 (a)	74,000 (b)	46,000 (b)	37,000 (b)
• No. of employees in Mining "Industry Division" Payrolls				637,000 (a)	1,068,000 (a)	1,180,000 (a)	1,009,000 (a)	925,000 (a)	901,000 (a)	712,000 (a)	622,000 (a)	3,364,000 (b) [redefinition]	3,223,000 (b)	3,281,000 in "Mining Industry" in 1999 (b)
3.0 Value of Metal Mining Production/Shipments			7,462 establishments (in 1860) (a)	7,730 establishments (in 1902) (a)	$390,000,000 7,834 establishments (in 1909) (a)	$566,000,000 2,739 establishments (in 1919) (a)	1,799 establishments (in 1929) (a)	2,164 establishments (in 1939)(a)	$1,517,000,000 3,668 establishments (in 1954) (a)	$1,826,000,000 2,351 establishments (in 1958) (a)	$2,296,000,000 1,155 establishments (in 1967) (a)		Value of shipments : (b) Metal Mining $9,864,000,000 Iron ore $$1,715,000,000 Copper ores $3,375,000,000 Pb & Zn ores $472,000,000 Au & Ag ores $6,995,000,000	
4.0 Value of Metals				$319,000,000 (in 1970 $) (a)	$470,000,000 (in 1970 $) (a)	$866,000,000 (in 1970 $) (a)	$507,000,000 (in 1970 $) (a)	$752,000,000 (in 1970 $) (a)	$1,351,000,000 (in 1970 $) (a)	$2,022,000,000 (in 1970 $) (a)	$3,926,000,000 (in 1970 $) (a)			Value of all metals produced in 1997 $13,074,000,000 (b) and $9,800,000,000 in 1999 (d)
5.0 Value of Mineral Production • Metallic Minerals Production				$702,000,000 (a)	$1,151,000,000 (a)	$1,270,000,000 (a)								
• Exports				$258,000,000 (a)	$382,000,000 (a)	$411,000,000 (a)								
6.0 Railroad Freight: Transport Products of Mines					483,861,000 tons (in 1911) (a)	712,155,000 tons (a)	642,537,000 tons (a)	570,220,000 tons (a)	746,808,000 tons (a)	649,228,000 tons of a total of 1,240,789,000 tons (a)	Total of 1,484,110,000 tons (a)			
7.0 Gross National Product Attributed to Mining									$9.2 billion in 1950 (a)	$12.7 billion in 1960 (a)	$16.9 billion in 1970 (a)		$5.2 billion in 1990 (b)	$5.0 billion in 1998 (b)
8.0 Total Mining Industry • Assets												$126,900,000,000 (b)	219,200,000,000 (b)	$324,294,000,000 9,726,000,000 (in 1997) 20,700 Firms 26,900 Establishments 586,200 Employed $27,800,000,000 Payroll (in 1997) (b)
• Net Income												$7,800,000,000 (in 1980) (b)	5,300,000,000 (in 1990) (b)	
9.0 U.S. Exports of Metals														$25,100,000,000 (in 1999) (d)

References:

(a) U.S. Department of Commerce
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Historical Statistics of the United States Colonial Times to 1970

(b) U.S. Department of Commerce 2000
U.S. Census Bureau
Statistical Abstract of the United States, December

(c) U.S. Geological Survey.
U.S. Department of the Interior

(d) U.S. Geological Survey
U.S. Department of the Interior
Minerals Yearbook Statistical Summary 1999

(e) U.S. Environmental Protection Agency 1995.
EPA Office of compliance Sector Notebook Project.
Profile of the Metal Mining Industry. September.

TABLE 2
SUMMARY OF SELECTED CANADIAN MINING AND MINERAL STATISTICS 1858 – 2000 (EXPRESSED IN CANADIAN DOLLARS OF THE DAY UNLESS INDICATED OTHERWISE)

Year	1858	1886	1893	1900	1905	1910	1920	1930
1.0 Value of Mineral Production Excluding Fuels								
Metallic					$37,400,204 (e)		$77,900,000(g)	$142,700,000(h)
Non Metallic								$15,200,000(a)
Structural								$43,100,000(a)
Copper		3,505,000lb(a)	8,109,856lb(a)	18,937,138lb(a)	48,092,753lb(a)	55,692,369lb(a)	81,600,691lb(a)	303,478,356lb(a)
		$385,550(a)	$871,809(a)	$3,065,922(a)	$7,497,660(a)	$7,094,094(a)	$14,244,217(a)	$37,948,359(a)
Lead			2,135,023lb(a)	63,169,821lb(a)	56,864,915lb(a)	32,987,508lb(a)	35,953,717lb(a)	332,894,163lb(a)
			$79,636(a)	$2,760,521(a)	$2,676,632(a)	$1,216,249(a)	$3,214,262(a)	$13,102,635(a)
Zinc				212,800lb(a)	9,413lb(a)	5,063lb(a)	39,863,912lb(a)	267,643,505lb(a)
				$9,342(a)	$139,200(a)	$120,003(a)	$3,057,961(a)	$9,635,166(a)
Gold	**34,104 oz. (a)**	70,782 oz. (a)	47,243 oz. (a)	1,350,057 oz. (a)	684,951 oz. (a)	493,707 oz. (a)	765,007 oz. (a)	2,102,068 oz. (a)
	$705,000	$1,463,196(a)	$976,603(a)	$27,908,153(a)	$14,159,195(a)	$10,205,835(a)	$15,814,098(a)	$43,453,601(a)
Silver		355,083 oz (in 1887)(a)	428,738 oz. (a)	4,468,225 oz. (a)	6,000,023 oz. (a)	32,869,264 oz. (a)	13,330,357 oz. (a)	26,443,823 oz. (a)
		$347,271(a)	$330,128(a)	$2,740,362(a)	$3,621,133(a)	$17,580,455(a)	$13,450,330(a)	$10,089,376(a)
2.0 Direct Employment								
Direct Employment in Metal Mining and Mineral Processing	Records of this time focus on mineral quantities and production value						30,623(h)	21,997(d)
Payroll							$15,113,823(g)	$35,055,000
Direct Employment in Non-metallic Mining							5,210 (in 1925) (u)	5,373
Payroll							$5,308,000(u)	$5,723,000
All Employees in Mines, Quarries and Oil Wells						30,371 (in 1911)	89,200(h)	40,467 (in 1931)
Payroll							$88,131,528(g)	
3.0 Payroll Value Added to the Canadian Economy from Metallic Mining Sector								
4.0 Value of Mineral and Mineral Product Exports Including Fuels		$10,221,255(a) ($2.23/capita)	$20,035,082(a) ($4.04/capita)	$64,420,877(a) ($12.04/capita)	$69,078,999(a) ($11.49/capita)	$106,823,623(a,f) ($14.93/capita)	$227,859,665(a,g) ($26.40/capita)	$279,873,578(a) (27.42/capita)
5.0 Mineral Exports as Percent of Canada's Total Exports	Pre-Confederation							
6.0 Value of Exploration Expenditures in Canada	-	-	-	-	-	-	-	
7.0 Mineral Properties Held by Canadian Companies								
8.0 Area of Mineral Claims in Good Standing								
9.0 Mining Profits								
10.A Foreign Direct Investment in Canadian Mining and Smelting								$217,000,000 Foreign Investment
10.B Canadian Long-Term Investment in Mining and Smelting							**$427,000,000 Metallic Sector capital investment**	
11.0 Dependent Communities								

TABLE 2 (Cont'd)
SUMMARY OF SELECTED CANADIAN MINING AND MINERAL STATISTICS 1858 – 2000 (EXPRESSED IN CANADIAN DOLLARS OF THE DAY UNLESS INDICATED OTHERWISE)

Year	1940	1947	1950	1960	1970	1980	1990	2000
1.0 Value of Mineral Production Excluding Fuels								
Metallic	$382,503,012(a,i)	$395,140,994(c)	$617,238,340(c)	$1,003,696,000(d)	$2,890,322,000(d)	$9,696,956,000(k)	$12,777,666,000(l)	$9,800,000,000
Non Metallic	$26,011,498(a)	$54,670,989(c)	$94,721,564(c)			$2,532,360,000(k)	$2,385,190,000(e)	$4,000,000,000
Structural	$42,472,651(a)	$84,576,785(c)	$132,296,212(c)			$1,668,577,000(k)	$2,633,058,000(e)	$3,200,000,000
Copper	655,593,441lb(a)	451,723,093lb(c)	528,418,296lb(c)	878,524,000lb(u)	1,345,434,265lb(d)	1,432,000,000lb(ub)	1,276,079,200lb(e)	1,371,591,283lb(z3)
	$65,773,061(a)	$91,541,888(c)	$123,211,407(c)	$264,847,000(u)	$779,242,403(d)	$1,859,637,000 (ub)	$1,361,344,000(e)	$1,687,681,000 (z3)
Lead	471,850,256lb(a)	323,336,687lb(c)	331,394,128lb(c)	412,000,000lb (uc)	389,185lb(d)	504,000,000lb (ub)	171,712lb(e)	314,708,876lb(z3)
	$15,863,605(a)	$44,200,124(c)	$47,886,452(c)	$43,927,000 (uc)	$123,138,074(d)	$273,766,000 (ub)	$117,389,000(e)	$95,843,000 (z3)
Zinc	424,028,862lb(a)	415,725,826lb(c)	626,454,598lb(c)	814,000,000lb (uc)	1,251,910lb(d)	1,768,000,000lb(ub)	1,056,108lb(e)	2,058,508,929lb(z3)
	$14,463,624(a)	$46,686,010(c)	$98,040,145(c)	$108,635,000 (uc)	$398,858,754(d)	$858,190,000 (ub)	$1,533,278,000(e)	$1,567,274,000 (z3)
Gold	5,311,145 oz. (a)	3,070,221 oz. (c)	4,441,227 oz. (c)	4,629,000 oz. (u)	2,408,574 oz. (d)	1,627,484 oz (ub)	5,073,144 oz. (e)	4,944,219 oz. (z3)
	$204,479,083(a)	$107,457,735(c)	$168,988,687(c)	$157,152,000(u)	$88,057,464(d)	$1,165,417,000 (ub)	$2,132,534,000(e)	$2,045,444,000 (z3)
Silver	23,833,752 oz. (a)	12,504,018 oz. (c)	23,221,431 oz. (c)	34,017,000 oz. (uc)	44,250,804 oz. (d)	34,401,570 oz. (ub)	37,713,403 oz. (e)	40,808,316 oz. (z3)
	$9,116,172(a)	$9,002,893(c)	$18,767,561(c)	$30,244,000 (uc)	$81,863,988(d)	$828,805,000 (ub)	$296,547,000(e)	$277,306,000 (z3)
2.0 Direct Employment								
Direct Employment in Metal Mining and Mineral Processing	46,885(d) 60,351(j)	39,314(d)	47,697(d) 67,560(j)	61,882(d)	66,590(d)	47,592(k) in metallic sector	50,000 est.	52,297 in metallic mining sector
Payroll	$105,500,000	$96,798,000	$142,030,000(d)	$308,043,000	$580,546,000	$1,091,848,000(k)		2,129,228,000
Direct Employment in Non-metallic Mining	6,471	9,593	10,116	11,206	15,150			
Payroll	$7,618,000	$17,342,000	$25,334,000	$49,546,000	$115,425,000			
All Employees in Mines, Quarries and Oil Wells	108,886(i)	72,000 (u)	120,388(j)	97,571(n)	130,230 (in 1971)	126,422(k)	152,471(m)	Metallic 72,900 401,386 in all 4 stages
Payroll			$333,444,697(j)	$453,902,607(n)		$2,979,470,000(k)	$5,190,620,000	
3.0 Payroll Value Added to the Canadian Economy from Metallic Mining Sector	$231,137,000(d)	$235,574,000(d)	$344,925,000(d)	$706,059,000	$1,846,310,000			$3,000,000,000
4.0 Value of Mineral and Mineral Product Exports Including Fuels	$529,825,035(a) ($46.39/capita)	$644,869,975(c) ($51.25/capita)	$1,045,450,073(c,j) ($74.68/capita)	$2,100,739,000 (in 1958)(ud)	$5,164,921,000(o) Gross value of metallic production	$31,841,758,000(k)	$41,305,385,000(l)	$44,000,000,000
5.0 Mineral Exports as Percent of Canada's Total Exports								13.3%
6.0 Value of Exploration Expenditures in Canada	Contract Drilling $1,575,786 payroll 2,422,948 ft drilled (p49)	Contract Drilling: $3,179,473 payroll 4,072,622 ft drilled (p49)	Contract Drilling: $4,532,903 payroll 6,006,747 ft drilled (p55)	Contract Drilling: $7,977,782 payroll 5,521,211 ft drilled (p60)	Contract Drilling (in 1969) $21,341,415 payroll 7,766,957 ft drilled (p69)	Contract Drilling (est.) $53,394,000 payroll 7,880,000 ft drilled (ref-m)	Contract Drilling in 1991 $60,667,000 payroll (m) 8,488,170 ft drilled	$473,400,000 (w,x) exploration and deposit appraisal
7.0 Mineral Properties Held by Canadian Companies								In Canada 4,600 Abroad 3,300
8.0 Area of Mineral Claims in Good Standing								62,474,038 ha (in 1999) (uf) (6.3% of Canada's area)
9.0 Mining Profits					$605,600,000 Net profit after taxes (v70)			5.4% Average return on capital 5.9% Average return on equity (uh)
10.A Foreign Direct Investment in Canadian Mining and Smelting		$272,000,000 Foreign Investment	$476,000,000 Foreign Investment	$1,439,000 Foreign Investment	$3,231,000 Foreign Investment			Total $25B in mining, oil sands, & oil and gas
10.B Canadian Long-Term Investment in Mining and Smelting	$615,918,818 **Total Capital Investment**			$3,291,000,000 Total Capital Investment	**$4,689,000,000** Total Capital Investment			**$5,800,000,000** Capital Investment
11.0 Dependent Communities								**128 including about 700,000 people**

Note 1: Circa 1950, reporting definition changed to reflect number of "establishments" (e.g. companies, partnerships, proprietorships) in sand and gravel sector.