

THE BOREAL BELOW

Mining Issues and Activities in Canada's Boreal Forest



Foreword

The mining sector is a major industrial player and source of long lasting and wide-ranging environmental and social impacts within and beyond the boreal forest region, both now and into the foreseeable future. Mining and mineral exploration leave virtually no part of the vast boreal forest untouched. With few exceptions, the entire forest landscape is subject to mineral exploration, and every major watershed is host to a mining operation. Abandoned mines are scattered across the region, the majority of them unattended and a great number of them not yet even evaluated for their impacts on the environment. Mines bring with them a full slate of industrial infrastructure – roads, power generators, transmission lines, camps or communities, and related development, paving the way for other resource extraction players, who inevitably follow.

This report has been prepared by Northwatch and MiningWatch Canada to provide an overview of mining activities and issues, including an inventory of operating mines and a preliminary cataloguing of closed and abandoned mines and new mineral development activities in Canada's boreal.

The report offers a survey and general analysis of mining activities and impacts, but falls short of being fully comprehensive, particularly in its cataloguing of mining activity (other than operating mines). This is chiefly because the time and resources allocated to the task permitted only an initial review and inventorying. The report provides a solid and reliable overview, and refers the reader to additional resources and information sources.

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1.0 Mining the Boreal

1.1 An Introduction to Canada's Boreal as a Mining Region

Canada's boreal is an immense northern forest "draped like a green scarf across the shoulders of North America".¹ It comprises 77% of Canada's forest land and over 90% of the country's remaining large intact forest lands, stretching in a multi-hued green band from the Yukon Territory to southeast Newfoundland.

Representing 25% of the world's remaining intact forests, Canada's boreal is host to millions of migrating song birds and some of the largest caribou herds in the world, as well as the large predators that depend upon them. The region is also home to over 600 Aboriginal communities. In total, approximately 3.5 million people live in the boreal region.²

The boreal is, in the romantic imagination of North Americans, the last and everlasting wilderness. While the wilderness qualities of the boreal may, tragically, prove to be less than everlasting, the legacy of the mining activities which rob the great northern forest of its wildness will be permanent.

So what is so "boreal" about mining in Canada? Three factors stand out:

- Eighty percent of the mining in Canada occurs in the boreal forest region.
- The long term impacts of mining and the slow recovery rate of the boreal ecosystem couple to make mining of great concern, particularly considering its prevalence.
- Because more readily accessible ore reserves have already been depleted, more mines are being

developed in more remote locations. This phenomenon ensures that the mining industry will retain its deserved reputation as a frontier-buster, bringing the roads, power developments and infrastructure with it into the last remaining remote or semi-remote areas.

Canada's boreal forest builds soil, filters water, captures carbon and produces oxygen. While difficult to monetize the value of such life-giving functions, they have been quantified as nearly \$ 92.8 billion³ worth of environmental services.

Mining, forestry and hydroelectric development are the most significant industrial activities in the boreal. These activities provide infrastructure in remote areas and interact with each other to "open up" a region.

"The window of opportunity for preserving all of the values of the boreal forest is closing rapidly"⁴

The last 50 years have seen rapid, poorly controlled, and poorly planned development in the boreal, as transportation has improved and resources have become depleted in other regions.⁵ Neither the cumulative effects of the development nor its ecological context appear to have been effectively considered at any point in this development "rush", which is taking place in Canada's least conserved landscape.⁶ Both the country's leading scientists and Senate subcommittees have identified the Boreal ecosystem as at risk of being lost in the next half-century, unless industrial development is drastically curtailed.⁷

There exists an unholy marriage between the unique impacts of mining and the unique qualities of

the boreal forest region. The acid laden mine effluent and acid laced air discharges of the mining industry overlay the thin and naturally acidic soils of the boreal to stress these forest ecosystems perhaps beyond recovery. The slow growing and slow healing taiga is brutalized by earth-stripping activities of the diamond and mineral exploration industry, where crews move tens of thousands of the thin boreal soils each day in the search for pretty gems and minerals.

For the impacts of mining activity in Canada's boreal forest region to be evaluated, they need to be viewed in the context of the natural characteristics and function of the boreal forest. Since a full discussion of the boreal forest ecosystem is available elsewhere, the following section is intended only to provide the environmental context for the later discussions of mining in this region.⁸

1.2 The Ecology of the Boreal Forest Region

The northern ecoregion accounts for about one-third of the earth's total forest area and is identified as one of the world's three great forest ecosystems.⁹ Soft water boreal lakes around the world may contain 80% or more of the world's unfrozen freshwater.¹⁰ Canada's boreal ecoregions cover an enormous part of the country: six million square kilometres (91.4 billion acres) or 58 percent of Canada's landmass.¹¹

Boreal ecosystems contain relatively low numbers of species (approximately 100,000 in Canada¹²) and their simple community structures make them vulnerable.¹³ Limited numbers of plant and animal species result in lower genetic diversity in an ecosystem. Efficiency is reduced if the information content of a system is reduced.¹⁴ Therefore,

removing a few species from a boreal ecosystem that contains a relatively lower number of species may be more likely to degrade vital community and ecosystem functions than the removal of the same number of species from a tropical ecosystem that contains hundreds of thousands of taxa.¹⁵ The disappearance of only a few species has been shown to impair the proper functioning of food chains and biogeochemical functions in boreal lakes.¹⁶ In addition, lower biotic productivity of boreal ecosystems increases their recovery time following disturbance.

Winters in the boreal forest are long and severe while summers are short and often warm.¹⁷ White and black spruce, as well as tamarack dominate the boreal forest.¹⁸ In east and central portions, balsam fir and jack pine occur, and in the west and northwest, alpine fir and lodgepole pine. Prominent broadleaved trees are white birch, trembling aspen and balsam poplar.¹⁹ Soils in the boreal are mainly thin and acidic, including podzols, brunisols, luvisols and cryosols.²⁰ Over 200 bird species breed in the boreal and wildlife includes caribou, lynx, black bear, moose, coyote, timber wolf and recovering populations of wood bison.²¹

Typically, there is no senescent phase in boreal forest development and forest systems appear to accumulate biomass and nutrients continuously until interrupted by fire or other disturbance.²² Boreal forest plant communities are well adapted to fire, which occurs at average intervals of 80-100 years in mid-continental boreal systems.²³ Fires are larger and occur with greater frequency in the boreal shield than in any other forested region of the country.²⁴

1.3 Definition and Delineation of the Boreal Forest Ecozones

The boreal forest region has been defined many ways. This poses some challenge to efforts to quantify activities or impacts in Canada's boreal region, since such quantification must first identify which delineation has been used.

The 2001 issue of this report relied upon Stanley Rowe's 1972 delineation of Canada's forest regions in general, and, in particular, adopts the boreal forest region defined by Rowe as "Boreal – Predominantly Forest".²⁵ This delineation does not include the taiga and the transitional area between the prairies and the boreal forest. For the 2007 issue of the report, the delineation used by the Canadian Boreal Initiative was adopted to allow easy comparison and co-relation with other important research papers that are being produced by or in partnership with the Canadian Boreal Initiative (CBI).

The Canadian Boreal Initiative defines the Canadian boreal region using the National Ecological Framework for Canada Ecozones (NEFC). The following NEFC ecozones are considered to be boreal: Boreal Shield, Boreal Cordillera, Boreal Plains, Taiga Shield, Taiga Cordillera, Taiga Plains, and Hudson Plains. The NEFC definition is the most recent national land classification effort and is intended to provide a consistent spatial context within which ecosystems can be described. At the same time, the classification scheme is relevant to conservation planning at many spatial scales because it is hierarchical. In addition, the classification scheme is ecologically-based, taking into account the combined influence of vegetation, geology, landform, soil, climate, wildlife, water and human factors.

Natural communities typically do not start and stop according to lines on a map. As one moves northward from the more deciduous forests of the south, there is generally no abrupt line that marks the beginning of the Boreal region. This adds uncertainty to classification of natural communities. The southern most part of the Boreal Shield ecozone, known as the Algonquin Lake Nipissing ecoregion, was removed from CBI's boreal definition because the area's tree species are predominantly non-boreal. Other areas along the southern fringe of Boreal ecozones remain as part of the boreal as defined by CBI because the characteristic vegetation is predominantly boreal. The absence of a clear boundary along the southern and northern fringes of the boreal region has resulted in differences among boreal boundaries as defined by classification schemes such as the NEFC and Rowe's Forest Regions of Canada.

1.4 A Summary of Mining Activity

Canada's boreal forest is host to approximately 7,000 abandoned mines (10,139 are "on file" across Canada), 72 operating mines and 14 smelters. In 2007, approximately 98 projects are in "advanced exploration" or under development, with thousands more properties being prospected under mineral claims.

Both mineral exploration spending and claim staking activity have been on an increase over the last several years, largely in response to a combination of diminishing mineral reserves and rising metal and commodity prices.

Exploration

Exploration spending also continued to climb in 2006 and 2007. Reports for 2006 covering the 734 exploration and deposit appraisal

projects across the country place total expenditures for the year at \$1.7 billion, up 32% from \$1.3 billion in 2005. A further increase of 9% to \$1.9 billion is indicated for 2007. This represents a run of four years in a row where mineral exploration expenditures have topped \$1 billion per year.

Government sources identify a favourable investment climate, sustained high commodity prices, and different tax incentives available in Canada as significant factors.²⁶

Most of this exploration activity- 75% of it – took place away from existing mine sites in 2006. With higher commodity prices, more known deposits are being fast-tracked toward production decisions.²⁷

Spending increases were observed in every jurisdiction across Canada in 2006, with the exception of Manitoba. The largest spending increases were in Saskatchewan, British Columbia and Québec. In 2007, all jurisdictions except for Alberta and the Northwest Territories are indicating increases in expenditures.²⁸

Exploration spending has been highest for precious metals, with total expenditures of \$667 million in 2006. Base metals exploration spending was \$380 million, diamonds \$303 million, and uranium \$190 million. Diamonds accounted for between 20 and 25% of total expenditures. Uranium expenditures doubled from 2005, reaching \$190 million in 2006 with more than 350 projects under way. In 2007, uranium exploration spending is projected to reach as high as \$241 million. Saskatchewan remains the leading jurisdiction for uranium expenditures, and Newfoundland-Labrador has been second in both 2006 and 2007.²⁹

Operating Mines

Over the twelve months of 2006, the value of metal mining in Canada increased 45% to \$21.2 billion. Most of the increased value was due to higher commodity prices.

- Nickel value increased 76% to \$6.2 billion, with a 17% increase in production.
- Copper jumped by 79% to \$4.6 billion, but production remained stable.
- Iron ore increased by 10.5% to \$2.6 billion.
- Gold output was down by 13.5%, but its value increased by 8.4% to over \$2.2 billion.
- Uranium rose dramatically to \$1.4 billion, a 26.4% increase, although the volume produced declined by 22.4%.
- Zinc production declined by 4.0%, but its value more than doubled to \$2.1 billion.³⁰

The value of Canadian diamond production declined in 2006 as a result of slightly lower quality of stones mined, but it remains a dynamic part of the Canadian mining industry. In addition to the two diamond mines operating in the Northwest Territories, a third – Jericho Mine – commenced production in 2006 in Nunavut. In 2006, Canada was the third leading diamond-producing country in the world in terms of value, behind Botswana and Russia.³¹

An increasing number of former deposits, or former mines, are now being fast-tracked toward production by companies wanting to take advantage of the current high prices and commodity demand.

Despite extensive exploration and record spending on exploration and deposit appraisal, Canada continues to have relatively and increasingly low ore reserves, especially for base metals.³²

In 2005 and the first half of 2006, 11 mines, including 4 new mines (a copper-zinc mine in Newfoundland and Labrador, a gold mine in Ontario, a coal mine in British Columbia and a diamond mine in Nunavut) came on stream. Another 20 mines, including 11 new mines, may open or be re-opened before the end of 2008.³³

In Canada's Boreal region, there are 11 coal mines and 56 producing metal mines, including:

- Alberta's seven coal mines;
- British Columbia's four coal mines, one copper-gold mine, one gold mine and one gold-silver mine;
- Manitoba's three gold mines, three copper-zinc-gold-silver mines, two copper-nickel mines and one copper-zinc, and one 1 lithium-caesium-rubidium operation;
- Newfoundland-Labrador's two iron ore mines, one nickel mine and one copper-zinc;
- Nunavut's one diamond mine;
- Ontario's nine gold producers, one zinc-copper, one nickel-copper, one nickel, and one platinum group;
- Québec's ten gold mines, one zinc mine, one iron, one iron-titanium, two zinc copper-gold, one cobalt-copper-nickel, and one copper-gold;
- Saskatchewan's three uranium mines and one gold operation;
- Yukon's one zinc-lead-silver operation;
- North West Territories' one tungsten operation and two diamond mine.

1.5 An Economic Snapshot

There is not a lot of reliable data available to assess the socio-economic role of mining in the Boreal. Most data aggregate quarries, oil and gas and mining, or mineral fuels and mining. Some data include Stages I-V in mineral

production and processing, including everything from exploration to manufacture of metal products. Government data do not segregate the Boreal from other eco-regions in Canada, so an assessment of the socio-economic impacts in the Boreal requires extrapolation of data prepared for other purposes. Since 1996, Environment Canada has not updated the State of the Environment report, which was largely based on 1991 statistics.

A broad definition of the Canadian mineral industry includes mining (including coal), primary metal manufacturing, non-metallic mineral product manufacturing, and fabricated metal product manufacturing. It does not include the crude petroleum and natural gas industries. The minerals industry (excluding bitumen) accounted for \$42.0 billion, or 3.9%, of Canada's GDP in 2005. Measured at basic prices in 1997 dollars, this was the same contribution to GDP as in 2004. Mining contributed 23.7% to the industry's GDP, primary metal manufacturing, 29.2%, non-metallic mineral manufacturing, 13.4%, and fabricated metals, the remaining 33.7%.³⁴ In other words, mining itself contributed less than 1% of GDP in 2005.

The total value of all mineral commodities mined in Canada, including metals, non-metals and coal, was \$24.3 billion in 2004, \$26.4 billion in 2005, and \$33.6 billion in 2006³⁵. The increase was due to rising commodity prices; for several commodities production actually decreased while "value" increased.

In 2006, Canada's mineral industry (excluding crude petroleum, natural gas and bitumen) accounted for \$39.9 billion, or 3.7%, of Canada's GDP, a slight drop from the previous year. Mining contributed 24.5%, primary metal manufacturing

30.0%, non-metallic mineral manufacturing 12.9%, and fabricated metals the remaining 32.6%.³⁶

In 2005, exploration was a major economic activity with 736 project operators prospecting at 2300 properties in Canada, with total expenditures of \$1.3 billion, doubled since 2000. The largest increase was in uranium and diamond exploration in Saskatchewan and copper and gold in British Columbia. Ontario continues to be the lead jurisdiction for exploration spending overall, with \$341 million spent in 2006, ahead of British Columbia at \$219 million and Québec at \$205 million.

According to data compiled by Statistics Canada, employment in the Canadian mining industry stood at an estimated 50,734 in 2006, showing an increase over previous years but still hovering at the half-way mark from its high in the early 1980s.

Gains in employment were recorded for all three sectors of the mining industry metal, non-metal and coal mining from 2005 to 2006, with employment in metal mining increasing by 5.2% to 22,109, non-metal mining by 9.1% to 23,166, and employment in coal rising by 6.0% to 5,458. When the primary metal, non-metallic mineral and metal fabricating industries are included, employment in 2006 totalled an estimated 370,000, up from 357,000 in 2005.³⁷

However, the number of person-hours paid per tonne mined dropped by one-third between 1995 and 2004.³⁸

1.6 Mining and Natural Capital

Of the ten largest employment sectors who reported to the National Pollutants Release Inventory in 2002,

the primary metals sector ranked number one for total releases per job with an astonishing 19,253 kilograms of contaminants and toxics released per job in that year alone. The level of toxic releases per job was more than four times higher than the second ranking sector, and more than eight times higher than the chemical and chemical products sector.³⁹ It should be noted that mining companies are not required to report contaminants transferred to tailings ponds and waste rock dumps to the NPRI, so these figures for pollution are greatly underestimated.

A landmark study called *Counting Canada's Natural Capital: Assessing the Real Value of Canada's Ecosystems*⁴⁰ was undertaken in 2006 to assess the economic importance of the Boreal to Canadians. The study not only measured its benefits to the general economy but assessed the integrity and value of the ecosystem, using "natural capital accounting". Natural capital accounting looks at the physical and qualitative conditions of the services provided by nature to humans and attempts to quantify these services in dollar values. The study had a number of limitations because of the unavailability of data. For example, the study had to aggregate mining with oil and gas extraction for most of its figures. Also, mining pollution costs are not included: "Further analysis is needed to compile comprehensive data for mining sector pollution costs, and therefore no cost estimates have been included in this study."

It also did not include data on the depletion of mineral reserves. The Canadian Minerals Yearbook states: The apparent life indices for the major metals in Canada at the end of 2005 were 17 years for nickel, 10 years for copper, 8 years

for molybdenum, 8 years for gold, 7 years for zinc, 6 years for silver, and 4 years for lead.⁴¹

In a study published on January 17, 2006 in the Proceedings of the National Academy of Sciences, Yale University researchers said that their findings had determined that supplies of copper, zinc and other metals cannot meet the needs of the global population forever, even with the full extraction of metals from the Earth's crust and extensive recycling programs, and that depletion will be an immediate problem for some precious metals like platinum.⁴²

Counting Canada's Natural Capital did, however, draw a number of startling conclusions:

- The market value of mining and oil and gas activity in the Boreal is estimated at \$14.5 billion, while the industry is estimated to have received more than \$1 billion in federal government subsidies.
- The estimated cost to human health from pollution from these activities (mining, oil and gas) is estimated at \$9.9 billion.
- The total non-market value of Boreal ecosystem services is estimated at \$93.2 billion, at least 2.5 times greater than the net market values of forestry, mining, oil and gas and hydroelectricity combined.

Biodiversity

Large scale resource development activities such as commercial logging, mining and hydroelectric generation pose the single greatest human threat to biodiversity in the North American Boreal forest ecosystem.⁴³

Recent decades have seen rapid development in the Boreal, as resources have become depleted

elsewhere and transportation in the region has improved.⁴⁴ But that development has been poorly planned and poorly controlled. Only 2.66% of the ecosystem is strictly protected from all forms of large scale industrial activities, and 30% of the Boreal forest is now within a kilometre of a road or access route.⁴⁵

The negative impacts of resource development, such as fragmentation and habitat loss, are magnified by global influences such as climate change, acid rain, and industrial pollution.

Most soils in the Boreal are highly sensitive to acid precipitation, being relatively thin and also highly acidic and low in nutrients and oxygen. Acid rain has already had a significant effect on these soils where base ions have been partially leached away.⁴⁶ Since base ions in soils neutralize acid deposition, in soils where their levels are low, acid precipitation is having more effect than it did previously.⁴⁷ Particularly in the Canadian Shield region, soils are acidic enough to stunt forest growth by up to 10%.⁴⁸

Direct causes of impacts to Boreal waters include industrial contamination, alteration of flow patterns, invasive species, and discharge of eutrophying nutrients and persistent contaminants.⁴⁹ Improper management also causes degradation of Boreal waters. Clear-cut logging, climate warming, acid precipitation and stratospheric ozone depletion are among the more important indirect stressors.⁵⁰

Climate Change

Human alterations to the atmosphere are causing climatic warming, acid precipitation and increasing UV radiation resulting from ozone depletion. The Boreal region is among the most sensitive to all

three influences, which together have a synergistic effect on ecosystem degradation.⁵¹

The global climate is changing as we are releasing large amounts of greenhouse gases such as carbon dioxide (CO₂) into our atmosphere. As a gas, CO₂ contributes to higher global temperatures (climate change) that could have a profound impact on human health, water systems, wildlife habitats and vegetation. The reduction of the boreal's carbon storage capabilities, due to land conversion and forest clearing, intensifies the rate of climate change. The impact of atmospheric changes is difficult to predict, but has been recognized as a threat to Canadian biodiversity over the medium and long term.⁵²

Canada's Boreal forest stores an estimated 150-190 billion tonnes of carbon (CO₂)⁵³ – almost ten times the total annual global carbon emissions from fossil fuels.⁵⁴ Canadian Boreal trees store an amount of carbon (30 billion tonnes) that is roughly 40 times Canada's total annual fossil fuel emissions.⁵⁵ Soils and peat lands also serve a critical carbon storage role. However, if the climate continues to warm and thaw the permafrost below the peat lands then the necessary surface water would drain away and allow peat land decomposition thereby releasing carbon into the atmosphere. It is expected that climate warming will degrade the Boreal forest faster than any other ecosystem in Canada.⁵⁶

According to Environment Canada: "We will see a shrinking of the Boreal forest due mainly to the fact that it cannot move northward without running out of soil or running into water."⁵⁷ Since 1970, records reveal an upward trend in forest fire activity.⁵⁸ Insect and disease outbreaks have also increased in area and

duration in the past 30 years due to fire control, harvesting, forest fragmentation, pollution, invasive species and climate change. First Nations, as well as other indigenous communities, are the first to experience the devastating impacts of climate change, including flooding and other emergency situations, loss of reliable travel routes, poor hunting, fishing and gathering, loss of land, threats to food security, increased risk of respiratory illness and infectious disease.

The mining sector is both a significant contributor to and a direct recipient of the phenomena of a warming climate. Climate change may also present several challenges to the mining industry such as tailing treatments that rely on encapsulating and freezing tailings to prevent acid leaching, a shortened winter road season, greenhouse gas emissions, and depleted water resources.

There is no complete set of data for greenhouse gas emissions from the mineral sector, and the estimate that 3% of the greenhouse gas emissions in Canada are from the mining sector is associated with a relatively low degree of certainty.⁵⁹

Greenhouse gas emissions from mine development and operations come primarily from the operation of heavy vehicles, from on-site generators, and from shipment of concentrates and ores off-site. However, more significant sources of greenhouse gas emissions are smelting and refining processes, and the very high energy demanded by those processes.⁶⁰

Between 1990 and 2001, coinciding with a slump in the mineral sector, the industry managed to decrease its energy consumption by 22% and improved its energy intensity (energy per unit of metal milled) by

5.5%. In 2004, gold, base metal, iron ore and diamond mines had a combined output of 6,684,300 tonnes of CO₂, which was approximately 9% of the Canadian total from all sources.⁶¹

Mines in Canada are particularly vulnerable to the effects of climate change. Many mine facilities have been designed to rely on water cover to reduce acid generation in their tailing or waste rock area. Others, such as the Raglan Mine, have designed their waste rock and tailings to remain frozen in permafrost to reduce acid generation and for overall stability. Rising temperatures and reductions in the water budget will adversely affect both of these approaches. Moreover, although mines across Canada have been designed to handle extreme weather events, facilities will have to be re-evaluated for their ability to handle future conditions as those extreme events become more common and more severe.⁶²



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2.0 The Mining Sequence

2.1 An Overview of the Mining Sequence

Dubbed by both industry and regulators as the mining “sequence,” a chain of events is set off when the first stake is driven in the ground to claim a piece of wilderness as a mineral prospect. The sequence supposedly continues through mine development and operation and metal refining, until industry casts their last backward glance at an exhausted mine and the operator moves on to other ventures. In the 150 year history of mining in Canada, there are few if any examples of a major mining operation which has been fully closed out.

Mining has stages in its development, operation and closure: the initial prospecting and staking of the mineral claim; the exploration and evaluation of the claim for its mineral potential; the development and operation of the mine; the milling and refining of the ore into the sought-after metals; and the closing out of the mine and, in most cases, the perpetual care of that site.

The stages may not always be sequential. For example, some initial evaluation of mineral potential may take place at the time the claim is staked, and the exploration activities can extend to the actual production of ore. At the closing end of the mining sequence, mine operators frequently blur the line between a suspended mine, i.e. one which still has commercially viable ore reserves but which has temporarily suspended operations, and a closed mine. Some closed-out or abandoned mine sites are redeveloped, taking them back to the starting point in the mine sequence.

There is also a great deal of variation among mines in terms of the

milling, refining and further processing of the ores. Most mines will have an on-site mill, but few have on-site smelters, and frequently there is cooperation among producers, with one smelter servicing more than one mine. For example, Vale-Inco’s (formerly CVRD-Inco) operation in Thompson has phased out some of its products at the Manitoba Division, and is now shipping copper in concentrates from Thompson to Vale-Inco’s Ontario Division in Sudbury.

The following sections provide a description of each stage, including the activities generally assigned to that stage and the related impacts. More discussion of major areas of impact, such as acid mine drainage or air emissions, occurs in Section 4, which discusses environmental concerns. Additional issues are described in Section 5, which describes the role of government and regulation, and in Section 7, which organizes the discussion by province and territory.

2.2 Prospecting

Frequently, prospecting and exploration are clustered or discussed together, as if they are one stage in the mining sequence. There are however, disadvantages to doing so. There can be distinctly different impacts in the different stages, and different rules apply. Neither prospecting nor mineral exploration are activities which are conducted without environmental harm.

Anyone with a prospecting licence can enter on property to look for minerals, even before a claim is staked. Prospecting is about finding and staking out a mineral “prospect,” or an area which may host a mineral deposit or ore body of such quality and quantity as to make the mining of that ore a profitable venture.

“Mining was very different when free entry laws were established. Mines were smaller, less intrusive, and left much less of an ecological footprint. Modern day hard rock mining is a large scale, mechanized, industrial activity that has significant environmental impacts...These laws were passed at a time when the scope and scale of hard rock mining that exist today would not even have been contemplated. Incremental changes have modernized the law of free entry, but the underlying philosophy of free entry has remained intact.”⁶³

Generally, prospecting begins with some review of information already known about an area, such as geological reports, past exploration reports, maps, or other information which might provide some “clue” as to the mineralogy. The geological maps developed by federal and provincial governments are essential to this endeavour.

Individuals and companies gain the exclusive right to search for minerals on an exploration property, and to develop any discoveries, by staking a claim. In most cases physical staking of a property takes place on the ground, known as “claim staking.” Several provinces now allow “map staking” or “internet staking” in some or all regions. Map staking allows a company or individual to place a mineral claim on an area and so establish a form of tenure over that area, simply by identifying the area on a map and paying a small fee.⁶⁴

Free Entry

The mineral industry in Canada enjoys almost unrestricted land access. Exploration across the boreal forest takes place under a “free entry” tenure system, except in Alberta, where a discretionary mineral tenure system is in place.⁶⁵

In most jurisdictions, surface and sub-surface rights are severed from each other, with subsurface rights held by the Crown even when the surface rights are privately held, and occupied as residences, farms or recreational properties. Under a “free entry” regime, prospectors are permitted to explore and claim sub-surface rights to minerals without consulting other resource users or surface rights holders.

The free entry system is based upon the following premises:

- Mining prevails over private property interests.

- Mining is the highest and best use of Crown lands.
- All Crown lands are open for staking and mineral exploration unless they are expressly excluded or withdrawn by statute.
- Mining prevails over Aboriginal land rights.
- Mineral tenures are appropriately granted on a “first come/first served” basis.
- Mineral potential is so valuable that it warrants leaving the staked area essentially unregulated and potentially unusable for other resource interests.⁶⁶

The system was developed in Europe in the 1500s, largely to serve the financial needs of warring noble clans, where kings had an interest in keeping the coffers full in order to pay the military tab.⁶⁷ In Canada, the free entry system first appeared in the west, during the frontier days of the early gold rushes and it was first written into the *Goldfields Act of BC* in 1859. The frontier mentality of the free entry system then traveled east, where its mark is still clearly seen in the mining legislation of the Yukon Territory and the Northwest Territories, Saskatchewan and Manitoba. The free entry system was adopted by Ontario, based on the example of British Columbia. Ontario’s mining rules then influenced the laws of first Québec and then, later, the regimes developed in New Brunswick and Newfoundland.

The system persists to this day, giving priority to mineral development over other land uses and other social, environmental or cultural values. Under the system, miners have a pervasive right of entry and access on lands that may contain minerals, and a right to locate and register a claim without consulting the Crown, other land users, or others with an interest in the land,

such as Aboriginal communities or surface rights holders.

Staking is not allowed on reserve lands without the permission of the First Nation, although staking can take place on Crown lands that are of traditional Aboriginal use and interest. The Haida/Taku Supreme Court decision makes it clear that the Crown has an obligation to meaningfully consult with First Nations on these lands before it makes decisions about resource allocations. (These matters are discussed further in Section 6).

While the mechanics vary slightly from one jurisdiction to the next, the way the free entry system operates is a three step process:

1) The prospector or “free miner” as they are sometimes called, must obtain a prospecting license. These are available, generally, to anyone over 18 years of age for a small fee, usually around \$25. The licence then gives the individual the right to prospect for minerals on any lands in the province or territory in which the licence has been granted, subject to a few exceptions (private lands where the mineral rights have not been reserved to the crown, a few excepted land uses such as cemeteries or occupied houses, or – in most jurisdictions – parks and protected areas or areas withdrawn by a minister’s order.

2) Upon entry, the prospector can stake a mineral claim.

3) After having staked a mineral claim, the prospector has exclusive right to exploit the minerals beneath the surface of the claim area, but in exchange must meet requirements to conduct a certain level of mineral exploration – measured by expenditure per hectare or per claim – within a set time frame.

Consequences of the Free Entry System

The consequences of the free entry system are both social and environmental.

Environmental impacts include all of those associated with prospecting and exploration, discussed elsewhere in this section, but the free entry system provides such encouragement to mineral exploration that these impacts are both multiplied and more widespread as a result of the system.

The system's granting indiscriminating access for mineral exploration means that sensitive features and natural values are completely unprotected during these early stages of the mining sequence.

All players are welcome. Past performance and a track record of environmentally damaging practices on the part of any particular operator are not factors in the free entry system. As a result, mine operators that have left a trail of destruction in their wake, like Peggy Witte of Royal Oak Mines, or Cliff Frame of the Westray disaster, are treated like other prospectors when they stake claims.

The free entry system creates an expectation on the part of the industry and a practice on the part of government that all mining permits will be granted. The instances of mine permits being refused are few and far between. The government has no discretion to choose amongst applicants in order to reduce the impact on the land.⁶⁸

From a resource revenue perspective, the free entry system defers the possibility of government royalty collection to the time of production, and prevents governments from collecting royalties and rents associated with the development

of the resource unless and until a mine is developed. By contrast, the oil and gas process guarantees that licenses will be granted and royalties collected in a timely way. For example, the *BC Petroleum and Natural Gas Act* establishes clear provisions whereby provincial oil and gas rights are to be publicly auctioned, for a fee, and royalties are charged to tenure holders.⁶⁹

By giving pre-eminence to mining interests, the free entry system limits the land from being allocated for other uses. This is exacerbated by policies that potentially "sterilize" land for other uses if it has "significant mineral potential," such as Ontario's Mineral Development Policy.⁷⁰

Operating under an antiquated system which favours one particular land use over all others inevitably leads to conflicts. In today's society, the public expects to be consulted on a broad range of policy and environmental matters, and governments have sworn allegiances to the mantra of "sustainable development." First Nations, land owners and the public at large are showing an increasing unwillingness to sacrifice environmental and community values for the sake of mineral exploration and exploitation.

With prices for gold, copper, uranium and just about every metal hitting record highs, prospectors have been claiming millions of hectares. Many landowners are finding that when prospectors want to look for minerals on their property there is little they can do to stop them.⁷¹

Recently conflicts have erupted across the country, within the Boreal forest region and elsewhere. Conflicts between miners and ranchers, cottagers and others in rural Canada are becoming more common, as companies look to cash

in on the recent commodity boom and flex their free entry muscle.

While some of the recent conflicts and confrontations have been outside the Boreal region, the implications for the Boreal forest are clear: if the absolute “right to mine” entrenched in the free entry system can be effectively challenged, any resulting changes to the system will be of benefit system-wide.

The stakes can be high. In 2003, a company that mines clay (diatomaceous soil) for kitty litter entered Kamloops property belonging to the Bepples family to begin mining. The Bepples lost their lawsuit, their land, and their peace of mind, and they gained a view of a kitty litter plant. In 2004, a court reduced the amount of compensation they were paid. Others have lost their privacy, their use and enjoyment of their own land, and any sense that they are equal before the law when they find themselves in conflict with mineral development interests.

The free entry system has also

gained profile and attracted controversy in Ontario in recent years. There have been a number of conflicts as a result of mining companies staking on rural residential lands in Ontario. At one point in 2002, there were 36 disputes before the Provincial Mining Recorder from the Bedford-Perth municipality alone. At another point, a group in Ontario managed to have 47 of 61 mining claims cancelled on private property through pressure on the provincial Ministry of Northern Development and Mines.⁷²

North and south, confrontations and court actions have been the response of First Nations and other local residents as mining interests move in.

In northwestern Ontario, in July 2006, Ontario Superior Court Judge Patrick Smith suspended the mining operations of Platinex Inc. and castigated the provincial government for ignoring the rights of First Nation community.

Kitchenuhmaykoosib Inninuwug

First Nation (KI), a First Nation of more than 1,500 members on Big Trout Lake about 600 kilometres north of Thunder Bay, announced a development moratorium on its treaty lands in 2001. The community was reacting to a mineral exploration rush across the region and plans to push clear-cut logging into the northern half of Ontario’s Boreal forest.

In response, Platinex launched a \$10 billion lawsuit against the First Nation and sought an injunction to keep protestors away from its operations after demonstrations by KI residents in February forced a stop to exploratory drilling. Judge Smith ruled that granting Platinex the injunction would “send a message to other resource development companies that they can simply ignore aboriginal concerns.” Citing recent Supreme Court of Canada rulings that First Nations must be consulted on development of lands covered by treaties, Smith said negotiated settlements “must occur before any activity begins and not afterwards or at a stage

One angry landowner in BC is taking action

Rob Westie and his family had built their dream home on their dream property, nestled on the side of Bluenose Mountain just north of Vernon in the British Columbia interior. But in January 2006 life changed abruptly when an eccentric neighbour staked the mineral rights and developed an irregular habit of lurking about the family home. Initial complaints to police were met with inaction; local police said there was nothing they could do because the neighbour had secured the mineral rights to Westie’s land and much of the surrounding area. Under Canada’s “free entry” mining system, prospectors and mining companies have the right to enter both public and private property to explore and develop their mineral claims. That means they can legally cut down trees, dig trenches, drill holes and even use heavy machinery to take away thousands of tonnes of rock samples, all without the permission of a landowner.

Westie has since assembled a group of angry landowners and neighbours – including a teacher, farmer, developer, sawmill manager and retired cowboy - and started a grassroots rebellion. His B.C. Landowners Rights Group has drafted a letter explaining the lack of landowners’ rights and the goals of the organization. The members are preparing to draft a faux-amendment, to be voted on at their website, and they’re sending their message far and wide.

But BCLOR’s backcountry revolt may have a broader base than first meets the eye – the number of landowners whose rights have been threatened or obliterated has exploded in recent years, and environmental activists and environmental law groups have taken note.⁷³

(Summarized from story printed by The Tyee, June 14, 2006)



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where it is rendered meaningless.”

A subsequent court decision in 2007 (discussed in more detail in Section 6 of this report) provided more direction to the company, requiring them to fund consultations with the First Nation to develop a Memorandum of Understanding on how exploration activities might proceed.

In an opposite corner of the province, two Algonquin First Nations communities have launched a \$1-billion lawsuit against the province and a \$10-million countersuit against a mining exploration company that is suing them for blocking access to a potential uranium mining site in south-eastern Ontario.

The Ardoch and Shabot Obaadjiwan First Nations allege that Ontario breached their aboriginal rights and failed to consult them before granting a company mining rights on their traditional lands about 90 kilometres north of Kingston near Sharbot Lake. The countersuit against Frontenac Ventures is intended to send a message to the company that launched its own \$77-million lawsuit against the two communities in July 2007.

Frontenac Ventures has won a contempt of court motion against Ardoch and Shabot Obaadjiwan protesters disobeying an injunction that ordered them off a site near Sharbot Lake. Protesters had occupied the potential mining site from June to October 2007.

The land in dispute is mainly “Crown” land that is the subject of ongoing land claim talks between the Algonquins and the federal and provincial governments. The Algonquins say uranium mining could cause environmental damage to the land and the company should not have been granted rights to the

land before the land claims are settled.⁷⁴

Attempts to reform the Free entry system

In the early 1970s the government of British Columbia removed the right of the free miner to enter lands to mine, and the automatic right of the claimholder to obtain a lease and to mine, though it retained the right of the free miner to explore and develop minerals. It also installed a requirement for a production plan to be approved by a Minister as being the best possible method of producing minerals, and to consider environmental, social and economic issues. These changes were “greatly disliked by the mining industry,” and were rescinded two years later with a change of government from NDP to Social Credit.⁷⁵

While reform was a matter of central concern and of much debate during the development of the Whitehorse Mining Accord of 1995, no agreement on actual reform was forthcoming.⁷⁶

In 1997, the Canadian Arctic Resources Committee petitioned the Auditor General of Canada to provide leadership in reforming the free entry system. CARC wrote:

The substance of our petition is that the system of disposing of Crown mineral rights in the Northwest Territories (N.W.T.) is entirely inconsistent with the definition of sustainable development contained in the Auditor General Act. Furthermore, it is our contention that there is no evidence that the Department of Indian Affairs and Northern Development (DIAND) is making any progress towards adapting the current regime so that it is consistent with the principles of sustainable development...

A free-entry system makes it

impossible to take into account considerations of ecosystem health in the absence of an adequate planning mechanism designed to ensure that lands valued for reasons of ecosystem health are withdrawn from disposition or staking. This is not the case in N.W.T. where mineral staking precedes ecological planning.⁷⁷

The response provided by the Department of Indian and Northern Affairs was telling. It read, in part: The licensed staking of mineral claims is among the least intrusive of all mining activities and causes relatively little disturbance to the land. The effects of this activity are not very different from those of many unlicensed uses of Crown land such as hunting, fishing, hiking and ecosystem assessment.

In August 2007, Ontario's Ministry of Northern Development and Mines has put forward a proposal to require notice that staking has taken place be provided to surface rights holders, and that the consent of the surface rights holder would have to be sought prior to exploration work. The proposed changes were posted for a 60 day public comment period in August 2007.

Alternatives to the free entry system do exist. In the provinces of Alberta, Nova Scotia and Prince Edward Island someone wishing to do mineral exploration must first apply for and obtain an exploration or land use permit. The owner of the mineral resource, i.e. the government, has the discretion to decide whether and on what terms it will issue the permit. If a permit holder later wishes to develop a mineral deposit on the lands for which they hold an exploration permit, the permit holder must apply for and obtain a mining or mineral lease.

Again, the government has the discretion to decide whether and on what terms it will issue the lease.⁷⁸

Staking

Staking a mineral claim is done by two principal means: claim staking or ground staking, which happens in real time on real land, and map staking, which happens on paper or on-line. Both result in a form of mineral tenure, and both are part of the free entry system.

Staking a claim on the ground generally involves cutting sight lines through the bush, blazing trees to mark the claim boundaries, and driving a claim post – properly identified, usually with a prospecting tag – into each corner of the claim.

Prospecting can also include ground-work, such as stripping or trenching to remove the overburden (soils and subsoils, with associated vegetation) and so expose the mineral bearing rocks below, and can involve initial drilling to obtain samples from depth. Frequently, geochemical and/or geophysical surveys are done in advance of staking the claim, and maps and geological reports will have been reviewed, in order to identify areas of mineral interest.

The impacts include adverse effects on wildlife and wildlife movement, increased access and access corridors, garbage, fuel spills, forest clearing, disruption of the forest floor and breaking of forest cover, use and spill of drilling fluids, etc. Noise from helicopter fly-overs have been known to disrupt geese, caribou, mountain sheep and goats.

The impacts are spread over a vast area because prospecting surveys large tracts of land to identify potential mineral deposits.⁷⁹ The sheer volume of the activity lays to

rest any notion that prospecting is a benign presence.

Ground Staking is used exclusively to acquire claims in New Brunswick, Ontario, Yukon, Northwest Territories and Nunuvut and in the unsurveyed parts of Manitoba and Saskatchewan. Map Staking is used exclusively in Nova Scotia and Alberta, and in the surveyed parts of the province in Manitoba and Saskatchewan. Ontario has proposed to move to map staking in the surveyed part for the province to address issues related to conflicting surface rights. On-line Map Staking is used exclusively in Québec (2000), British Columbia (January 2005), Newfoundland (February 2005), has been announced in Manitoba (October 2005), and is under consideration in the Yukon, Northwest Territories, Nunuvut, Ontario and Saskatchewan.⁸⁰

Map staking is a paper-based system, with claim boundaries referenced by the land survey system (legal subdivision, section, township, range, Meridian) rather than by ground staking. On-line map staking refers to an internet-based, applicant driven method of acquiring mineral dispositions. Dispositions are acquired by selecting available areas/cells on a seamless digital GIS map, and electronic payment of fees.⁸²

While from an environmental perspective, there may be benefits to a system that means less traffic in the bush and fewer disturbances from activities such as blazing boundary lines, map staking brings controversies of its own.

From industry, government and public perspectives there are both advantages and disadvantages to the map-staking system in general, and an on-line map staking system in particular. What constitutes an

On January 12, 2005 the Province of British Columbia replaced its traditional claim staking method with an Internet system. No longer did free miners need to drive actual stakes into the ground to mark their claims. Nor did they have to walk into one of the two provincial Mineral Titles offices to register. Since January, all a registered free miner needs to do is to log in at Mineral Titles Online and stake a claim with the click of a mouse, even if he was in Hong Kong.

Pan Pacific Aggregates is a small company with no track record in mining or aggregate development. But in the course of a few hours, Pan Pacific captured a 19,320-hectare mining claim which envelops nearly all of the southern half of the Sechelt peninsula, including Premier Gordon Campbell's summer home overlooking the currently still scenic Halfmoon Bay. The fledgling company staked 51 claims on the day the Mineral Titles Online system opened for business. By the time darkness fell that January evening, the Vancouver-based firm had staked the subsurface rights to a swath of the Sunshine Coast that reaches from West Sechelt to Pender harbour.

During its first week of operation, Mineral Titles Online received 2.56 million hits, and a total of 3,110 claims were acquired. By March 31, some 2.2 million hectares of land had been staked online. By comparison, only 1.1 million hectares were staked in all of 2004 formerly regarded as a boom year.⁸¹ (The Tyee, April 19, 2005)

advantage or a disadvantage varies by sector and perspective.

In a 2005 discussion paper on On-Line Map Staking prepared by the Saskatchewan Department of Industry and Resources, advantages and disadvantages from a government perspective were outlined as follows:

Advantages

- Greater accessibility and efficiency; more efficient on-line mineral tenure administration;
- Reduced overall cost to acquire mineral dispositions;
- Secure mineral disposition title; map staking is subject to fewer disputes;
- Reduced conflicts among surface users, as surface access would not be required to acquire mineral dispositions;
- Competition: a number of jurisdictions have converted to map staking processes so it is more accessible and less expensive to acquire mineral dispositions in those jurisdictions.

Disadvantages

- Loss of jobs and economic benefits to local areas. Ground staking offers short-term, seasonal, well-paying jobs for many residents of rural and northern regions.
- Eliminating ground staking potentially decreases the skilled workforce available to carry out the continuum of exploration work, as claim staking crews are also line cutting crews.
- Monopolistic acquisition. Map staking allows for the acquisition of large tracts of land very quickly compared to ground staking. This could result in large areas of land being unexplored but held by the transfer of work from smaller areas of focussed exploration. There is also the potential for well-financed

companies to control large area of Crown mineral rights rather than having a number of competing companies carrying out separate exploration programs on the same lands.

- Speculation. On-line map-staking facilitates speculation as there are no up-front staking costs. Financial risk is limited to the recording fees. While large areas of Crown minerals may be applied for, this may not translate into increased exploration.
- No physical demarcation of disposition boundaries. Field exploration programs benefit from the demarcation of property boundaries. The lack of boundaries on the ground may cause conflict between adjacent, competing companies, for example during exploration work.
- Cost to government. The conversion to an on-line map tenure system is estimated to cost between \$1-2 million.
- To participate in an on-line map staking and mineral tenure process, clients require access to the internet, as well as electronic commerce. Clients with access to high speed computers, and areas with high speed internet access will have a competitive advantage. As online payments are typically limited to credit cards, clients must have access to this form of finance.

There is a diversity of views on this within both the mining industry and the environmental community. Within the environmental community, there is definite consensus on the adverse effects of the free entry system in general and the impacts of ground staking as part of that regime, but some differences of opinion on whether the advantage of reducing the environmental impacts of physically staking a claim and blazing lines outweighs

the disadvantage of making mining claims that much easier to obtain, and in the absence of any and all knowledge of the land upon which the claim is being made. Other concerns relate to the potential for monopolies, increased volume of staking, and loss of benefits to local communities. Some hold the view that the physical mark of the mineral claim is a necessary warning to other land users, including First Nations and surface rights holders, that a mineral interest is being pursued.

Among the miners, the difference tends to relate to the size of their company, with the larger companies and operators favouring map-staking and the smaller interests – in particular the individual prospectors – opposing map-staking because of potential loss of livelihood and economic benefits for local communities.

After years of debate, in 2007 the Prospectors and Developers Association of Canada agreed that the association should develop and advocate for a map staking policy in Canada on a “first come basis” which protects the confidentiality, mineral title and tenure of the claimant⁸³

The area of new mineral claims staked or recorded in Canada in 1999 was 5,189,069, hectares (ha) with expenditures totalling an estimated \$395 million.⁸⁴

2.3 Exploration

Following staking, further mineral exploration is undertaken. First steps may overlap with work done during prospecting and prior to staking a mineral claim – geological mapping, geophysical surveys, geochemical sampling – followed by physical sampling. Physical sampling includes soil and

sediment samples, grab samples, bulk samples and drilling. Many of the impacts in the exploration stage relate to the sampling that must be done to determine if the property has an economically viable mineral deposit.

Early Exploration

The earliest exploration activities will probably involve helicopter surveys, to look for visible mineralization and magnetic fields. If the company is looking for uranium, they will also check for radiation.⁸⁵

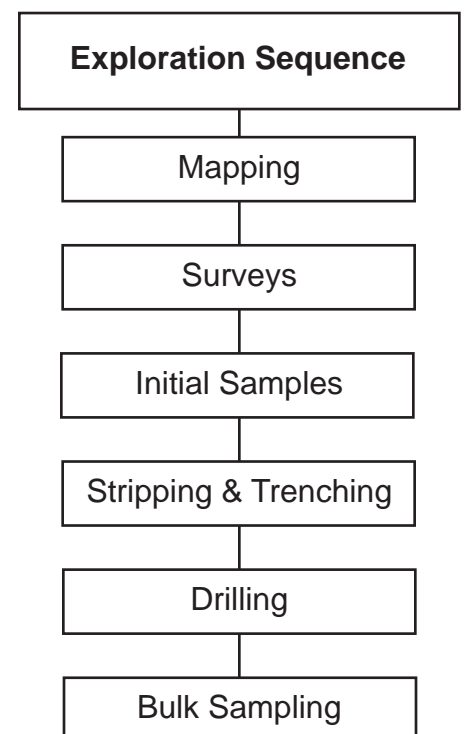
“Often the prospector will be attracted by a rusty rock surface due to oxidation of sulphide minerals.” (Mineral Exploration Primer, Association for Mineral Exploration British Columbia)

Exploring a mineral mining claim often includes soil sampling. A series of holes are dug at specified intervals to collect soil samples from identified soil horizons.

Soil develops over very long periods of time, in what would commonly be described as layers or more technically as “horizons.” Just below the leaf mould is a rich black soil horizon which is termed the ‘A’ horizon. It is rich in nutrients and hosts the plant rootlets. At the base of this rich black soil there is usually a leached zone, gray to white in colour, called ‘A2’ horizon, and then a tan to rich brown coloured horizon called the ‘B’ horizon. The “B” horizon tends to concentrate metallic ions which have been brought up by ground water from below and leached down from the ‘A’ horizon, and is the preferred horizon for soil sampling. A soil sampling survey may entail collection of hundreds, or even thousands, of soil samples.⁸⁶

Another sample done early in the exploration stage is a “grab” sample. A “grab” sample should mean a composite sample made up of random pieces of small rock samples which are roughly representative of all the material present. However “grab” samples are often a more carefully selected sample of the richest mineralization available. These samples are sent off to an assay lab for evaluation.⁸⁷

Trenching, power washing and/or more broadly-targeted stripping remove the soil and vegetation down to bedrock. Even if the trenching is done carefully – using a backhoe to remove the topsoil and then the deeper materials and then refilling the trench using the same materials, replacing them in reverse order – there is serious environmental disruption. Excavated material expands as much as 20 percent or more, which means the materials can not all be returned to the same trench.⁸⁸ Needless to say, all of the vegetative cover has been lost, and the soil structure will have been changed.



While the territorial governments have improved the regulation of mineral exploration in recent years and often require environmental assessments and public consultation prior to advanced exploration, most provinces have few or no regulatory requirements to rehabilitate these impacts in the early stages of exploration. However, some provinces and all the territories do include at least general direction in their regulations related to mineral exploration. For example:

- Saskatchewan requires that prior to any mineral exploration that involves drilling, trenching or hydraulic removal of overburden the operator must provide an outline of the exploration program. Further details may be required.⁸⁹
- Newfoundland-Labrador requires a security deposit.
- The Yukon requires a permit for “Stage 2 and 3” exploration.
- In Alberta, no permit is required unless the surface will be disturbed, and then an exploration permit (which costs \$50-\$100) is needed.
- In Newfoundland and Labrador, an exploration company which intends to do diamond drilling, trenching, heavy mineral studies or airborne geophysical surveys, or which will make extensive use of off-road vehicles or establish a camp, must provide an exploration plan. Work cannot commence until the plan has been reviewed by the department and an exploration approval issued.⁹⁰

In Ontario, however, an exploration project can surface strip up to 10,000 square metres, or 10,000 cubic metres without a permit as long as the stripped areas are separated by at least 500 metres from each other and are at least 100 metres from the nearest water body.⁹¹

Reclamation costs following strip-ping and trenching can vary significantly, depending on the site and the level of disturbance. Generally, costs will range from less \$1,000 per acre (\$2,400/hectare) to more than \$30,000 per acre (\$72,000/hectare).⁹²

Drilling

In a typical chain of exploration activities, drilling comes next.

Drills with diamond bits bore deep into earth, often going thousands of metres through solid rock, in order to produce sample rock cores which are then assayed or assessed for the presence of valuable minerals. If initial drill samples look promising, a series of drills will be done, often in a grid like fashion, and the results will be analysed as part of mapping out the ore body.

Drilling is done using two main methods: percussion drills which break up the rock as the hole is drilled producing rock chips like coarse sand which are flushed to the surface by circulating fluids or by compressed air; and core drilling methods which recover more or less continuous rock core from the drill hole by grinding, or cutting, an annular ring of rock from around the central core and recovering the core by a system of retaining core barrels or tubes. Percussion drilling uses steel rock bits and uses compressed air or water to force the drill cuttings to surface, where a representative sample is collected. Core drilling uses a hollow drill bit set with small diamonds, and drilling fluids are forced down the inner side of the drill rods. A drill core – a slender column of rock – is produced in approximately ten foot lengths.⁹³

Costs vary greatly, but can be averaged around \$30 per metre for percussion drilling and \$60 per metre for diamond drilling, plus the costs

of getting the equipment in and out, camp costs, and other supports.⁹⁴

There are numerous environmental concerns related to drilling during mineral exploration. Some common concerns are related to spills or leaks of fuels, oils and drilling fluids into soils, leading to contamination of vegetation, or into local water bodies.⁹⁵

The drill cores themselves are of concern. Regulations focus on storage of the drill cores for information purposes related to the mineralogy of the site and future mining potential. However anecdotal evidence suggests that it is common practice to simply discard the drill cores at the exploration site, creating potential for a number of physical hazards as well as environmental impacts such as those related to acid mine drainage, metal leaching or radiation.

The release of radon gas to surface is a concern that is perhaps highest in operations exploring for uranium, but it is not restricted to uranium exploration, given that thorium and uranium are present in many ore bodies that may be explored for other metals.

Radon is a cancer-causing, radioactive gas which is odourless and tasteless. It is a by-product of uranium, and has been estimated by the U.S. Surgeon General to have caused many thousands of deaths each year, and has been named the second leading cause of lung cancer in the United States today.⁹⁶ It is released from the drill holes themselves, but also from drill cores and rock samples.

Bulk Sampling

Before actual mine development, bulk samples are usually taken to more accurately establish the grade of the ore. Bulk sampling can

be done from surface, or through sinking of an exploratory underground shaft. Bulk sampling usually involves the removal of large volumes of ore.

Bulk samples range from one tonne to 1000 tonnes or more. Test milling procedures may be done in laboratories using small samples, in test plants available in certain localities, or in pilot mills erected to mill pre-commercial quantities, such as 100 tonnes per day.⁹⁷

In Ontario, for projects between ten tonnes and 1,000 tonnes, operators must obtain a "letter of permission." The written application must describe the materials that are to be excavated, the amount of material, the excavation methods to be used, and what rehabilitation will be done. A financial assurance must be provided for the greater of \$500 or \$1.00 for each tonne of the material to be excavated. The financial assurance will be returned following receipt of a final report, unless it is "proven" that the rehabilitation work was not completed.⁹⁸

Under Ontario's mining laws, bulk sampling of over 1,000 tonnes passes an exploration project over the regulatory threshold and makes it an "Advanced Exploration Project," with requirements to develop and file a closure plan with the Ministry of Northern Development and Mines and provide public notice that the project is underway.

In British Columbia, bulk sampling can be done under a "Notice of Work" for "Small Mines and Exploration Projects" which is filed with the Mining Operations Branch District Manager.⁹⁹ The "Notice of Work" requires very general and brief descriptions of locations, equipment, and reclamation work. If bedrock excavation is to be 1,000 tonnes or more a program

for predicting and managing acid mine drainage and metal leaching must be provided.¹⁰⁰ Only sampling which results in the extraction of an amount equal to or greater than 10,000 tonnes of mineralized rock must comply with Part 10.1.2 of the B.C. Mining Code.

In bulk sampling, the line begins to blur between mineral exploration and mining. Bulk sampling is often underground exploration, and often requires sinking a mine shaft or driving a "decline" or mine adit into a hillside (essentially, a mine adit is a horizontal mine shaft).¹⁰¹

Underground exploration investigates the continuity of the mineralized zone, and provides information about rock stability and structure and possibly water flows. From the explorationist's perspective, the bulk samples allow extensive metallurgical studies and test milling.¹⁰²

Feasibility Studies

At this stage, the company will undertake a feasibility study to examine questions of profitability, and prepare the company to go to financiers for money to develop a mine. The feasibility study will address a number of questions:

- 1) A description of the ore body. A detailed set of drill results and estimates (grade, how was the cut-off grade set? how extensively is the area explored?) prepared by an independent qualified person.
- 2) Capital requirements to develop the mine; projected cash flow.
- 3) Access to the ore body and to the land to develop it.
- 4) Energy - How much power will the project require? What is the source(s) of that power? How much will it cost?

The Aquarius Mine in Timmins, Ontario is an open pit gold mine with a projected life span of five years. Numerous issues surround the mine development proposal, including a scheme to fill a cold-water stream in a nearby Boreal valley with the mine tailings. However, nothing illustrates the elastic boundaries of “advanced exploration” better than the installation of the mine’s experimental freeze wall. The mine design includes surrounding the open pit with a freeze-wall, which is purported to replicate permafrost, and therefore create a barrier to control groundwater movement during open pit operations. The company, Echo Bay Mines, installed the freeze wall - a series of pipes every eighteen inches that will be filled with brine brought to sub-zero temperatures - and two giant freezer plants, all before a single provincial permit had been issued or the federal environmental assessment concluded.¹⁰³ Company reports in 1998 indicated an intention to actually begin freezing the sub-surface wall before provincial permits were issued, in order to demonstrate the method’s feasibility and thereby attract needed investment and development dollars.¹⁰⁴

5) Transportation - What are the plans for transportation infrastructure? (rail, roads, port development, etc.) What will it cost?

6) Water - How much water will be needed? Where will it come from?

7) Labour - What are the labour needs: skilled and unskilled? At construction?

8) Market - Where will the ore be processed? Is there a need to transport ore to different smelters and refineries (e.g., zinc, copper, gold)? What competition can be expected for the product? Nationally? Internationally? What penalties will there be for contaminants?

9) Regulatory Approvals and Permits- Provincial and federal permits required? Areas of regulatory uncertainty: changes to federal or provincial legislation, political uncertainty.

10) Unfunded liabilities: Accident potential: earthquakes, avalanches, flood events, experimental technologies etc. Emergency plans? Closure and reclamation bonding requirements: long-term liability.

11) Competitive Internal Rate of Return (IRR) and Net Present Value (NPV).

The mine infrastructure begins to develop, often while the feasibility studies are still being done. This includes shaft sinking, pit excavation, road building and construction of surface facilities. The mine site will be designed, including: mine production and processing facilities, waste management areas for waste rock, tailings and solid waste and sewage, and administration buildings. Depending on location, mine design and development are also likely to include the design and construction of roads,

diesel farms, power-lines, and exploration and mining camps.

All of these activities – and associated impacts – are quite likely to occur in the course of gathering the information a company will require in order to make a decision to move to an operating mine. Except in jurisdictions that provide for Environmental Assessment of advanced exploration, all of this activity will take place prior to any environmental review of the mine proposal.

Impacts from mineral exploration

Impacts from mineral exploration are numerous. Overburden is stripped. Many kilometres of geophysical grids are cut through vegetation and surface soils. Large volumes of water are consumed. Roads and trails increase overall access to the area, making other development projects more attractive and increasing hunting pressures. Leaks of fuels, oils and drilling fluids lead to contamination of soils, spawning streams and fish-bearing waters. Garbage is left behind in exploration camps. Mine waste, e.g. waste rock and ore, is left behind and may be acid-generating/metal-leaching. Noise, such as that from drill rigs, ATVs and 4x4s, and low-flying aircraft carrying sensing equipment, further disturb wildlife and people who live in the Boreal.¹⁰⁵

Drill cores may be left at the site indefinitely, leaching heavy metals and (if radioactive) radiation. If the company is drilling for uranium, the drill holes can act as conduits for radon gas to get to the surface, where it can contaminate surrounding plants.

Radiation effects are a special concern in mineral exploration, as they are in uranium mining and milling. However, as noted above, in mineral

Exploration Cycle

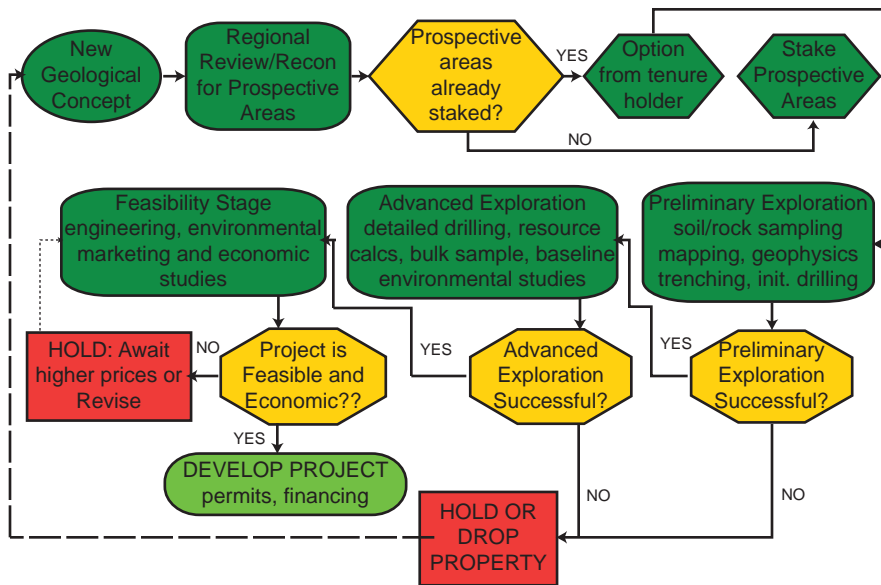


Figure 1 Source: "Mineral Exploration," Prepared by FinisTerre Mineral Industry Advisors, March 2003

exploration they are primarily a concern with uranium exploration, but not exclusively, given that rock formations being explored for other metals may also contain thorium and uranium.

Exploration crews searching for uranium will receive radiation exposures from uranium and its associated radioactive decay products in the drill core and cuttings, as will other nearby residents and users of the same land base.

The three primary sources of radiation exposure due to mineral exploration are:

- Gamma radiation
- Radon gas, and
- Radioactive dust

The primary source of worker radiation exposure will be from external gamma radiation. The external gamma radiation dose received by exploration crews will depend on the grade of uranium ore (varying from approximately 0.1 percent to approximately 20%), the amount of time the workers spend close to the drill core or ore samples, and the amount of drill core and ore

samples in the vicinity.

Radon gas will emanate from the core samples and drill cuttings. Radon gas and radon progeny are not considered to be a significant source of worker radiation exposure because it is assumed that the drill core is being handled in a well-ventilated area.

The radiation dose that workers receive from the inhalation or ingestion of fine radioactive dust (containing alpha or beta particles) can be significant if basic preventive measures are not taken. That includes "good housekeeping" to prevent the re-suspension of dust by workers moving about, cutting of core samples by a wet process or in a separately ventilated enclosure.

According to the "Occupational Health & Safety Radiation Protection Guidelines for Uranium Exploration" issued by Saskatchewan Labour "it should be evident that exploration crews are unlikely to receive significant radiation exposures as long as the uranium mineralization they are working with has grades below 0.2

% uranium." The average grade of uranium in Saskatchewan is 4-5%; uranium exploration reports in northern Ontario are estimated grade at 0.3%, both of which are in the "significant radiation exposure" zone, even by the permissive standards of Saskatchewan Labour.¹⁰⁶

Because they are working with "naturally occurring radioactive material," exploration crews are classified as incidentally exposed workers and are regulated provincially. This is in contrast to workers in uranium mines who are usually classified as nuclear energy workers and whose radiation exposures are regulated under the federal *Nuclear Safety and Control Act*.¹⁰⁷

2.4 Mine Operation

Extraction

The operation of a mine includes not just the mine itself (where the ore is removed from the ground) but also the creation of waste rock and mine tailings, and all of the infrastructure related to the mine's operation.

Major impacts of mine development include air strips, roads and power lines. This mine infrastructure will use and impact much more land than the mine itself. An instructive example is the three major highways into Saskatchewan's Boreal forest north of the Churchill River, which have all been built to serve the mining industry. Public and community access has been incidental. These highways, to Cluff Lake, Key Lake and Wollaston Lake, involve about 1,000 kilometres of road constructed largely at public expense.¹¹¹

Surfacemining operations can create serious dust problems, and open pit and strip mine projects, many of which operate 24 hours a day, also

At the proposed Kemess North Mine, the gold grade is only .307 grams per tonne of ore, and copper is .16 % of the ore. The mine is expected to produce 397 million tonnes of finely ground toxic tailings and 325 million tonnes of acid-leaching waste rock. Northgate Mineral's preferred option was to dump the waste rock and tailings into nearby Duncan Lake.¹⁰⁸ At Northgate's sister operation, the Kemess South Mine, 260 tonne haul trucks move more than 30 million tonnes of waste rock each year.¹⁰⁹

At the Cigar Lake Mine in northern Saskatchewan, waste rock will be a source of arsenic, thorium, radium and radon contamination (radon will also emanate from the mill and the tailings facility) for hundreds of thousands of years.

At Cigar Lake, high-grade uranium ores will be mined underground using waterjets to cut the rock. Phase I of the Cigar Lake project will take 11 years, and will produce over 8,000 tonnes/year of U_3O_8 from the rich eastern part of the ore body. Phase II will last longer (28 years), and will produce about 2,700 tonnes/yr. Waste rock from the mining operation will be dumped into Bizarre Lake, which is 3 km northwest of the mining site. A total of 36% of the volume of Bizarre Lake will be infilled by this waste rock, which will be bulldozed far enough into the lake to remain underwater. As a result of heavy metals leaching out of waste rock, arsenic levels in the waters of Bizarre Lake could exceed the Saskatchewan Surface Water Quality Objectives (SSWQO) within 20 years of the start of operations.¹¹⁰

create high levels of noise and light pollution. Blasting in mines, both open pit and underground, can affect the local water table and local well conditions, as well as the structural integrity of local buildings. Stories abound in mining towns of pictures shaken from walls, and tea cups sent dancing off their shelf when the local mine blasted.

While the mine shaft and milling facilities may be relatively localized, the impacts of waste rock, tailings and waste water storage are enormous.

The ore can be extracted in a number of ways: an open pit or series of pits, strip mining, underground operations, or through heap leaching. Those extraction systems which create the most surface disturbance and create the most waste rock – strip mining and open pit mining – are the most economical to operate.

However, underground operations also heavily impact the environment, particularly in terms of water consumption and contamination, largely through mine dewatering. Underground mines have to be constantly pumped to keep them dry enough to allow operation.

During a mine's operational period, water is pumped out to keep the mine dry and to allow access to the ore body. Pumped water may be used in the extraction process, sent to the tailings impoundments, used for activities like dust control, or discharged as a waste.

The water can be very acidic and laden with high concentrations of toxic heavy metals, including methyl mercury, or with radionuclides.

Estimates are that in Canada the gross water use of the extraction stage of metal mining is 1,542 million cubic metres of water per

year.¹¹²

Waste Rock

All mines create waste rock, and a great many, by extension, create acid mine drainage when the sulphide bearing waste rock is exposed to air and water. This phenomenon is discussed in more detail in Section 4.

Waste rock comes from the need to remove a large volume of rock which is not ore-bearing in order to get to the ore body. Waste rock can also include low grade ore, which may be stored separately in a stockpile for later processing when prices are potentially higher, or mixed with high grade ore to provide a consistent grade for the mill. In both underground and open pit mines, waste rock material ends up on the surface where it and runoff water must be managed.¹¹³

Waste rock is created at a rate of one million tonnes per day in Canada. To mine one tonne of gold, between one and three million tonnes of waste rock are generated, depending on the grade of the ore. At the Golden Bear Mine in northern British Columbia, mining enough gold to create a 6 gram wedding ring will require more than 6 tonnes of waste rock and tailings.¹¹⁴ In 2004, 228 million tonnes of ore was mined in Canada from metal mines, and an additional 70 million tonnes of ore from non-metal mines.¹¹⁵

Piles of mine waste rock and dumps of overburden material (soil and vegetation moved to expose the bedrock) can be massive structures. Some mountain top coal mines in British Columbia are constructing the largest man-made structures on the face of the earth. These immense waste dumps are often up to 400 meters high and contain in excess of one billion cubic meters of material.¹¹⁶

At the Wolverine Project in the Yukon Territories, the developer estimates that the relatively small mine will generate 1,940,000 tonnes of potentially acid-generating waste rock. Approximately 2/3 of the waste rock will be placed back underground, but over half a million tonnes will require above-ground disposal, along with another million tonnes of dilution waste rock which will be separated from the ore during mill processing.¹¹⁷

The generation and management of mine waste is such a significant part of a mining operation that the mining industry is in fact a waste management industry.

While many mines have tailings which are acid generating and metal leaching – resulting in massive amounts of environmental contamination – uranium mines have additional problems.

Each year Canada's uranium mining and milling activities produce around one million tonnes of waste rock and tailings.¹¹⁸

Waste rock management and rehabilitation are laden with both environmental and economic consequences which can significantly affect the viability of local ecosystems and the profitability of mining operations. Examples have shown that rehabilitation costs following inadequate planning have been greater than \$100,000 per hectare.¹¹⁹

2.5 Processing

In the processing stage, ore is crushed and ground in the mill, and the valued metals are separated from waste using gravity, magnetic, or flotation techniques. This results in two streams: concentrate that is

Project Phase	Total Waste (t)	Source of Waste Rock	
		Mine Development	Stope Drifts
Advanced exploration (2005)	62,000	62,000	
Pre-production (2006-7)	70,000	70,000	
Operations (2007-19)	1,808,000	338,000	1,470,000
Total	1,940,000	470,000	1,470,000

further refined either on or off-site, and the mine tailings, the management of which poses one of the greatest challenges to the mining industry.

The water quality impacts which begin at the exploration and mining stage intensify at the mine mill, for two reasons. First, the milling process creates mine tailings. Secondly, in the processing of the ore – first in the mill, and later in the refinery and/or smelter – a number of chemical agents are added to the toxic soup which is mine effluent. On top of that, the processing of minerals demands a huge supply of energy, and refining of the metals has enormous impacts on air quality.

Milling

One of the biggest impacts of both mining and milling is acid mine drainage. Acid mine drainage happens when water and air meet acid-generating sulphates in a rock. The greater the surface that is exposed, the greater the acid-generating ability of a sulphide-bearing rock. In the process of removing rock from the ground and grinding it into very small particles, the rock's greatest potential for acid generation is reached.

Common pollutants from metal mines and milling processes include arsenic, cyanide, copper, selenium, mercury, cadmium, lead, nickel and zinc. Chemicals used in high volumes at mine sites, primarily as reagents in the milling process, include ammonia, calcium chloride,

chlorine, hydrochloric acid, copper sulphate, sodium cyanide and sulphuric acid. Many of these chemicals and heavy metals have been declared toxic under the Canadian Environmental Protection Act.

These same pollutants are transferred out into the natural world, through air and through water. Heavy metals pass through plants into the food chain, affecting reproduction and wildlife and ecosystem health.¹²¹ Industry's efforts to treat mine and mill waste water frequently mean adding more chemicals or foreign substances to the water, usually at the "end of pipe" or close to the property's edge. Regulatory limits on pollution only apply as the contaminants leave the mine property.

As the ore is being extracted from the mine, the ore and waste rock are separated. The ore is then processed through a number of steps, with a variety of treatments or techniques used for each step. Major steps in ore processing include grinding and crushing, chemical or physical separation, and dewatering.

Grinding and crushing are done to further separate the valued minerals prior to further processing. Crushing is used for coarse size reduction, and is done dry. Grinding is done wet and is used to achieve finer size reduction. Chemicals such as lime, soda ash, sodium cyanide and sulphur dioxide many be added in the grinding circuit in preparation for ore

At the recently closed Dome Mine in Timmins, the mine effluent had been persistently lethal to the two test organisms, Rainbow Trout and *Daphnia magna*. The company (the mine was owned by Placer Dome at the time) suspected that copper was the cause, although the copper levels were below those permitted in the regulation. The company's response was to add yet another chemical to the mix: Ethylenediamine Tetraacetic Acid. EDTA is a chelating agent, which makes the harmful pollutant - in this case thought to be the copper - biologically unavailable for a certain period of time. Simply put, the company began adding EDTA to its lethal effluent, making the toxic elements in the effluent biologically unavailable to the test organism for long enough to pass the lab tests. However, the problem is clearly not solved; it is simply displaced and left to reappear further downstream.¹²⁰

separation. The ore must be ground fine enough – to about the consistency of face powder – to “liberate” the desired minerals from the waste material or the separation methods that follow will not be as effective.

After the ore has been crushed and ground – creating the most surface area possible – the ore then goes through either a physical process or a chemical process of separation.

Physical separation processes rely on differences in size, density or surface energy that cause differences in the physical properties or behaviour of mineral particles. Common processes are gravity separation, where minerals are separated on the basis of differences in their density, magnetic separation where minerals are separated on the basis of differences in the minerals' magnetic susceptibility, and flotation separation where minerals are separated on the basis of differences in their surface properties. All three of these so-called physical processes may use some amount of process reagents, i.e. chemicals.

Flotation separation is the most commonly used process for physical separation, and it uses the most chemical reagents. In this process, ground ore is mixed with water, forming a slurry. Air bubbles are introduced into the slurry, and minerals that favour contact with air float to the top and those that favour contact with water stay in the slurry, resulting in a separation of the various minerals in the ore.

Chemical separation processes use chemicals to dissolve and precipitate one or more minerals. They are commonly used for the recovery of gold, silver and uranium, and in some cases it is used for the recovery of copper.

The most common method for

recovering gold or silver is to leach them with cyanide. A solution of calcium or sodium cyanide is used to dissolve the metal, it is leached with cyanide, and then recovered. Uranium and copper are leached using sulphuric acid, after which it is recovered using an ion exchange or a solvent extraction.

The concentrates from most physical ore separation processes are in the form of a slurry, which must then be dewatered prior to further processing.

The end product of ore separation is an ore concentrate. Ore concentrates are then sent for further processing, such as at a smelter or refinery, to produce a pure metal for sale, such as gold, or an industrial product which will go on to further processing or production, such as uranium trioxide which is used to make pellets for fuel rods in nuclear reactors.

Tailings

Tailings are an extremely high volume “by-product” of ore separation. Tailings are a mixture of water, finely ground rock from which the valued minerals have largely been removed, and residues of all of the chemicals that have been used in the processing of the ore.

There are three primary environmental concerns associated with mine tailings: loss of habitat due to the extensive areas required for tailings management, impacts on water quality and aquatic ecosystems, and impacts on air quality, primarily from dust.

Common minerals and elements found in tailings include arsenic, barite, calcite, fluorite, radioactive materials which are naturally present in many ores, mercury, pyrites/sulfide compounds, cadmium, and hydrocarbons introduced

by mining and processing equipment (e.g. oils & greases). Common additives found in tailings include cyanide, sodium ethyl xanthate and potassium amyl xanthate which are flotation agents, methyl isobutyl carbinol which is a frothing agent, sulfamic acid which is a cleaning / descaling agent, sulfuric acid used in leaching, activated carbon which is used in CIP (Carbon In Pulp) and CIL (Carbon In Leach) processes, and calcium compounds which have been introduced as lime to aid in pH control. Tailings are “disposed” of, or managed, in two primary ways in Canada: by returning them underground, or through tailings management areas on surface. Because the material expands considerably during the processing stages (described above) it is generally not possible to return all the tailings to the underground, even if a company was to make that kind of a commitment. Management on surface has generally involved creating an impoundment through the construction of a series of dams or the taking of a natural valley – or lake – for tailings disposal. A dry cover and vegetation will generally be established to control dust and direct run-off, or a water cover to prevent acid mine drainage and metal leaching in cases where the tailings are acid-generating.

An estimated 417,813 metric tonnes of mine tailings are generated each day in Canada, for a whopping total of 152 million tonnes per year.¹²²

Mine tailings are commonly acid generating. Use of a water cover and the addition of lime is the most common treatment for acidity. Ferric sulphate is frequently added to precipitate heavy metals.

Smelting

Refining and smelting metals creates a number of serious air quality impacts, including the release of sulphur dioxide and fugitive and stack releases of heavy metals, which can contaminate waterbodies and soil and impair human and ecosystem health.

Further metallurgical processing, such as smelting and refining, is carried out either on-site, or off-site, with the concentrates shipped to another facility for further refinement.

Base metal smelters extract metals of “economic value” from concentrates for sale to global markets: copper, lead, zinc, nickel, cobalt, cadmium, silver gold, platinum and palladium. In the process of extracting these metals, vast amounts of hazardous pollutants detrimental to human health and the environment are released to air, land and water, all of which make these operations a major source of pollution in Canada.

While dust and diesel fumes are air quality problems encountered during mining operations, it is in the refining stage that air quality impacts become extreme. Regulation of air quality is usually a matter of provincial jurisdiction and the regulatory regimes do not prevent substantial releases of sulphur dioxide (SO₂) and other harmful substances, including arsenic, nickel, cadmium and lead.¹²³ For example:

- Manitoba has a regulation to control the release of SO₂ which was written specifically for the mine complexes in Flin Flon and Thompson (HudBay and CVRD-INCO, respectively). The

limit is set at 34 ppm, and when the companies exceed that limit, they must notify the public.

- Ontario’s regulatory standard for SO₂ is .25 ppm, but from 1983 until 2001, the smelters in Falconbridge and Sudbury operated under a special control order which allowed a release of .50 ppm. In 2001 the Ministry of the Environment “toughened” the control order with new requirements to reduce emissions to .34 ppm by 2002. The companies will have fourteen years – until 2015 – to meet the current legal limit of .25 ppm.¹²⁴

Approximately 800,000 tonnes of SO₂ are emitted annually from smelters in Canada, about one-third of the total from all industrial sources. Three facilities alone – Inco Copper Cliff, Inco Thompson and HudBay in Flin Flon, contribute to more than 80% of these emissions, each emitting in the order of 200,000 tonnes.¹²⁵

Over the years, most smelters have reduced their emissions by the construction of sulphuric acid plants and the introduction of other technologies, in order to comply with regulated limits. Despite this, the base metals sector remains the single largest industrial source of sulphur dioxide emissions as well as emissions of a number of highly toxic metals – mercury, arsenic, cadmium, chromium, lead, beryllium, and nickel in Canada.

Flin Flon’s HudBay smelter, in operation since 1930, is notorious for its emissions of mercury, one of the most pervasive toxic substances known. Where emissions from this facility were in the order of 20 tonnes about 15 years ago, they remain inordinately high (over 1400 kg annually) today, making this facility the largest point source of mercury emissions to air in North America. There are untold

amounts of mercury in the tailings ponds of this facility and in this community.¹²⁶

Sulphur dioxide, along with other pollutants, is a major cause of acid deposition which is linked to other environmental issues such as climate change and the leaching of mercury (in its most toxic form, methyl mercury) into rivers, lakes and streams. Likewise, the toxic metals – arsenic, cadmium and the like, add to the toxins in the waterbodies and soil, severely compromising the health and diversity of the forests, vegetation and the aquatic and terrestrial ecosystems upon which we all depend.

Exposure to SO₂ (as a gas and in the form of miniscule sulphate particles) can contribute to asthma, bronchitis, cardiovascular disease and possibly lung cancer. Similarly, mercury and lead are extremely toxic and a cause of developmental and neurological disorders as well as damage to organs. Arsenic, nickel, chromium and cadmium are associated with the development of various cancers. For a number of these substances, there is no “safe” threshold below which adverse effects cannot be found.

Communities in Sudbury, Thompson, Rouyn, Flin Flon, Belledune, Trail and other smelter towns bear the brunt of the pollutants most directly and are particularly at risk of having elevated rates of asthma, cancer and other pollutant-related ailments. Because many of these pollutants, such as SO₂ and mercury, are long-distance travelers, their influence on environmental and human health is also exerted hundreds and even thousands of kilometres from their source.

The legacy from these smelters will live on long after these facilities shut down. In economic terms, the

costs for remediation, health care and lost opportunities for other development are significant.

2.6 Mine Closure

At this stage in the mining sequence, the economic ore body has been exhausted and the mine has to be closed. The mine site should be returned to its “original” state or to a productive alternative. Structures are removed, openings to surface capped, and re-grading and revegetation work done. Most often the area is reclaimed by constructing ponds, ditches, dykes, and wetlands or tailings areas, and by establishing vegetation over the mine site, the waste rock piles and any mine tailings areas not under water.

It is important to note that there has never been a major mine in Canada that has been fully closed out, and fully returned to a productive alternative, far less to its “original state.” There are many issues around mine closure: the standard of care that is provided, public oversight in the mine closure plan and its implementation, the long-term nature of the impacts, and the need for long-term monitoring and perpetual care.

Mine closure and reclamation is an expensive and lengthy process, with uncertain results. Long term monitoring is needed to ensure that the remediation efforts are successful and to identify any new or emerging environmental concerns.

It may take a decade or more for problems to emerge. For example, at Algoma Ore Division’s closed out George McLeod Mine in Wawa the underground workings slowly filled with water. When the underground workings reach the “full” point and start discharging to surface water – estimated to begin 10 years after its closure in 1998 – the

mine water will require treatment of acidic discharge, possibly in perpetuity, in order to meet surface water quality standard.¹²⁷

Closure Plans

In most jurisdictions government policy requires that prior to mine start-up, an approved closure plan detailing all clean-up requirements must be in place, with financial securities assured by the mining company sufficient to cover the cost of implementing the closure plan. However, this policy is not necessarily reflected in regulation or in practice. Moreover, the cost estimates for mine closure and long term care are generally not publicly available, and public consultation is either limited or absent.¹²⁸

At some mines, estimated closure costs and associated financial securities posted by the mining companies in conjunction with the mine closure plans, are much lower than real costs are likely to be. Québec deliberately sets the bond at 70% of the cost of reclaiming the tailings.

Closure plans for the mines may not include appropriate disposal or treatment of massive piles of acid-generating/leachate toxic waste rock, and may not appropriately evaluate the risk of groundwater contamination to the area through seeps from the tailings areas and underground workings. In such cases, the actual closure costs will be far greater than those initially estimated, or the closure work will be limited and environmental impacts will result.¹²⁹

While there is a somewhat common approach to closure planning in jurisdictions across Canada, there is also a great deal of variety in application of that approach. Generally, policies require the identification of the mine owner/operator as the party who is responsible for mine

closure and associated costs. They usually emphasize physical stability of the mining site at the time of closure (capping mine shafts and preventing inadvertent access to mine openings, for example). Closure planning requirements are usually accompanied by a requirement for some form of financial assurance, and include some broad statements suggesting an expectation that the mine site will have some alternative use possible after closure requirements have been met.

In some cases, the bar is set particularly low. In the Yukon, the goal is “to return the mine site to a viable and, *wherever practical*, self-sustaining ecosystem.”¹³⁰

Requirements for public review of mine closure plans and related financial assurances vary greatly. In Ontario, there is a requirement for a public notice and an information centre in the local area prior to mine development, and a notice is posted on a provincial electronic registry advising the public of a 30-day comment period during which they can visit the Ministry of Northern Development and Mines offices in Sudbury and review a mine closure plan. For the very few who do, there may be information about the financial assurance and its form included in the several binders that usually comprise the closure plan, but the form and amount of the financial assurance is not otherwise available to the public.

Under the Yukon’s new Mine Site Reclamation and Closure Policy, mine operators are “encouraged” to seek the views of the public in developing the closure plan, but not actually required to do so.¹³¹ But that is still one step better than in Newfoundland-Labrador. The word “public” does not appear in the regulation under Newfoundland’s Mining Act dealing with mine

closure and financial assurances.¹³²

Requirements also vary a great deal with respect to annual reports. In Ontario, companies are required to prepare annual reports describing progressive reclamation, but they are only required to provide these to the Ministry of Northern Development and Mines on request. Under Newfoundland and Labrador Regulation 42/00 (Mining Regulations under the Mining Act) annual reports must be provided each year, within two months after the end of the operating year, but the regulation does not require that the annual report include any description about progressive rehabilitation work that has been done, or any other aspect related to mine closure.¹³³

Financial Assurances

Financial assurances in the Yukon “will be reasonable, flexible and responsible.” The financial assurance instrument is supposed to provide the Minister with a “reasonable ability to access the full security at any time” Alternatives to the posting of real funds will be considered.¹³⁴

In Newfoundland and Labrador financial assurances are required, but are based on a closure plan which may or may not have had any public scrutiny and which may or may not adequately estimate the amount of rehabilitation that will be required and the financial resources needed to return the site to an environmentally stable condition.¹³⁵

In Ontario, financial assurances can be in the form of cash, bank drafts and certified cheques, letters of credit, surety bond, a qualifying environmental trust, corporate financial tests (meaning self-assurance), pledges of assets, sinking funds, a per tonne levy or royalty, or a bank letter of guarantee.¹³⁶ As

mentioned above, there may be information about the financial assurance and its form included in the several binders that usually comprise the closure plan, but the form and amount of the financial assurance is not otherwise available to the public. In 2006, MiningWatch Canada obtained information about self-assurance at mines in Sudbury through an Access to Information request.

The Exit Ticket

In response to industry's concerns about the costs and uncertainties associated with cleaning up after themselves, Ontario introduced the concept of "exit tickets" in their 1996 round of changes to the Mining Act. Under this new scenario, after a company completes the remedial work set out in their own closure plan, the operator may apply to the Province for an "exit ticket," through which all liabilities and ownership of the property – and its associated hazards – would be transferred back to the crown.

In June 2001, Homestake Canada and Barrick Gold, joint owners of the Renabie Mine, applied to "surrender" the Renabie Mine patented mining claims to the Crown. Homestake and Barrick propose to make a one-time payout of \$102,290,¹³⁷ and, in exchange, to be exempted from any further site liability even if it arises as a direct result of the companies' (in) actions. To date, the Ministry of Northern Development and Mines has not issued the exit ticket for this property, but nor has it been removed from the public registry of proposed instruments to be issued by the Ministry of Northern Development and Mines.

2.7 Perpetual Care

After a mine has been closed – after buildings have been demolished

and most structures removed, openings to surface capped, regrading done, and revegetation initiated – the mine moves into a state of perpetual care. This means that the site must be cared for forever, or at least into the foreseeable future.

After closure, most major mines require perpetual care to monitor such concerns as structural stability of the dams and structures which impound millions of tonnes of tailings. Many mines also require water treatment long after closure, some virtually into perpetuity. Long term monitoring is also required to identify new and emerging environmental issues, such as latent acid-generating potential or changes in surface water quality. The stability of underground workings and pit walls is another concern. Sludge from any waste-water treatment ponds must also be managed.

A key purpose of perpetual care is the ongoing inspection of the stability of dams that contain tailings. Tailings dams have failed due to weaknesses in construction or from overtopping. In addition to extraordinary rainfall events, overtopping can occur because the spillway is inadequate, or because beavers have built dams in the area. Beavers frequently dam spillways, causing the tailings pond to overflow or increase the water pressure on the dam, resulting in its collapse and the release of massive volumes of tailings.

There are numerous examples of major tailings dam failures in the past, both in Canada and abroad. In August 1995 a tailings dam failure at Cambior's Omai Mine in Guyana released) 4.2 million m³ of cyanide slurry, resulting in an 80-kilometre section of the Essequibo River being declared environmental disaster zone. Less than a year later, in March 1996, a loss of tailings at

Placer Dome's Marcopper Mine in the Philippines filled 18 kilometres of the local river with tailings, forcing the evacuation of 1200 residents and resulting in \$80 million in damages. In April 1998 the operations of a third Canadian company, Boliden, caused another environmental disaster when a dam failure at the Los Frailes Mine in Spain released 4-5 million m³ of toxic water and slurry, covering thousands of hectares of farmland.¹³⁸

Closer to home, there is a long history of major dam failures in Canada. British Columbia examples include an August 1991 incident when a dam failure at Cominco Ltd's Sullivan mine released 75,000 m³ of material during a construction project at the tailings impoundment. On November 30, 2004, Teck Cominco's tailings pond dam at Pinchi Lake failed, resulting in toxic, mercury-laden effluent spilling into a fish-bearing lake. The dam was 100 metres long and 12 metres high. An ill-fated reclamation activity directed by the company resulted in its complete collapse. The dyke itself was constructed with mercury-contaminated earthen material.¹³⁹

In Ontario, several failures have occurred in Ontario's Boreal region, including at the Zenmac Tailings near Schreiber, the Coppercorp Mine near Wawa, and the Matachewan Mine on the Montreal River, south of Timmins.

In 1990, a beaver dam constructed upstream caused a major dam failure at the Matachewan Mine, resulting in a major release from a 150,000-m³ tailings area. The release took out a section of provincial highway and contaminated the Montreal River, which was a source of drinking water as well as a recreational fishery. The Province of Ontario spent millions of dollars on clean-up efforts.

Perpetual care activities include treatment of effluent from acid-generating/metal-leaching waste. Waste can continue to generate contaminants for thousands of years. Treating mine effluent is costly, and the sludge precipitated from treatment must also be disposed of.

One of the greatest challenges in the closure and post-closure period is limited success in predicting future environmental conditions.

A major U.S. study released in 2006 examined 25 case studies of hard rock mines, comparing predicted and actual impacts on water quality in order to examine the reliability of predictions relied upon during the permitting process.¹⁴⁰

While 18 of the 25 case studies predicted low potential for acid drainage, 9 mines had acid drainage on site. The study found that 8 of those 9 mines had initially predicted low acid drainage potential or had provided no information on acid drainage potential. 21 of the 25 case study mines (84%) had exceedences of water quality standards in either surface water or groundwater or both. Nearly half of those had underestimated or ignored the potential for contaminant leaching in Environmental Impact Statements. The contaminants included copper, cadmium, lead, mercury, nickel, or zinc (in 63% of the cases), arsenic and sulphate (58%), and cyanide (53%).¹⁴¹

Planning for perpetual care involves many unknowns, some of which have will have financial or environmental price tags. To ensure that monitoring and maintenance are provided in the longer term, adequate financial assurances are essential, as are the legal means to require companies to maintain financial responsibility for their mines' post-operation care.

There are an estimated 7,000 abandoned mines across the Boreal region (10,139 identified to date across Canada). In the absence of sound regulations, consistently implemented to make the mining companies responsible for mine closure and perpetual care, more will follow. If mines are created and then closed out inadequately – or not at all – and if the mining companies do not maintain long-term responsibilities for the long-term hazards, the mines of today will become the mistakes of tomorrow, with taxpayers and the environment footing the bill.

Government's failure to require mining companies to care for closed mines into perpetuity will result in more abandoned mines in the future.



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3.0 Mining and the Environment

3.1 Impacts on the Land

Access to the Land Base

The core issue from which all others flow is the historic assumption that mining is the highest and best use of land. This assumption is enshrined in the Free Entry claims system. A hangover from feudal England and the early colonization of North America, the current system of access to land and land title has become a fundamental source of uncertainty for all stakeholders, and is increasingly a source of conflict, primarily between the mining sector and the holders of surface rights, conservation interests and/or indigenous land rights.

In Canada, mineral rights usually rest with the Crown. The system currently in effect in most of Canada for staking mineral title (Alberta being the exception, where mineral permits are on allocation basis) gives priority rights to mineral exploration and development. This allows mineral claims to be established on by far the greatest proportion of public land, and also on private land where the mineral or sub-surface rights are not specifically granted to the surface holder, i.e. the property owner. Mineral claims can be staked without any consultation or any consideration of other values or potential land uses. Once established, a mineral claim then normally grants the claim holder the right to mineral exploration, with all of the companion impacts of surface disturbance, etc.¹⁴²

Over 23 million hectares of land were put under new mineral claims in 2005, bringing to more than 57 million hectares the land occupied by mineral claims “in good standing” at the end of 2005,

or approximately 5.7 percent of Canada’s total area. In Alberta, over 12% is under mineral claim, followed closely by Saskatchewan with 11.4% of its land base under mineral claim. Exploration spending continues to climb, with \$1.7 billion spent in 2006 and \$1.9 billion predicted for 2007. Spending is spread over 734 exploration and deposit appraisal projects across the country.¹⁴³

The issues around unfettered land access for the mineral sector are fourfold.

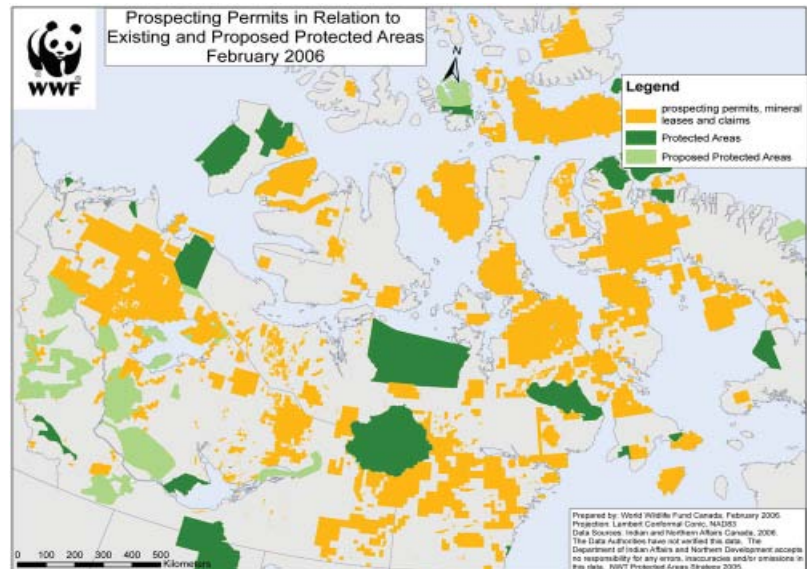
- Establishment of mineral tenure forfeits or makes more difficult other land use designations, such as protection of biodiversity and wilderness.
- The staking of mineral claims often proceeds where Aboriginal land rights are unsurrendered, but where Aboriginal control over the land base is not fully established.
- Mineral exploration activities proceed without consideration of the operator’s past practices or their ability or commitment to sound environmental performance.
- Establishing mineral tenure opens the door to exploration activities and all related impacts, including those impacts related to the infrastructure required to support a mineral exploration project. These impacts include exploration and haulage roads, rail lines, power lines and power generating facilities and water use.

Currently, in most jurisdictions, land can be withdrawn from staking for urban development and wilderness protection. However, there are increasing conflicts with an industry that wants the right to explore and mine in any area with “significant mineral potential.”

In the far North, conservation groups and Aboriginal peoples are faced with mineral claims that have been staked in caribou calving grounds; in areas of great cultural and spiritual significance and in unique and fragile eco-systems. The Traditional Knowledge concerns of elders in northern communities was confirmed in 2006 in a study undertaken by the World Wildlife Fund (WWF) Canada. The study found that “the pace of the mineral rush in Canada’s north is resulting in significant barriers to the establishment of protected lands and waters, and/or for protected lands as outcomes of current lands planning exercises. The mapping - produced by WWF Canada but based on government data - quite dramatically illustrates the significant proportion of Canada’s northern land base that is under prospecting permits, mineral leases and claims. The maps show a conservative portrayal of the situation, as oil and gas leases are not included – though such leases are extensive throughout the western Arctic.”¹⁴⁴

In northern Aboriginal land settlements, land use planning has endeavoured to protect these areas through land withdrawals and challenges to mineral development. However, in the Cree agreements and Nunavik in Québec, in Nunatsiavut in Labrador, and in Nunavut, most lands are categorized as Category 2 or 3 lands – which still ensures easy access by prospectors to mineral rights. Nonetheless, exploration rights can still be denied by the Aboriginal governments, or the various review boards.¹⁴⁵

In the Nunatsiavut Assembly, rampant uranium exploration is now being challenged with a motion to ban uranium mining on Nunatsiavut lands, brought forward by the Executive.¹⁴⁷



The February 2006 WWF Canada map of ‘Prospecting Permits in Relation to Existing and Proposed Protected Areas’ in Canada’s north¹⁴⁶

In Québec, advanced exploration on Cree lands and in Nunavik is subject to review by COMEV, the Environmental Assessment Tribunal.¹⁴⁸

In the Mackenzie Valley of the Northwest Territories, advanced exploration is subject to Environmental Assessment by the Mackenzie Valley Environmental Impact Review Board, which enables substantial public participation. In the fall of 2007, mining companies were stunned when the Review Board refused an advanced exploration permit to Ur-Energy for uranium exploration in the Thelon River basin. For the Dene, this area is the “place where God began” and is sacred. The Thelon is one of the most beautiful and wildlife-rich places in the North.¹⁴⁹

Similarly, people in the Yukon have had to deal with mining claims in the Tombstone Mountains, and in the Peel River watershed. In the Northwest Territories, there is an advanced exploration project in the heart of the proposed Nahanni Park expansion.¹⁵⁰

In the South, where the competition over land access is intense, the protection of large parts of the

landscape is even more difficult to achieve. For example, British Columbia, Saskatchewan and Manitoba have allowed mineral development within provincial parks.¹⁵¹

Ontario’s Living Legacy – the product of Ontario’s deeply flawed land use planning exercise in the late 1990’s – allowed mineral exploration in almost half of the newly created protected areas.¹⁵² As discussed in more detail in the regional overview of mining in Ontario, a lengthy process of “disentanglement” has followed in the near-decade since the Living Legacy’s suite of protected areas were announced. Dozens of areas that had been declared “protected” under Ontario’s Living Legacy have since been tossed out of the province’s system of parks and protected areas, in favour of allowing mineral exploration to proceed.

Manitoba struck the Protected Areas Initiative with conservation groups and the mining industry in 1990, which set aside protected areas and left others open for mining. The agreement was revised in 1996 and 2000. Any areas of significant mineral potential were excluded from protection.¹⁵³

Federal minister upholds contested decision to block arctic uranium exploration

October 25, 2007 – 18:58

By: THE CANADIAN PRESS

<http://www.570news.com/news/business/article.jsp?content=b1025152A>

OTTAWA – The federal cabinet has upheld a recommendation by a northern environmental regulator that the mining industry fears could sterilize a large and potentially rich chunk of the Northwest Territories to future development and cripple the ability of prospectors to look for new deposits.

In a letter to the Mackenzie Valley Environmental Impact Review Board this week, Indian and Northern Affairs Minister Chuck Strahl said he agreed with its recommendation to block Ur-Energy's (TSX:URE) uranium exploration program on the Upper Thelon area east of Great Slave Lake.

"The responsible ministers have agreed to adopt the recommendation of the review board," Strahl wrote.

Last May, the board shocked the mining industry when it denied Ur-Energy's plan to drill up to 20 holes near the Thelon River because it threatens the spiritual and cultural well-being of the area's Akaitcho Dene.

"If implemented, the recommendation of the review board would effectively terminate mineral exploration in an important part of the N.W.T.," three industry leaders wrote to then-minister Jim Prentice after the original decision.

"This would have a very detrimental effect on the investment climate of (the) N.W.T. and the North in general."

The letter was signed by Mike Vaydik of the N.W.T. Chamber of Mines, Gordon Peeling of the Mining Association of Canada and Tony Andrews of the Prospectors and Developers Association of Canada.

Individual companies working in the North also registered strong protests.

"The rationale behind the board's recommendation is such that it appears likely that no mineral exploration activities within the southeast N.W.T. will be possible," wrote Bayswater Uranium president George Leary, one of several mining CEOs who wrote to protest the board's recommendation.

Miners claimed that the board had created a de facto national park without any of the normal consultations. However, Strahl's decision promised his department would come up with a plan for long-term land-use planning for the area by the end of November.

"It would be an action plan for developing the resources in the area," said Carolyn Relf, the department's director of minerals and petroleum development....

...Miners also have to work harder to understand the cultural ties aboriginals feel towards their traditional lands, said Gratton.

The Thelon Basin is considered one of the earth's last pristine wildernesses.

Residents from the community of Lutsel K'e described the area as "the place where God began" and "the heart and soul of the Dene."

However, the area drained by the Thelon River, which flows from the N.W.T. into Nunavut, has been the subject of an intense staking rush.

Dozens of companies are prodding the tundra for uranium after prices for the silvery metal grew from \$7 a pound a few years ago to over \$100 now. They have registered hundreds of prospecting permits, claims and mineral leases – 1,000 such dispositions on the N.W.T. side alone.

The area is also subject to an agreement between Ottawa and the Akaitcho Dene not to make any decisions on the land for five years pending the land-claim settlement. That interim land withdrawal is currently awaiting cabinet approval.

As well, part of the region has been singled out by Environment Minister John Baird for the creation of East Arm National Park near the east arm of Great Slave Lake.

Québec has only recently begun to protect lands for conservation purposes, and is the only province to explicitly allow exploration in these areas. Plans to develop protected wilderness areas in Mistissini, Wemendji and the Dumoine have all met resistance from the mining industry.¹⁵⁴

While mineral tenure is only quasi-ownership, it does establish rights and privileges for the tenure holder that are well beyond those of other stakeholders, and is the foundation for procuring other rights and approvals, such as permits for mine development. In Saskatchewan and British Columbia, a holder of mineral tenure is entitled to compensation if the disposition of resources is cancelled as the result of an environmental assessment.¹⁵⁵ In the NWT, the owner of the Prairie Creek advanced exploration project in the Nahanni Park area is holding out for at least \$100 million in compensation before he will give up the claim.¹⁵⁶

An important Supreme Court of Canada decision in 1997 clarified that Aboriginal title includes subsurface rights, and that it is a right to the land itself, rather than just a right to fish, hunt, or gather. The *Delgamuukw* case also asserted that governments must consult with First Nations, and may have to compensate them if their rights are affected. The decision could have far reaching consequences for mineral tenure as it has been recognized.¹⁵⁷ Subsequent court decisions have added to this body of understanding, such as *Musquem*, *Mikeseew*, *Haida-Taku* and *Platinex* cases.

A 2007 judgement in *Platinex* (discussed elsewhere in this report), required the Ontario government to fund consultations with the First Nation and develop a Memorandum of Understanding,

before the company could access the land for exploration purposes.

In areas of recent land claims settlements in the North, this has led to definitions that restrict the Aboriginal peoples' control of subsurface rights to a small amount of land in their traditional territory – the equivalent of a reserve – but surrender the rights to the subsurface on the rest of the territory.¹⁵⁸

Surface Disturbance

All stages of the mining sequence can result in the disturbance of the land surface and the terrestrial ecosystems which it supports, as well as the aquatic ecosystems into which they drain. As discussed in earlier sections of this report, disturbing the surface – frequently stripping it – is integral to mineral exploration.

Over the last several years, an average of 20 million hectares are staked each year in new mineral claims, with an expectation that a considerable percentage of those will move into exploration, with all of the attendant surface impacts. The exploration stage of the mining sequence includes exposure of the bed rock through the removal of the “overburden” of soil and vegetation, and trenching and drilling to get at the rock below.

In stripping, trenching and sinking even temporary shafts (for the purpose of taking bulk samples) ground disturbance is inevitable and frequently the level of disturbance is extreme at the site level. A typical trench is 20-30 metres in length and 4-5 metres in width. Roads are a “normal” part of this exploration stage, given the dependence of modern mining on heavy equipment. The same is true of exploration drilling, which often requires considerable site development in order to accommodate a

drilling rig.¹⁵⁹

In the mining sequence, surface disturbances come not only from the mines themselves – particularly strip mines and open pits – but also from the large areas needed for the disposal or dumping of mine tailings and waste rock. An estimated 40 million hectares have been used for mining purposes. This figure excludes most of the related infrastructure, such as road systems, power lines and power generation projects.

Many of the most pervasive threats to biological diversity - habitat destruction and fragmentation, edge effects, exotic species invasions, pollution and overhunting - are aggravated by roads.

- Reed Noss, *The Ecological Effects of Roads*

Roads rank as the supreme disturbance at a landscape level. An estimated 30% of the boreal forest is now within 1 kilometre of a road or access route.¹⁶⁰ Studies have shown that roads significantly affect animal distribution, fragment animal and plant populations, and are mortality sinks for animals. For some species roads are impassable barriers. Roads fragment the population, and each isolated pocket is subject to all of the problems associated with rarity, including genetic deterioration.¹⁶¹

In addition to the direct impact of habitat loss, roads also facilitate the invasion of exotic species, some of which might out-compete indigenous plants, resulting in significant changes to the ecosystem. Roads also create an “edge effect,” considered one of the most harmful consequences of habitat fragmentation. Forest edge is a zone of influence

which causes changes in microclimate, increased blowdowns, and changes both in competition dynamics among plants and in predator-prey relationships among birds and animals.¹⁶²

Contaminated Soil

The impacts of smelting and refining metals move quickly from smokestack to soil. Over time contaminants accumulate in the soil, making it a storehouse of hazards: arsenic, copper, lead, zinc, nickel among them.

There are ten smelters operating in the boreal region of Canada, run by Vale-Inco, Xstrata (formerly Noranda and Falconbridge), HudBay Minerals, Rio Tinto and Alcan. Others, such as Vale-Inco and Xstrata's operations in the Sudbury basin, also continue to have an impact on the boreal forest through their significant contributions to acid rain.

Algoma's Wawa Operation

Algoma Steel's sintering plant in Wawa has ceased operations in the southern reach of the boreal, but its impacts will be in the soil and waters of the Lake Superior basin far into the future.

The Algoma Ore Division (AOD)'s sintering plant combined ore from the George McLeod Mine with "reverts," iron-bearing wastes from steelmaking. The materials passed over flames on a conveyor to form the raw material for Algoma's Sault Ste. Marie, Ontario blast furnaces. Massive amounts of sulphur and arsenic were spewed into the air.

The Ministry of the Environment's control order specified a "zone of control," which meant that Algoma Ore Division was only required to control SO₂ when the wind was blowing towards the town, and that the company wasn't allowed to

burn sinter when the wind blew the wrong way. The net result is a forty kilometre "kill zone" downwind of the old sintering plant. The boreal forest in the kill zone was completely destroyed, and extremely high levels of arsenic are found in the soils in and around the town of Wawa.

In conjunction with the plant closure in 1998, the Ministry of the Environment undertook studies to assess the extent of arsenic contamination of the town and surrounding areas. Initial estimates put the resulting cancer risk for residents as high as 1 in 10,000.¹⁶³ Soil arsenic levels exceeded the MOE soil cleanup guideline of 20 micrograms per gram (µg/g) over a large area of the fume kill zone.¹⁶⁴ In the western half of town, soil arsenic concentrations consistently exceeded the guidelines, approaching 1,000 µg/g in the surface soil near the AOD gate. All school playgrounds and public parks, however, were found to have soil arsenic levels below the 20 µg/g clean-up guideline. The 1 in 10,000 cancer risk identified in initial assessments as resulting from arsenic contamination was 100 times higher than the risk level used by the Province to set regulations.¹⁶⁵ A study of arsenic uptake into firewood identified elevated levels of arsenic in local edible mushrooms, and warned against their consumption.¹⁶⁶

Two subsequent studies served to downplay the obvious concerns over the arsenic contamination. The first study was conducted in September 2000 and included personal interviews and urine samples of 184 residents, distributed relatively equally across the three different zones which delineate different degrees of contamination. The conclusion: "This study did not produce evidence that Wawa residents are at an increased risk of cancer

due to exposure to arsenic."¹⁶⁷

A study of plant uptake of arsenic found that symptoms of arsenic toxicity could not be induced in a sensitive plant species at arsenic concentrations up to 533 µg/g, which was higher than all but a few of the most contaminated residential Wawa residential properties. The study concluded that the form of arsenic in the soil in Wawa "must be very insoluble and therefore biologically unavailable" making the risk from elevated soil arsenic concentrations in the soils of Wawa "very low." The ultimate conclusion of this study was, therefore, that there were to be no restrictions to the "normal use" of residential properties in Wawa.¹⁶⁸

Similarly disturbing results have emerged in the few studies that have been done of soil contamination in the shadow of other stacks, such as the Horne Foundry in Rouyn-Noranda (discussed in the overview of mining in Québec) or the operations of Hudson Bay Minerals, as well as operations found south of the boreal such as in Sudbury, Falconbridge, and Port Colborne.

Soil contamination does not occur solely as a result of air emissions that find their way to the soil. According to an Environment Canada report prepared under the Canadian Environmental Protection Act, the highest reported concentrations of arsenic in surface waters in Canada were found in lake water samples collected in the Yellowknife area, an area well known for its high profile arsenic problems due to gold mining dating back to the 1940s. In the mid-1970s concentrations ranging from 0.700 to 5.5 ppm of arsenic were reported in two small Yellowknife area lakes – Keg Lake and Kam Lake – the lakes most heavily impacted by mining.¹⁶⁹

Abandoned Mines

While definitions vary, abandoned mines are most consistently defined as those mine sites where the mine operator or exploration company has ceased or suspended indefinitely their activities, be that exploration, mining or mine production, without rehabilitating the site.¹⁷⁰ Some parties make a distinction between abandoned mines, those being all mine sites in the condition just described, and orphaned mines, abandoned mines for which an owner cannot be identified.

Abandoned mines create a number of problems, including public health and safety concerns and environmental hazards. These problems stem from both physical and environmental hazards. Physical hazards are related to abandoned mines, including open pits and shafts, trenches, dam collapses, and ground subsidences, when an underground mine collapses, creating new pits and openings from surface to underground. Environmental hazards include acid mine drainage, metal leaching, and contamination from process agents, fuel and other pollutants that may have been left on site.

Cost estimates vary, but a conservative estimate in the mid 1990s placed the price to clean up all abandoned mines in Canada at \$6 billion or higher.¹⁷¹ More recently, the federal government estimated that the cost for cleanup of abandoned mines in the northern territories alone would be \$555 million. As the federal Commissioner of the Environment and Sustainable Development noted in her 2002 report, long-term site management will be needed in many cases because complete and definitive cleanup will not be possible.¹⁷²

Mines become abandoned for a variety of reasons, changing over

time and varying by jurisdiction. Historically, mines became abandoned because there was no legislative mechanism to prevent them from becoming so, and not enough understanding of the physical and environmental hazards involved.

In the first few years of World War II, mining was frequently driven by the war effort. The federal government operated Ontario's more notorious abandoned mine, the Kam Kotia near Timmins, as a source of copper, and gold mining was classed as a "war industry," with gold production essential to Canada's funding of the war effort.¹⁷³ There were no rules in place to require cleanup, and, over the decades, many records were lost or destroyed that would have matched owners with sites. Through legislative and regulatory developments during the 1980s and '90s, rules were slowly developed to require companies to clean up after themselves, and to put aside funds in order to do so. The effectiveness of the rules are still unproven in several cases.

In 1999 and 2000, the establishment of a multi-stakeholder working group to address the issue of abandoned mines in Canada was proposed to the Intergovernmental Working Group of Mines Ministers, and a national workshop on abandoned mines – supported by the Mines Ministers – was held in 2001. Following the recommendation of that workshop to the Mines Ministers meeting, the National Orphaned/Abandoned Mines Initiative (NOAMI) was launched and a multi-stakeholder advisory group, including industry, government, First Nation and environmental organizations – was established.

In the ensuing years, NOAMI has established a number of task groups (Information Gathering/Inventory, Community Involvement,

Cobalt Mining Camp Arsenic

In the town of Cobalt in north-eastern Ontario the rush to mine the deposits of silver and other metals in the early 1900s, combined with early mining practices and lack of knowledge about environmental protection at the time, led to massive deposits of waste rock, mine tailings and refinery wastes throughout the actual Town of Cobalt and residential areas of Coleman Township, as well as in and around area lakes and nearby former mine and mill sites.

In 2005, the Medical Officer of health issued a public health advisory, cautioning against any use of Cobalt Lake for swimming, body contact recreation, or fishing. In May 2007, a similar public health advisory was issued for the nearby Crosswise Lake. The water of Cobalt Lake has been found to have levels of arsenic averaging around 0.720 ppm. By comparison, the interim Provincial Water Quality Objective for arsenic in surface waters is set at 0.10 ppm, in order to protect aquatic life. Aside from these health advisories, there are no plans to remediate arsenic-contaminated water bodies. or to clean up other affected sites in the area.

In addition to impacts on Cobalt and Crosswise Lakes, the surface waters in Cobalt contain some of the highest concentrations of arsenic in water anywhere in Canada.

Arsenic occurs in all lakes and streams in the Cobalt area. A typical background level of arsenic would be 0.004 parts per million (ppm) in Sasaginaga Lake, the source of the Cobalt town water supply. The Ontario Provincial Water Quality Objective for arsenic is exceeded in all lakes and streams sampled in the area except Sasaginaga Lake.

In studies done between 1991 and 1997, the highest concentrations of arsenic in surface water in the Cobalt area were in streams draining the tailings from the Nipissing low grade mill (average of 5.340 ppm in 6 samples) and the Nipissing high grade mill (average of 17.867 ppm in 8 samples).

Not only are the concentrations of arsenic in the surface waters around Cobalt high, but the total amount of arsenic released is also high. The Cobalt Mining Legacy website quotes data which show that the Cobalt area is one the largest sources in Canada of releases of arsenic to surface water. Estimates of the amount of arsenic released each year into Lake Temiskaming range from 10,000 to 18,000 kilograms. These estimates are based on measured concentrations of arsenic at a location in Farr Creek near North Cobalt, and the measured flow rate of the creek at the same location.

To put this amount in perspective, this means that more arsenic is being released from the mines around Cobalt than was released from all of the metal mines operating in Canada in 2003 put together, according to data reported to Environment Canada under Canada's Metal Mining Effluent Regulations.

Although there is less published data on soil contamination in the Cobalt area, the Ontario Ministry of the Environment has been carrying out soil sampling over the past several years. An interim soils report and Screening Level Human Health Risk Assessment prepared by MOE toxicologists, which summarize some of the MOE work to date, have confirmed that acute health effects may be experienced by visitors to 4 sites on the Heritage Silver Trail, a local tourist attraction, following short-term exposure to soils and tailings at these 4 sites.¹⁷⁴

In the Cobalt mining camp situation most of the former industrial sites are private property, formerly owned by Agnico-Eagle Mines Limited. Agnico-Eagle sold these lands in 2007, and it is unclear if the former or current property owners will be required to carry out remedial work to deal with the historical legacy of environmental contamination in the one-time thriving boom town.

Legislative and Institutional Barriers to Collaboration, Funding Approaches, and Guidelines to Legislative Review), has held three major workshops (Workshop to Explore Best Practices in Winnipeg, October 2006; Assessing Liabilities and Funding Options, Ottawa, November 2005; and Legal and Institutional Barriers to Collaboration Workshop, Ottawa, February 2003) and has published several reports, including the following:

- Rehabilitating Abandoned Mines in Canada: A Toolkit of Funding Options, Cowan Minerals Ltd., 2006;
- Capacity Building for a National Inventory of Orphaned/Abandoned Mines in Canada, Cal Data 2005;
- Best Practices in Community Involvement: Planning for and Rehabilitating Abandoned and Orphaned Mines in Canada;
- Lessons Learned on Community Involvement in the Remediation of Orphaned and Abandoned Mines – Case Studies and Analysis, 2003;
- Potential Funding Approaches for Orphaned/Abandoned Mines in Canada, Castrilli and C.N. Watson and Associates, 2003; and
- Barriers to Collaboration: Orphaned/Abandoned Mines in Canada, Castrilli, 2002.

The NOAMI steering committee reports to the Mines Ministers at their annual meeting each fall, including updates on action plans and recommended next steps.

The committee's role is to assess key issues and put forward recommendations to the Mines

Ministers concerning collaborative approaches and partnerships in the implementation of remediation programs for orphaned and abandoned mine sites in Canada.

In 2005, the Ministers agreed to support the ongoing activities of NOAMI as outlined in its detailed workplan, as long as human and financial resources permit. In particular, the Mines Ministers have agreed to encourage their respective Federal/provincial/territorial officials to participate in NOAMI activities, and agreed to the development of a portal site for a national inventory of inactive mine sites. They have also recommended the development of policies/legislation with respect to orphaned/abandoned mine-site remediation.

Participants in NOAMI's inaugural workshop in 2001 held the view that with adequate resources and resolve, significant progress could be made in the assessment, characterization and remediation/reclamation of orphaned and abandoned mine sites within 5-10 years.

Several of the provinces have made some commitment towards the remediation of at least a short list of high priority abandoned mines, and NOAMI has made some important contributions, particularly in terms of developing a body of related literature and a consensus on the need for action among the various stakeholders and governments. Significant steps have also been taken towards the creation of a national inventory.

However, much remains to be done at both a national and provincial/

territorial level before real success can be claimed in addressing the many challenges posed by abandoned mines.¹⁷⁵

3.2 Impacts on Water

Acid Mine Drainage and Metal Leaching

A major feature of mining is that it produces an extremely high volume of waste: waste in the form of rock, or rock that has been crushed into "fines" at the mill and rejected, called tailings. A typical Canadian metal mine rejects 42% of mined material as waste rock, 52% as tailings, 4% as slag with the remaining 2% comprising the "values" for which the ore was mined

Many Canadian base metal, precious metal and uranium mines work with rock that contains metal sulphide mineralization.¹⁷⁶ Crushing rock and grinding ore into tailings exposes huge quantities of waste rock materials to air and water. When metal sulphides in waste materials are exposed to both oxygen and water, there is potential for a reaction process that generates sulphuric acid. The acid dissolves metals in leachate as it passes through the waste materials. This phenomenon is known as Acid Mine Drainage, or AMD. The severity of the reaction depends on the concentration of metal sulphides and other mineralization in the rock. Predicting the potential of Acid Mine Drainage /Metal Leaching (AMD/ML) from mine waste is a complex exercise that involves estimating both the presence of acid-generating sulphides and any buffering materials in the rock that could counter the acid-

"...The influx of untreated acid mine drainage into streams can severely degrade both habitat and water quality, often producing an environment devoid of most aquatic life and unfit for desired uses. The severity and extent of damage depends upon a variety of factors, including the frequency, volume, and chemistry of the drainage, and the size and buffering capacity of the receiving stream" (Kimmel, 1983)

Receiver gets extension on Faro mine contract

CBC North Radio Apr 2 2004

WHITEHORSE – Federal authorities say they need more time to come up with a cleanup plan for the Faro mine.

It costs \$10 million a year just to maintain the Faro mine in its present state.

In the meantime, the company looking after care and maintenance of the property has been granted a five-year licence to continue.

The 'water use licence' was signed off this week by Premier Dennis Fentie.

The licence instructs the court-appointed receivers, Deloitte and Touche, on how to continue looking after the property.

David Sherstone heads the federal team working on a final abandonment plan for the Faro mine. He says they are still determining to what extent the property should be cleaned up.

"The estimates have run anywhere from \$125 million to well over \$200 million," he says. "Until you choose the criteria and standards you are going to clean up to, and until you then go back and look at the various methods and options that are out there, it will be another year or two until we have a good handle on what the abandonment costs will be."

Care and maintenance costs for the Faro mine average about \$10 million per year, with the federal government covering all costs. The new water license for Deloitte and Touche runs until 2009.

generating effect.

When acid mine drainage lowers the pH of the water, it makes it more acidic and more corrosive. Impacts range in severity, with toxicity dependent on discharge volume, acidity, and concentration of dissolved metals. The pH is the most critical component, since the lower the pH, the more severe the potential effects of mine drainage on aquatic life. If the pH is low enough, the water body will be unable to support many forms of aquatic life. The overall effect of mine drainage is also dependent on the flow (dilution rate), and the buffering capacity of the receiving water body.¹⁷⁷

Acid mine drainage with elevated levels of metals can have a devastating effect when discharging into headwater streams or lightly buffered water bodies. Like many other pollutants, acid mine drainage can cause a reduction in the diversity and abundance (total numbers) of macroinvertebrates and changes in community structure. Most organisms have a well defined range of pH tolerance, but when the pH falls below that range, the effect can be lethal. The primary causes of fish death in acid waters is loss of sodium ions from the blood and loss of oxygen in the tissues. Acid water also increases the permeability of fish gills to water, adversely affecting gill function.¹⁷⁸

Acidic waters typically have fewer species, due both to the direct effects of low pH levels on aquatic life, and to effects on the food chain. Studies have shown that direct effects of low pH on aquatic life are more critical than indirect effects on their food sources.¹⁷⁹

Leaching metals can increase the toxicity of mine drainage and also act as metabolic poisons. Iron,

aluminium, and manganese are the most common heavy metals which compound the adverse effects of mine drainage. The metals are generally less toxic at neutral pH. Trace metals such as zinc, cadmium, selenium and copper, which may also be present in mine drainage, are toxic at extremely low concentrations and may act synergistically to suppress algae growth and affect fish and benthos (seabed organisms).

Some fish, such as brook trout, are tolerant of low pH, but the addition of metals decreases that tolerance. In addition to dissolved metals, precipitated iron or aluminium hydroxide may form in streams receiving mine discharges with elevated concentrations of metals. Ferric and aluminium hydroxides decrease oxygen availability as they form. The precipitate may coat fish gills and body surfaces, smother eggs, and cover the stream bottom, filling in crevices in rocks, and making the substrate unstable and unfit for habitation by benthic organisms.¹⁸⁰

AMD/ML may not start for decades or more, and it can persist for hundreds to thousands of years. There are Roman mine sites in the United Kingdom that continue to generate acid drainage 2,000 years after mining ceased.¹⁸¹ There is great uncertainty around predicting rates of acid generation and the time it will take to exhaustion. Many mines do not undertake a proper assessment of AMD/ML potential at site. Technologies for dealing with AMD/ML exist, but at present there is no solution that allows a walk away. A mine that is generating or has the potential to generate AMD/ML must be monitored and treated in perpetuity.

Treating discharges at acid generating and metal leaching mine sites is usually accomplished by countering

the acidity of the effluent and by precipitating the dissolved metals. It is costly to treat discharge and to properly manage the toxic sludge that is precipitated from the effluent in the course of treatment. At the Geco and Wilroy mines, owned by Noranda Minerals Inc. near Manitouwadge, Ontario, an estimated 90 cubic feet per minute of water discharge will require long term treatment, at substantial cost, into perpetuity.

There are means of preventing AMD/ML, primarily by isolating the potentially acid generating material from oxygen and/or water, for example, by either flooding mine waste to create a water cover or by constructing a dry cover. Where water covers are used, regular inspections must be done as part of long term monitoring, and to ensure the stability of dams that contain the tailings. Perpetual care will likely be required to maintain the containing structures. As noted previously, many tailings dams have failed due to weaknesses in construction or from overtopping, sometimes because the spillway is inadequate, sometimes when beavers dam in the area, and sometimes when perma-frost melts.

Mines frequently plan to flood their impounded mine tailings at closure, thereby blocking the exposure of the tailings to air and preventing onset of AMD/ML. In engineering a water cover to flood these tailings impoundments, it is necessary to model a range of weather conditions (e.g. periods of drought) and to account for the effect of weather on maintenance of the water cover. However, in engineering water covers for the Shebandowan, Hemlo and Winston Lake mines in the boreal region of the Lake Superior Basin, the predicted effects of climate change were not accounted for when weather conditions were

modelled. Forecasts of climate change in the mid 1990's predict a reduction in precipitation in the Great Lakes Basin of up to 25%.¹⁸² Such a major reduction in precipitation may seriously interfere with maintaining water covers over tailings.

Acid mine drainage / metal leaching is the mining industry's greatest environmental liability. As of 1994, federal estimates of clean-up costs for acid mine drainage at existing mines were between \$2 billion and \$5 billion.¹⁸³

An estimated 20% of the 13 billion tonnes of mine waste existing in Canada as of 1994 is acid producing or potentially acid producing.¹⁸⁴ A 1995 report estimated the cost of treating acid mine drainage at \$194 per hectare of tailings or \$194 per tonne of waste rock, with a net estimate of \$3 to \$4 billion for the treatment of the inventory of acid-generating materials at Canadian mine sites in 1994.¹⁸⁵

The costs of acid mine drainage treatment are very site-specific. They are largely determined by the acid-generating potential of the rock combined with the rock's own buffering capacity plus local conditions and containment options. While no recent estimates are available, one could make a general approximation based on three factors: the treatment costs cited above, the estimate of 20% of mine waste being acid-generating, and an estimate of the volume of waste rock and tailings generated each year. Between 1994 and 2004 an average of 264 million tonnes of ore was mined in metal mines in Canada. Using this very approximate basis for calculating the costs of treating Canada's current inventory of acid-generating mine wastes, a contemporary estimate would be in the range of an additional \$10 billion.

While acid mine drainage tends to receive most of the attention, the primary source of concern should be the dissolved metals which are released through metal leaching. Leaching is not reliant on the presence of acid, though it is exacerbated by acid conditions. Significant metal leaching can also happen in neutral or alkaline drainage conditions.¹⁸⁶ While the solubility of aluminium, iron and copper is greatly reduced in neutral pH drainage, elements such as antimony, arsenic, cadmium, molybdenum, selenium and zinc remain relatively soluble and can occur in significantly high concentrations.¹⁸⁷

The rocks determine what the contaminants will be. In Labrador, the iron ore mines are a significant source of manganese. In the Selwyn Basin mineral deposit that runs through Kaska Dene Territory in Northeastern BC and the Southeastern Yukon, the major concerns from the zinc ores are lead, selenium, and mercury contamination. Many gold deposits are in arseno-pyrites which can release arsenic and/or aluminium into waters.

Polluting Process Agents

In addition to the water quality problems related to acid mine drainage and metal leaching, water quality is also impaired by the group of chemicals used in the processing of ores. A 1995 EPA study of mines showed that in 70% of the cases studied, surface water became contaminated, while for groundwater it was 65%.¹⁸⁸ While water can become polluted from a variety of other means – acid mine drainage from waste rock and tailings and fuel spills, for example – effluents from the mine and mill are perhaps the greatest source of contamination. Key culprits include cyanide, ammonia, chlorine, hydrochloric acid, and sulphuric acid.¹⁸⁹

BYG Mt. Nansen Mine - Horror Show in the Yukon

BYG brought the sulphur dioxide water treatment system over from Ketz River mine site (leaving the Ketz site without a means to treat their effluents) but never effectively ran the system at Mount Nansen. Pipes frequently froze and split resulting in the treatment facility shutting down.

There was no geologist on site, so blending of the ore was haphazard and excessive cyanide was used for extracting the gold. Over time BYG began to extract ore below the oxidized zone, cutting in to the high sulphur content ore (this should have required a new Yukon Territory Water Board (YTWB) hearing and water licence).

In August 1997, Little Salmon Carmacks First Nation and the Village of Carmacks expressed concerns about the environmental impact of the Mount Nansen mine.

February 3, 1998 BYG applied for an emergency amendment to its water licence and was granted a sixty day exemption from the requirement to pass the LC50 test due to the upcoming spring thaw and concerns about dam stability. The Yukon Conservation Society (YCS) had opposed this exemption because the effluent was extremely toxic and because BYG was not active in trying to lower with the high water levels in the tailings pond. YCS felt that BYG was in a situation of grave concern not because of unforeseen occurrences in weather, but because they had ignored their responsibilities in managing the mine site.

In March 1998, a public interest hearing was held as follow up to the concerns expressed by the First Nation and the Village of Carmacks in 1997.

In May 1999, Territorial judge Heino Lilles imposed the maximum fine of \$100,000 for each of three charges under the Yukon Waters Act because the company showed an attitude of “raping and pillaging the Yukon” and a “considerable disregard for its legal obligations.” There is little evidence of any diligence or reasonable care. The charges were:

1. Failure of LC50 test. With samples taken by Environment Canada from the polishing pond decant pipe on October 16, 1997, all the fish died within 24 hours. Also, zinc was 4 times higher than the allowed limit in the water licence.
2. A report containing chemical analysis of samples of tailings and effluent to determine the effectiveness of the proposed methods for long term arsenic stabilization was not filed.
3. Total cyanide concentrations in the tailings pond were analyzed and exceeded the maximum allowed (25mg/L). These levels were generally found to be 40-80mg/L and several as high as 180mg/L.

Maintenance costs over \$2 million per year, and the estimated reclamation bill would be \$8-10 million. Securities available for the site were \$400,000.

Cyanide

Cyanide is used to extract gold from ore, either through heap leaching of low-grade gold deposits, or as one of a series of conventional methods, which generally include gravity, cyanidation and carbon-in-leach processing.

The ore is ground, exposed to a cyanide solution; the cyanide dissolves the gold into the solution, and the gold is then removed from the solution, through a second chemical process. This process may be adsorbing the solution to carbon through a “carbon-in-pulp” process, or through the Merrill-Crowe process, which removes precious metals from a cyanide solution by zinc precipitation.¹⁹⁰

Heap leaching has also been used to extract gold from low-grade deposits, and is a common practice of Canadian mining companies in their operations outside Canada. In Canada’s boreal, only the Brewery Creek operation has used heap leaching in recent times, and it has ceased mining and had processed all stockpiles by the end of 2002.¹⁹¹

The Golden Bear Mine in north-eastern British Columbia also had a heap leach operation, until its closure in 2001. A third heap leach located 25 kilometres north of Amos, Québec was operated by Sphinx Inc. in the early ‘90s, but the operation was suspended due to low gold recovery.¹⁹²

Low-grade copper deposits are also heap-leached, but sulphur, not cyanide, is used to spray the ore-heaps and dissolve the copper. This method is proposed for the Carmacks Copper Mine in the Yukon.¹⁹³

Cyanide can be extremely toxic to some organisms, and can have an adverse effect on fish, plants,

wildlife and humans. Cyanide is readily absorbed by the skin, inhaled or swallowed; cyanide suffocates humans by blocking the transfer of oxygen across cell walls. Very small amounts of cyanide, 10 micrograms per litre ($\mu\text{g/L}$), can permanently affect a trout's ability to swim, while 100 $\mu\text{g/L}$ can be lethal. Chronic exposure may affect reproduction.¹⁹⁴ Typical levels of cyanide in mill discharges prior to treatment range between 25 and 250 $\mu\text{g/L}$, with the cyanide being present as free cyanide or cyanide complexes.¹⁹⁵

While cyanide breaks down quickly, particularly when exposed to sunlight, it breaks down into a variety of new compounds, including some which can be harmful. Free cyanide – cyanide before it has broken down – is highly poisonous to humans, fish and wildlife. The chemical breakdown of many cyanide and cyanide-related compounds often create high concentrations of ammonia and nitrate.¹⁹⁶ Thiocyanates are compounds that are formed when sulphur, carbon and nitrogen are combined. Exposure to cyanide will also expose you to thiocyanate because cyanide is changed to thiocyanate in your body.¹⁹⁷

Cyanide has to be transported to and from mine sites, and some of the greatest dangers come from truck accidents and train derailments. There are also serious concerns about how this deadly toxin is handled at the mine site. There is an International Cyanide Code that has been developed by the mining industry that sets out rules for the handling and transportation of cyanide. Unfortunately, the code is voluntary.

Ammonia

Toxic concentrations of ammonia in humans may cause loss of equilibrium, convulsions, coma, and death.

Ammonia concentrations can affect hatching and growth rates of fish; changes in tissues of gills, liver, and kidneys may occur during structural development.¹⁹⁸ At relatively low concentrations, ammonia in un-ionized form can interfere with fish reproduction and hamper normal growth and development. At higher levels it can kill fish.¹⁹⁹

Ammonia is contributed to local streams and lakes because of its use as a process reagent, from the breakdown of cyanide wastes into ammonia, and from unspent ammonium nitrate explosives. Large mines may have explosives factories on-site which will use ammonium nitrate to make explosives for blasting. There are dangers in terms of storage and handling on site, in transportation to the mine, and in disposal.

The free or un-ionized form of ammonia is toxic to fish, especially at high pH and low temperatures.²⁰⁰

Other Chemicals

Other problem chemicals include chlorine, hydrochloric acid, and sulphuric acid. Chlorine chemistry starts with ordinary salt – sodium chloride – but because chlorine is so reactive, it combines quickly with organic matter to form a variety of very toxic by-products and wastes called organochlorines the chemical link to pollutants such as PCBs

and dioxins.²⁰¹ Organochlorines are persistent in the environment, and are cancer-causing, either directly or by increasing the cancer-causing effects of other chemicals.

Hydrochloric acid is used to lower pH, and can produce acute effects on freshwater aquatic organisms below pH 5. Chronic exposure of fish to hydrochloric acid has resulted in abnormal behaviour and deformed fish at pH 4.5 and 5.2, but not at pH 5.9. Reproduction is impaired at pH values less than 5.9.²⁰² Sulphuric acid interferes with fish's ability to take in oxygen, salt and nutrients needed to stay alive. It also lowers pH, which in turn throws off the balance of salts in the fish tissue, adversely affecting reproduction. These impacts are in addition to those already discussed in relation to acid mine drainage and metal leaching.²⁰³

Mixing Zones: The Solution to Pollution?

Mixing zones are an area of lake or river, usually immediately downstream from an effluent pipe, in which exceedences of water quality objectives are allowed by permit. Using the old axiom "dilution is the solution to pollution," mixing zones rely on the assimilative capacity of the natural environment to absorb the impact of environmental contaminants. Polluted water is diluted by mixing it with the fresh water of

Surface Water Releases of Ammonia		
Facility	1999	2005
Hudson Bay Mining & Smelting Ltd. Flin Flon, MB	13,780 kg	26,173 kg
Sleeping Giant Mine, Cambior Ltd. Amos, QC	25,728 kg	7,249 kg
Falconbridge Ltd Kidd Metallurgical Div Timmins, ON	26,385 kg	12,076 kg
Rabbit Lake Mine, Cameco Corporation Ltd. Saskatoon, SK	14,580 kg	14,100 kg
Facilities selected at random Source: National Pollutants Release Inventory		

a living lake or stream.

Dilution is a common approach in managing waste water at Canadian mine sites.²⁰⁴ Most jurisdictions across Canada permit the use of live water bodies as mixing or dilution zones for toxic effluent.

In British Columbia, mine permits almost always allow for exceedances of Water Quality Objectives for some contaminants in water as it leaves tailings impoundments. The federal Metal Mining Effluent Regulations (MMER) does not permit mixing zones, but it only addresses seven contaminants. (The MMER is discussed under the “federal regulation” in section 5 of this report.)

Use of Mixing Zones for Mine Discharge Permits – an Ontario Perspective

The Ontario Water Resources Act (OWRA) is a provincial instrument for regulating discharges to water. The “general prohibition” set out in Section 30 of the OWRA is considered a very powerful piece of law, in that it states: “every person that discharges or causes or permits the discharge of any material of any kind into or in any waters ... that may impair the quality of the water of any waters is guilty of an offence.”

Section 53 of the OWRA sets out the requirement that no one may “establish, alter, extend or replace new or existing sewage works except under and in accordance with an approval (i.e. Certificate of Approval or C of A) granted by a Director” of the Ministry of the Environment (MOE.) The rules are enshrined in two documents: “Water Management Policies, Guidelines, Provincial Water Quality Objectives of the MOE,” and Procedure B-1-5, “Deriving Receiving-Water Based, Point-Source Effluent Requirements

for Ontario Waters.”

Both these documents are clear on the subject of mixing zones and effluent discharges. They define a mixing zone as “an area of water contiguous to a point source or definable diffuse source (of effluent discharge) where the water quality does not comply with one or more of the Provincial Water Quality Objectives (PWQO).”

PWQOs are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycle during long-term exposure to the water.

Procedure B-1-5 says “a mixing zone is, under no circumstances, to be used as an alternative to reasonable and practical treatment [of effluent, prior to discharge].” It also says that any mixing zone must be designed to be “as small as possible” and “the dilution of such effluents, and thus the use of mixing zones should be minimized...”

Although the intent of B-1-5 seems quite clear, it can give rise to considerable fuzziness when it comes to legally binding permits and their enforcement. In practice, if the C of A allows for a monitoring station downstream of the effluent discharge point, or any provision for the effluent to be diluted by the receiving water when a legal effluent limit is being established, a mixing zone has been approved. What B-1-5 calls “reasonable and practical treatment” is open to interpretation: a discharger would generally prefer that it be interpreted in their favour, so that expensive effluent treatment technology can be dismissed as unreasonable or impractical.

A total of 30 Certificates of Approval under Section 53 of the Ontario Water Resources Act

issued for Northern Ontario mine discharges between 1978 and July 2007 were reviewed. Of these, 3 approvals (10 %) permitted the use of a mixing zone (including discharge to natural wetlands) and 3 were unclear, and would make the PWQO difficult to enforce.²⁰⁵

Sediments

Sediment affects fish and fish habitat in a variety of ways, depending on the nature and severity of the sedimentation. It can have an impact on fish, fish habitat and food sources.

Suspended solids are fine particles suspended in water. The degree of sedimentation is described in terms of "total suspended solids" or TSS. Some sedimentation happens naturally, especially in mountainous glacial streams, as a result of erosion and other natural processes. However, mining activities can dramatically increase the amount of suspended solids in water.

Blasting, the removal of vegetation, the use of heavy equipment, and road and bridge construction can

all cause erosion.²⁰⁶

Fish are affected directly and indirectly. If the level of suspended solids is high enough, it will kill fish directly. At lower levels, it can cause rot in fins and retard fish growth. At higher levels, it can reduce the survival rate of young fish, cause fish to hatch prematurely, or can smother fish eggs, preventing their hatching.²⁰⁷

Fish habitat can be destroyed, including spawning grounds and food sources. Suspended solids make the water turbid, which can also negatively affect the fish's ability to find food and avoid predators.²⁰⁸ Turbidity also reduces the amount of light that penetrates the water, which in turn can lower the temperature and reduce plant growth. Both of these have obvious effects on fish habitat and food sources.

Sedimentation or increased turbidity is caused by many mining activities but placer mining is particularly problematic. Placer is a

deposit of gravel which contains particles of gold deposits. Placer mining removes very large volumes of sediment from stream beds and stream banks.²⁰⁹ Bulldozers and backhoes have replaced the pick and shovel, and a single operation can strip tens of thousands of cubic metres per season.

Placer Mining

Only a small proportion of mineral production in the Boreal is placer mining, but the impact can be tremendous, particularly with respect to fish and fish habitat.

The process of placer mining occurs directly in the streams and rivers, and the effect on a watershed is dramatic. The romantic image of a placer mine is that of an old man stooped over a stream, gold pan in hand. The modern reality, however, is corporate, huge and mechanized. Current placer mining practices rely on heavy equipment to move tonnes of material from river beds and banks, creating enormous problems with sedimentation.

Permit to Pollute the Groundhog River

In August 2003, Ontario's Ministry of the Environment approved Falconbridge's proposal to construct a 15-km pipeline from the Montcalm mine site to dump the contaminated mine effluent from their new copper-nickel mine into a sturgeon spawning ground in a pristine stretch of the Groundhog River.

Falconbridge projects that the Montcalm Project will produce a total of 5 million tonnes over its 7 years of operations, at a rate of 750,000 tonnes of ore annually. In July 2002, Falconbridge applied to the Ministry of the Environment (MOE) for a permit to construct and operate a mine water treatment system, and to discharge the mine effluent to the Groundhog River via a wetland and Montcalm Creek. Several months later, Falconbridge withdrew that proposal, and in January 2003 submitted a second application which included their new proposal, which was to send the effluent into the Groundhog River, either through an 8 km drainage ditch through a provincial park, or via 15 kilometres of buried pipeline to discharge effluent directly into the Groundhog – into a sturgeon spawning ground.

Falconbridge has one reason for getting their mine effluent to the Groundhog River: to ensure that the large volume of water in the river mixes with the mine effluent, lowering the measurable levels of contamination. The Ministry of Natural Resources and the Ministry of the Environment acknowledged that the effluent would affect the receiving water in general and the sturgeon population in particular. MOE rationalized this by arguing that it could take several years before we begin to see a local decline in the numbers of sturgeon. They said that the decline would be arrested when the project ceased operation, assuming current exploitation levels and habitat conditions are maintained.

The Diavik Mine on Lake Ekati (Lac de Gras)

Aboriginal people named the lake Ekati for quartz veins found in local bedrock outcrops resembling caribou fat. Lac de Gras is 60 kilometres long, and averages 16 kilometres wide. Lac de Gras has a 4,000 square kilometre drainage area. Lac de Gras, with Lac du Sauvage to the northeast, form the headwaters of the Coppermine River flowing 520 kilometres from western Lac de Gras to the Arctic Ocean. It has a maximum depth of 56 metres. Water temperature ranges from 0°C to 4°C in winter and 4°C to 18°C in summer.

The water quality resembles distilled water. Although aquatic productivity is low, lake trout, cisco, whitefish, arctic grayling, burbot, longnose sucker, and slimy sculpin are among the fish that live in the lake.

Diavik mines the bottom of the lakebed behind a huge dike and discharges its mine water, after treatment, back into the lake. There is increasing concern over water quality changes. Diavik was discharging more ammonia than permitted under its original licence and there were serious concerns about the aquatic baseline and the ability of the current program monitoring aquatic effects to detect changes in water quality. These concerns came to a head during the November 2006 Wek'ezhii Land and Water Board public hearings for Diavik's water licence renewal, and the Water Board refused the license until the situation was rectified.²¹⁰

This gold mining method is most prevalent in British Columbia and the Yukon. The Yukon Placer Authorization under Section 35 of the Fisheries Act allows placer mines in the Yukon to discharge sediment levels that are higher than anywhere else in North America or New Zealand. Sediments often carry elevated levels of metals such as arsenic, antimony, chromium, cadmium, aluminium and lead.²¹¹

In 2003, it was announced that the Yukon Placer Authorization (YPA) would be phased out after long-standing concerns about the effects of mining on the health of freshwater fish and salmon in the Yukon. Under Section 35 of the Fisheries Act, the old YPA allows "habitat alteration, disruption or destruction" for placer mining, and standards for sediment levels far exceed other regulated activities (e.g. 200 mg/L in salmon rearing streams and up to 18,000 mg/L in some fish bearing streams for placer mining compared with 15 mg/L for hardrock mines.)²¹²

As of 2008, placer mining will now be regulated under the Yukon Placer Regime. The Regime is being developed through three phases of consultation. It is scheduled for implementation for the 2008 mining season. The government committed \$650,000 in 2007 to develop capacity for monitoring new water quality information and for completing its consultation and implementation.²¹³ Under the new regime, specific standards will be set in each of 19 separate watersheds and monitoring will be carried out on a regular basis. Standards will be adjusted to reduce negative impacts if observed.

The new Regime involves complex and highly technical components, for example, the use of a new risk management matrix developed by

DFO. Its effectiveness is unproven, and a high degree of training and financial resources will be required to properly implement the new Yukon Placer Regime. Independent studies commissioned by the Yukon Conservation Society suggest that if the Regime is properly implemented, it has potential to achieve 'no net loss' and in some cases a net gain of fish habitat in areas currently affected by placer mining. If it is not implemented properly, it could be disastrous.

Water Consumption

Mining operations are a major industrial user of water. Water is pumped from open pits and underground mines to "dewater" them, in order to allow mining to proceed. Water is used to wash the ore, and in milling and refining processes. Water is also used to slurry tailings from the mill to the tailings management areas, and is frequently used as a water cover for acid generating mining tailings. While the mining industry describes these uses as "temporary," the fundamental fact remains that clean water goes in, and contaminated water comes out.

The mineral sector is ranked as the fourth largest industrial user of water, following thermal power, manufacturing and agriculture. In contrast to the reductions in the manufacturing sector, gross water use by the mineral extraction sector increased by 8% from 1991 to 1996. The water recycling rate in the sector declined from 336% to 231% during the same period (this reduced efficiency in water use explains the increase of 42% in total water intake.)²¹⁴

In 1996, the mineral extraction sector had a combined water intake totalling 518 million cubic metres, an increase of 42% from 1991. When combined with the re-circulation

of 1,197 million cubic metres, the sector had a gross water use of 1,715 million cubic metres.²¹⁵

An estimated 78% of the water is discharged to freshwater bodies, with an estimated 15% is transferred to tailings ponds.²¹⁶

In a survey of water-taking permits for one district in northeastern Ontario, 77% of the permits issued within one year were for mining purposes. Not all of the permits included totals or limits for the amount of water use permitted, but, of those that did, average water taking volumes was 6.4 million litres per day.²¹⁷ Some permits are for much higher volumes. One such was issued to North American Palladium Ltd for their Lac Des Iles Mine northwest of Thunder Bay, for a water taking at a rate of 30 million litres per day, for a period of five years.²¹⁸

At a national level, the mining and metal sector consumes a total of over 2 billion cubic metres of water annually.

Dewatering

Many mines, both open pit and underground, have to remove water in order to get at the ore bodies. The displaced water may come from saline aquifers, or be contaminated with heavy metals. Pumping the water from one area to another, may create a “cone of depression” and/or interfere with the water table.

Citizens opposing a niobium mine near the agricultural area of Oka, Québec, were worried that the mine would lower the water table.

The diamond mines in the Northwest Territories often require the dewatering of entire lakes or portions of them. At Ekati Mine, each open-pit requires the draining

of the lake that sits atop the kimberlite “pipe” and then some 35–40 million tonnes per year of waste rock is excavated from the pits. Any fish are removed. The 3.4-km Panda Diversion Channel diverts water around the Panda and Koala pits into Kodiak Lake. Other lakes were taken for disposal of processed kimberlite and waste rock.

The Victor Diamond mine in the muskeg of the James Bay lowlands of northern Ontario is unprecedented in terms of the amount of water it will have to draw down to maintain the mine pit. Steven Wilbur, a hydrologist, was asked to comment on the impacts during the Environmental assessment for the project. He stated:

“The scale of the proposed dewatering is of such a large magnitude and perhaps unprecedented. At this time, I have not researched a database of large mine dewatering projects, but in my experience (at mines and with dewatering-related projects) I have never come across a dewatering program of this scale. The dewatering will create a cone-of-depression by end-of-mine that has a surface area radius of influence easily much greater than 1950 km² (assuming the extent being equal to the 3-m drawdown isopleth which has a radius of approximately 25 km). This affected area is roughly equivalent to one-third the size of the province of Prince Edward Island. If the 1-m isopleth were considered, the affected near-surface area would be substantially greater, perhaps another 1.5 times more. In one sense, it seems that the only reason the dewatering scheme can be contemplated is because of the sparsely populated area of the Nayshkootayaow River basin.

The long-term costs to create the cone and deplete groundwater

currently in storage from a rock volume of over 18 km³, and pump all the excess recharge to/from this zone is so substantial that it is difficult to comprehend its economic feasibility. This large cone will largely result as a consequence of relatively high transmissivities of the sedimentary units (i.e., primarily fractured and karstic limestone) underling the site area. In contrast, if the country rock of the kimberlite was less transmissive granite or schist, for example, the size of the cone and volume of groundwater to be dewatered would be much smaller and have much less of a consequence.”²¹⁹

There are now emerging concerns about methyl mercury in the water being extracted to make way for the mine. David Lean, a biologist at the University of Ottawa, says that draining the water from the muskeg and placing it in the river “will indeed result in the contamination of fish with mercury.” The rivers that will be affected are prime fishing areas for the residents of Attawapiskat, 90 kilometres from the mine site. De Beers itself admits that the levels of methyl mercury will be doubled by the mine.²²⁰

3.3 Impacts on Air

The chief sources of air pollution from the mineral sector are smelters and metal refineries, but air emissions throughout the mining sequence and across the sector contribute to the mining sector’s nasty reputation as one of Canada’s top polluters.

Greenhouse Gases

While the mines and metals sector did not manage to get “top ten” billing for its greenhouse gas (GHG) emissions, it occupies a significant spot in the “top hundred.” Ten smelting or mining facilities hold

that dubious distinction, including Algoma Steel's mills in Sault Ste. Marie, which cranked out close to 4 million tonnes of greenhouse gas emissions in 1995.²²¹ Also topping the million tonne mark were Alco's Aluminerie de Baie-Comeau, Iron Ore Company of Canada's operations in Labrador City, and QIT-Fer et Titane's smelter (complexe metallurgique de Sorel-Tracy).

According to Canada's 2006 national inventory of greenhouse gas sources and sinks, the mineral sector is heading in the wrong direction in this respect. The report scatters segments of the mineral sector throughout several different categories, making it difficult to ascertain the full extent of the sector's (mis) performance, but several aspects are clear:²²²

- Mining showed a large increase in emissions between 1990 and 2004 – 9.2 million tonnes (about 149%), when excluding the portion related to oil sands activities.
- Within the manufacturing sector, which included iron and steel, non-ferrous metals and mining, the three mining-related sectors showed no decrease in the GHG emissions over the reporting period, while the mining sector showed a 149% increase.
- Within the industrial processes sector, which included Mineral Production and Metal Production, and "Other and Undifferentiated Production," the largest single source of emissions in 2004 was Metal Production, with over 17 million tonnes of emissions. The "Other & Undifferentiated Production" category, which includes the use of petroleum coke for anodes in metal production, accounted for the largest increase in emissions (about 45%) since 1990.
- Metal production was highest

emitter of GHGs within the industrial processes category throughout the reporting period of 1990 to 2004.

- Emissions from commercial fuels sold to the mining sector (metal and non-metal mines, stone quarries, and gravel pits, oil and gas extraction industries, mineral exploration and contract drilling operation) tripled between 1990 and 2004, with a total of 15,400,000 tonnes released from this source alone in 2004.

Heavy Metals and Toxics

Smelters are major emitters of sulphur dioxide (SO₂), carbon monoxide, nitrogen oxides, particulate matter, and other toxics and metals. These pollutants are released into the atmosphere, which becomes a sink for industrial contaminants. Although the atmosphere as a whole is kept relatively constant through a number of self-regulation mechanisms, air emissions can overwhelm natural balances and serious problems are created.²²³

In Canada, 40% of SO₂ emissions come from the mineral sector in 1995.²²⁴ By 2002, 47% came from the base smelters.²²⁵ The leading cause of acid rain, sulphur dioxide discharged to air also brings a host of other health and environmental problems.

Sulphur dioxide reacts with other chemicals to form very fine particles, which, once airborne, can lodge in the lungs and cause inflammation and damage to tissues. Recent studies have identified strong links between high levels of airborne sulphate particles and increased hospital admissions for heart and respiratory problems, as well as higher death rates from these ailments.²²⁶

Recent studies in the United

Kingdom have concluded asthmatics may experience symptoms including tightness of the chest, coughing and reductions in lung function when exposed to hourly average concentrations of sulphur dioxide at the upper end of the range from 0.125 ppm to 0.4 ppm.²²⁷ For long-term exposures, SO₂ levels above 0.15 ppm have been linked with increased hospital admissions for cardiac or respiratory diseases. Exposures to levels of 0.027 to 0.031 ppm with high levels of particulate matter have been associated with increases in respiratory illness in children.²²⁸ An Ontario Ministry of the Environment report concurs that exposure to SO₂ at levels in the range of 0.1-0.5 ppm and above for periods as short as 5 minutes can adversely affect asthmatic individuals.²²⁹

In addition to deleterious effects on human health, high levels of SO₂ emissions are also harmful to the natural environment, resulting in plant stress, reduced growth, and damage to leaves and needles. Jack pine, considered a moderately sensitive species, has shown injury following a 2 hour exposure to 0.25 ppm; a one hour exposure at 0.25 ppm has been shown to injure begonias; a four hour exposure at the same level has damaged broccoli.²³⁰

Every contaminant goes somewhere. Heavier particulates and metallic dusts settle close to their source, while finer dusts and gases go further afield. Heavy metals are deposited in the soil and plants absorb them and transfer them up into the food chain. Air-borne particulates enter the lungs.

Some of the pollutants released from smelters are toxic at even very low levels. Arsenic can be acutely toxic at even low concentrations, causing reproductive and behaviour abnormalities in birds, Chronic exposure

to low doses of arsenic have been shown to cause cancer and nervous disorders in humans. Mercury and cyanide are both highly toxic, even in small doses. Some pollutants, like lead, are not toxic to plants, but they bioaccumulate in plants, and affect the health of organisms further up the food chain. Many, like chromium or manganese, are essential nutrients at low levels, but very harmful at higher levels. Zinc, the biggest toxic output from the Flin Flon smelter, is acutely toxic to fish, very harmful to humans, and reduces growth and vigour in plants.²³¹ Cadmium has been shown to cause "brittle bone" syndrome, and nickel is a known carcinogen.

Canadian mining smelters released more than 2.3 million pounds of heavy metals in 1998, including arsenic, mercury, lead, cadmium and nickel compounds.²³² Throughout the late 1990s, 6 smelters operated in Canada's Boreal region dumped 1.24 million kilograms of toxic heavy metals and 45 tonnes of toxic gases into the air each year.²³³ Hudson Bay Mining and Smelting (HBMS)'s operation in Flin Flon was the largest single contributor in 1999, spewing out 245 tonnes of zinc, 173 tonnes of lead, 132 tonnes of copper, 26 tonnes of cadmium, 19 tonnes of arsenic, and one and a half tonnes of mercury. Other notables included Noranda's Horne smelter with an output of over a hundred tonnes of lead, 144 tonnes of copper, and 69 tonnes of arsenic.

In 2002, the base metals smelting sector released 153 tonnes of arsenic, 196 tonnes of lead, and 258 tonnes of nickel to the air, which was 76%, 88% and 54% of the Canadian total, respectively. The sector also released 669,967 tonnes of sulphur dioxide, which was 47% of the Canadian total.

Manitoba has a regulation written

for its two smelters – the HudBay smelter in Flin Flon and CVRD-Inco in Thompson – which sets the level for SO₂ at 0.34 ppm. The two operations, combined, account for 95% of the sulphur dioxide emissions in Manitoba.²³⁴

Xstrata's Horne smelter produced more than 550,000 tonnes of sulphuric acid in 2000 as a by-product of their SO₂ control programs. Xstrata recently announced plans for an additional 10% reduction in their sulphur dioxide emissions from their current level of 80,000 tonnes per year. Xstrata's Kidd Creek Metallurgical Site reduced their sulphur dioxide emissions by 25% in 2000,²³⁵ to 4,090 tonnes.²³⁶

In Ontario the regulatory limit is 0.25 ppm, although the Sudbury basin smelters both operate under a control order that allows double the regulatory limit to be discharged. Even the 0.25 ppm is very permissive when compared to other standards internationally, such as the limit of 0.100 ppm on a 15 minute average set by the U.K. Expert Panel on Air Quality Standards.²³⁷

Radon

Uranium minerals are always associated with more radioactive elements such as radium and radon in the ore. Therefore in addition to the radioactivity of the uranium itself, other elements of the ore are also radioactive.

Uranium mine tailings include most of the original ore and most of the radioactivity in it. In particular they contain all the radium that was present in the original ore. When radium undergoes natural radioactive decay one of the products is radon gas. Because radon and its decay products (daughters) are radioactive and because the tailings are now on the surface, radon gas is a major release to air

Smelter tops national pollution lists

Jonathon Naylor, Staff Writer, Northern Visions Gazette, 10/15/2007

The HBMS smelter has risen to the top of the national list of arsenic, mercury and cadmium polluters, reigniting demands for tougher government regulations.

According to the federal government's National Pollutant Release Inventory, the smelter was Canada's largest emitter of those metals and the second-largest producer of lead and sulphur dioxide in 2006.

Emissions reductions are warranted ASAP, said Dr. Elaine MacDonald, senior scientist with Ecojustice, a Toronto-based environmental advocacy organization.

Dr. MacDonald said arsenic, cadmium and lead are known carcinogens, while mercury is a toxicant that can harm developing children. Sulphur dioxide, in high enough concentrations, is a respiratory irritant.

We're not talking about chemicals to be taken lightly, said Dr. MacDonald.

The National Pollutant Release Inventory, or NPRI, shows the smelter produced 25,899 kilograms of arsenic last year. That was only slightly ahead of the Copper Cliff smelter in Ontario, which was second on the list.

The difference was far more drastic when it came to cadmium. The smelter's 28,663 kilograms of that element were 11 times more than the Kidd metallurgical site in Ontario, which was number two.

There was also a sharp contrast between first and second place for mercury. HBMS's 912 kilograms were nearly triple the amount produced by the Sundance generating facility in Alberta.

With 61,048 kilograms of lead, HBMS was behind only the Falconbridge plant in Québec in that category.

The Flin Flon smelter also spewed 195,381 metric tonnes of sulphur dioxide into the air. That was slightly behind first place Husky Energy plant in Alberta, and only marginally ahead of the INCO smelter in Thompson, which was third.

In terms of emissions of arsenic, lead, mercury and cadmium, Dr. MacDonald said HBMS leads the pack not only in Canada, but across North America.

Alan Hair, vice-president of metallurgy, safety, health and environment for HBMS, said the emissions figures are no secret and the company is working to improve the situation.

"It's not the top of the charts that we want to be top of, and that's what we're working towards (changing)," he said.

Hair pointed out that smelters generally occupy the top spots in the NPRI because of the nature of the work involved. He said HBMS's rise to the top in some areas is not an indication the local situation is getting worse, but that other smelters are getting better at controlling pollution.

While HBMS has invested millions to clean up its operations over the years, Hair said there is more to do with Ottawa set to enforce stringent new air quality guidelines by 2015 or possibly sooner.

"What we've been doing in the last little while is assessing the technologies that are out there," he said. "We're moving into the phase of trying to establish the economics and to try and understand what makes sense based on our current business plan and ore reserves."

Hair said a multitude of emissions reductions techniques are being investigated. To cut down mercury emissions, for example, the company might employ methods to ensure less zinc is processed in the copper concentrate.

Most of the zinc is separated from the copper in an initial concentration process, but the small amounts that remain end up in the copper concentrate, creating the bulk of the company's mercury emissions.

Sulphur dioxide represents a unique challenge. While levels have declined sharply since HBMS's \$210-million Zinc Pressure Leach Project was implemented in 1993, it's not clear how the company might bring those amounts down further.

Hair said the conventional method of lowering sulphur emissions is to capture and convert them into sulphuric acid, which can then be sold for commercial use.

But Flin Flon is far removed from viable sulphuric acid markets, he said, so other options must be considered. One possibility might be to neutralize the sulphur into calcium sulphate and dispose of it.

In any event, Hair conceded that the company has its work cut out for it in the coming years.

It's technically, and will likely be economically, challenging for us to reach the 2015 targets, he said.

Hair said that while the company is trying to render progress as quickly as it can, it also needs to make the right business decisions.

"It's not a simple join-the-dots type of scenario," he said. "It requires a lot of thinking through."

In light of the NPRI data, Dr. MacDonald hopes Flin Flonners will do some thinking of their own and start asking more questions about what the pollution may mean in terms of their health.

She would like to see the information serve as the catalyst for residents to begin pressing governments to regulate HBMS to reduce emissions further.

Dr. MacDonald said research such as blood tests and an analysis of the dust in local homes should be undertaken to paint a better picture of how much exposure to the toxins residents endure. And she wants government to undertake a comprehensive health study, including a comparison of cancer rates between Flin Flon and other areas of the province.

But Dr. MacDonald does not believe residents should have to wait for a multi-year study to be completed before governments take stronger action.

With HBMS performing so well financially, now is the time to apply pressure on the company to make investments toward emission reductions, Dr. MacDonald added.

About 95% of the radioactivity in the ore is from the U-238 decay series, totalling about 450 kBq/kg in ore with 0.3% U308 (eg from Ranger). The U-238 series has 14 radioactive isotopes in secular equilibrium, thus each represents about 32 kBq/kg (irrespective of the mass proportion). When the ore is processed, the U-238 and the very much smaller masses of U-234 (and U-235) are removed. The balance becomes tailings, and at this point has about 85% of its original intrinsic radioactivity. However, with the removal of most U-238, the following two short-lived decay products (Th-234 & Pa-234) soon disappear, leaving the tailings with a little over 70% of the radio-activity of the original ore after several months. The controlling long lived isotope then becomes Th-230 which decays with a half life of 77,000 years to radium-226 followed by radon-222.²³⁸

and a significant environmental concern.²³⁹

When Radon-222 gas is released from a uranium mine, it deposits its solid radioactive dust on the ground for hundreds of miles downwind from the mine site. The Radon-222 and all of its radioactive decay chain products release twelve times as much radiation as is in the Uranium-238 itself. The radioactivity will be measurable in the area for more than 100 years after the mine is closed.²⁴⁰

The radon gas emanates from the rock and tailings as the radium or thorium decays. It then decays itself to (solid) radon daughters, which are significantly alpha radioactive.

“Radon progeny” is another name for the radon decay products or radon daughters. It’s the radon progeny rather than radon gas itself which delivers the actual radiation dose to lung tissues. The solid airborne radon progeny – particularly Polonium 218 and Polonium 214 - are of particular health importance because they can be breathed into and retained in the lungs. It’s the subsequent radiation released during the next steps of decay that delivers a radiologically significant dose.²⁴¹

Radon releases are a major hazard that will continue long after uranium mines are shut down. The U.S. Environmental Protection Agency (EPA) estimates the lifetime excess lung cancer risk of residents living nearby a bare tailings pile of 80 hectares at two cases per hundred.

Since radon spreads quickly with the wind, many people receive small additional radiation doses. Although the excess risk for the individual is small, it becomes significant given the large number of people concerned. EPA estimates

that the uranium tailings deposits existing in the United States in 1983 would cause 500 lung cancer deaths per century, if no countermeasures are taken.²⁴²

Mitigation

During the operational life of a mine the material in the tailings dam is usually covered by water to reduce surface radioactivity and radon emission (though with lower-grade ores neither pose a hazard at these levels). On completion of the mining operation, it is normal for the tailings dam to be covered with a shallow water cover or with clay and topsoil to reduce radiation levels to “near” those normally experienced in the region of the ore body. In Canada, ore treatment is often remote from the mine that the new ore comes from, and tailings are emplaced in mined out pits wherever possible, and engineered dams otherwise.²⁴³

Some jurisdictions in Canada do have special requirements for uranium exploration and mining, and if these were in place across the country and were consistently applied, the hazard would be reduced considerably.

In British Columbia, wherever standard assay results show or are expected to show uranium mineralization in a grade of 0.05%, all exploratory drill holes must be completely sealed with concrete on completion of exploration.²⁴⁴

In Québec, mine tailings must be stored underwater, or under an adequate layer of clay to ensure their safe management, which helps reduce radioactive emanations.²⁴⁵

At present there is no requirement by federal or provincial legislation to monitor exploration for uranium in Ontario.²⁴⁶

4.0 Mining and Society

4.1 Mining Communities in the Boreal

The National Roundtable on the Environment and the Economy (NRTEE) estimates that 80% of Canadian mining takes place in the Boreal. They estimate that 80 communities in the Boreal rely on mining or mineral-related activities for their economic survival, producing 75% of the country's iron, nickel, copper, gold and silver.²⁴⁷

According to the Atlas of Canada,²⁴⁸ in all of Canada, there are 185 mining-reliant communities, of which 88 have a reliance of 50% or greater, and 97 have a reliance of 30 to 49%. The economies of these communities depend either on local mining activity or on metal-processing plants.

The mining-reliant communities are spread across Canada. The largest numbers are in Québec (78) and Saskatchewan (32), although this is partly due to the total number of communities in each of these provinces. Also, in each of these provinces, mining sites employ people from more than one community.

Ontario has the largest communities (by population size) reliant on mining resources, as the tally includes the large steel-making cities of Hamilton and Sault Ste. Marie, and also Canada's largest mining centre, Greater Sudbury.

Most of the other communities of substantial size (over 10 000 population) are in Québec: these include the aluminium-smelting cities of Chicoutimi, Jonquière and Baie-Comeau, and relatively large mining and smelting towns such as Sorel-Tracy, Rouyn-Noranda, Val d'Or and Thetford Mines. Outside of these two provinces, the only

other mineral-reliant communities of over 10 000 are two mining cities, Bathurst, New Brunswick, and Thompson, Manitoba, and the smelting-smelting city of Kitimat, British Columbia.

Many of the communities of larger size: Hamilton, Greater Sudbury, Sorel, Thetford Mines and Kitimat are outside the Boreal eco-zones.

While mines provide employment and purchase goods and services in communities where they are located, the operations are strongly tied to commodity prices in a cyclical market, and mining is heavily dependent on outside capital and external markets, with the corporate structure being both physically and socially removed from the local community. Usually, economic benefits related to mining are relatively short-term, given that minerals are non-renewable resources and as such inevitably become exhausted. Even before an ore-body is depleted, the mine may shut down due to low global metal prices, or to shareholder attention and investment being drawn elsewhere. The result is suspended operations and laid-off workers.²⁴⁹

Populations in mining communities fluctuate dramatically. For example, Flin Flon, Manitoba, lost 26% of its population between 1981 and 1991; Schefferville, in Québec, lost 85%; and Saskatchewan's Uranium City lost almost its entire population going from 2,500 to fewer than 100.²⁵⁰ In 1898, the Klondike Gold Rush saw 25,000 people crowding into Dawson City and the surrounding territory, but by the early 1900's most had left.²⁵¹ As a general observation, mining operations do not necessarily provide long-term economic stability for either individual workers or the community at large.²⁵²

Local communities bear the brunt of the environmental and health costs during and after mining operations, and are often ill equipped to protect their interests.

The number of metal mining jobs in Canada in 2002 was 23,944,²⁵³ having dropped from a 40-year high in 1974 of 70,000.²⁵⁴ Even towns with operating mines have seen their populations age and dwindle.²⁵⁵ In remote communities, other resource-based economic activities such as farming, fishing and logging are often neglected and damaged by the pollution from the mine and smelters, and communities become dependent on power grids, chain stores and imported goods and services to supply their needs. Mining is dangerous and destructive work, which carries with it a high incidence of industrial disease and accidents – cancers, white hand, silicosis, injuries – which have not been dealt with by industry or government. Many mine workers are unwell or disabled.

In mining communities, services and infrastructure (power lines, sewage and housing) are often developed to accommodate the larger population that develops around an operating mine. At closure, when transient workers leave the community, those left behind are frequently left to shoulder a greatly increased tax burden as a result of the community carrying the costs of oversized and aging infrastructure.²⁵⁶ In addition, health and environmental impacts from the mine may reduce a community's investment appeal to other sectors. These factors, singly or in combination, often leave mining communities – or formerly mine-dependent communities, as they may become – economically vulnerable, and perhaps even willing to consider economic development or activities that carry with them an additional

environmental burden.

Social Impacts in Mining-Dependent Communities

Mining communities share a number of troubling social characteristics, including higher levels of violence against women, alcoholism, and family breakdown.²⁵⁷ They also suffer a number of industry-related health problems, including higher incidences of cancer, asthma and other respiratory diseases in mine workers, their family members, and other local residents.²⁵⁸

Major power imbalances can exist between communities and the mining companies they depend on. When communities try to organize around mining projects, they often cannot get the information and analysis they need. In order to effectively participate in any decisions around their community and neighbour mines, people need access to a comprehensive understanding of all of the impacts of mining. Yet this information, when it is available, is usually in a form and language that makes it inaccessible to most community members. Moreover, there is limited recognition of the right of local communities to in-depth analysis.²⁵⁹

With closure, the social environment in the community where the mine is operating often gets worse. Violence, increased drug and alcohol use, depressed expectations, power struggles, more extreme social hierarchy, and paralysis of normal ways of making decision are common.

When a mine closes or down-sizes, different segments of the population respond in different ways. Many miners and mining specialists can find work elsewhere and leave town. The young people – looking for opportunities and education – leave. More likely to

stay are those workers who mix their employment at the mine with marginal farming, hunting, fishing, trapping, and other activities, and thus have many other skills. Older workers (near retirement age) usually remain after closure because they are attached to the community, unable to sell their houses, and have a settlement package of some sort. Family employment after a closure tends to shift to the women, and to lower wages.²⁶⁰

One such case is the community of Kirkland Lake in northeastern Ontario, originally built on a booming gold market. The town found itself in economic difficulties in the late '80's, as the number of gold mines dwindled, and the nearby iron ore mine – a major employer in the area – shut down prematurely due to low metal prices and high transportation costs. It stepped the first of a series of waste entrepreneurs, and for the next decade the community was subject to one waste disposal proposal after another. They included massive landfills to service the urban communities 800 kilometres to the south, questionable tire “recycling” operations, and a series of proponents for PCB incinerators and extractors, all with high levels of risk and little local control.

A decade of such incursions have left the community seriously divided and no further ahead in terms of diversifying the faltering local economy.²⁶¹ Not a single mine operator had a community transition plan in place before closing, and not a single one of the mines left behind has been remediated. The last operator to go out, Kinross Mines, provided a full 10 minutes notice to its daytime shift workers of its intention to shut down operations immediately, and left the remainder of its work force and town officials to learn the news

from that morning's local radio broadcast.²⁶² The current boost in commodity prices means that some of the mines are reopening and others are being developed, but some of the hard feelings and deep divisions from the hard times linger.

Aboriginal residents, being more attached to land base, respond differently than the settler community. One community – Lynn Lake – became an Aboriginal service centre. Uranium City saw its entire white population relocate, while the Aboriginal community stayed. At Schefferville, the Naskapi and Innu are negotiating to take over the town site.

The availability of cheap housing has often resulted in a number of communities having an inflow of retirees and younger people. People drawn to rural communities by the inexpensive housing and closeness to nature, are often involved in the informal economy and practice values like voluntary simplicity. Many of them are artists, craftspeople, and “jacks of all trades.” They are resilient, and bring more education, theory, and a real economic contribution to the existing population.

Long Distance Commuting

Mining companies operating in remote areas of Canada do not build company towns any more for economic, business and regulatory reasons. Tumbler Ridge was the last mining town to be built. There are basically two kinds of Long Distance Commuting (LDC): Fly-in/fly-out: where workers are flown into the mine and stay in semi-permanent camps, and situations such as those in northern Ontario, where workers commute by car to nearby mines every few days.

If the mine is near or in a populated

area or First Nation, or if an existing community is a staging area for mine workers, then the community and its surrounding area will become a de facto “mining town.” However, the impacts are rarely recognized by industry or government, and no municipal taxes come from the company to compensate for the additional services that are required.²⁶³

Aboriginal Community Economics

There are 500 Aboriginal communities in the Boreal.²⁶⁴ Harry Bombay of the National Aboriginal Forestry Association estimates that 1 million Aboriginal people call the Boreal their home.²⁶⁵

In recent years, many of Aboriginal governments have attempted to

capture some of the benefits from mining by entering into Impact Benefit Agreements (IBAs) or Participation Agreements. These agreements are only as good as the negotiating power of the Aboriginal government that negotiates them. Most of the IBAs provide some revenue sharing, economic rents, job allocations, training and contracts for local businesses. Some have agreements dealing with monitoring of environmental impacts, and about reclamation and closure.

IBAs are relatively new, and in most cases it is too early to see how effective they have been in capturing long term economic benefits. Many of the mines – including the much touted NWT diamond mines – have a life of less than twenty years. It will be impossible to measure their

A Canadian Forest Service-commissioned study of traditional forest-related activities occurring in the predominantly native communities of Nahanni Butte and Liard River in southwest N.W.T. found many traditional activities being practiced. Some individuals are totally dependent on the bush, while others make their living from employment and still others participate in both seasonal employment and bush life. Many young people are engaged in trapping. Elders living in the bush rely considerably on fish and small game. Harvested food is shared and supplies a large proportion of the dietary needs of these communities.²⁶⁶

The cash replacement value of the materials harvested from the forest by these two communities — wild meat (moose, fish, bear, caribou, rabbit, grouse), animal furs, firewood, and crafts — was estimated to be between \$950,000 and \$1.7 million per year.²⁶⁷ This does not include medicinal plants, wood products made for their own use, skin clothing, bush cabins or guiding activities from tourism and hunting. The study concluded that financial compensation for the harvested materials could not adequately replace many of the items and would not constitute an acceptable alternative, as the harvesting and related activities are integral to the people's way of life.²⁶⁸ During its visit to Manitoba, the Subcommittee heard a similar account concerning First Nations communities in Northern Manitoba. In the area that is home to the 26 northern-most First Nations of Manitoba, the replacement value of fish and game harvested in the area has been calculated by researchers at \$30 to \$35 million a year. The Subcommittee was told that:

“If you had to replace the game and fish our people harvest and bring home, and pay cash at a northern store, at Safeway (where prices are nearly double Winnipeg prices), it would take \$30 to \$35 million to do it.”²⁶⁹

effectiveness and the sustainability of their provisions before the mine life is over. The most detailed study of Canadian IBAs has been undertaken by Ciaran O’Faircheallaigh, who reviewed the provisions of most of them, including those that were confidential in 2006. There is more discussion of IBAs in Section 6 of this report.

Many of the Aboriginal people in the Boreal still depend upon country foods. The Senate of Canada report on the State of the Boreal, entitled *Competing Realities*, describes the economic importance of the Boreal ecosystem to Aboriginal people who live there.

Historically, Aboriginal communities have gained little from mines on their territories. The Kemess South Mine provides an example:

Until the company decided to undertake an Environmental Assessment for a new mine (Kemess North) in 2004, Northgate Minerals had little or no interest in the employment possibilities for First Nations at the existing Kemess South mine. In 2004, out of 350 full-time and 125 seasonal employees, only 28 First Nations employees came from the affected communities,²⁷⁰ and they earned an average of \$15,000 to \$25,000 that year. After eight years of operation, the mine only had 16 people from affected First Nations in the union, although a training program was finally launched in June 2004. There are no contracts with First Nations-owned companies, and there had been no attempt to develop an Aboriginal contracting strategy, although the affected First Nations have occasionally been invited to bid on small contracts.²⁷¹ The number of Aboriginal employees at Kemess South had in fact been declining

over the past year, but their wages had gone up. By January 2006, 38 employees earned an average of \$47,368. However, the average industrial salary in BC in 2004 was \$77,800 ; the Kemess median was \$75,000.²⁷²

Even when an Impact Benefit Agreement is in the works, there are difficulties for First Nations communities in taking advantage of potential opportunities, as can be seen in the Victor Diamond Mine in northern Ontario. In the company’s Environmental Assessment submissions,²⁷³ it was already clear that the local Aboriginal communities will gain less than 12% of the project jobs and contracts, and that even these may be beyond their reach until educational levels and capacity are substantially improved. De Beers does not expect this to happen until well into the 12 year life of the project.

In fact, Appendix F to the Comprehensive Study report for the mine²⁷⁴ provided a compendium of the potential impacts on Attawapiskat and other northern Ontario communities.

Of total exploration expenditures to 2003, slightly over 12% of the total was paid out for Attawapiskat labour, goods and services. Over 40% of the local workforce of 400 was employed by De Beers during the time that the company was trying to obtain its ‘social license to operate.’ The company describes “real challenges to employment of the people of Attawapiskat in jobs requiring more than limited skills. According the company, the more educated people are already working, and the unemployed have low or very low educational achievement. “The jobs available during the construction phase may number up to 120, and during operations up to 75.”

“Uptake of direct business opportunities will depend on the degree to which new businesses are started in response to project supply requirements, and on the revitalization of the Attawapiskat economic development corporation.” There have been recent initiatives in Attawapiskat to start joint ventures with, for example, catering, road construction, and maintenance suppliers from outside the area.

It was anticipated that the Victor Mine might draw home some of the almost 45% of Attawapiskat First Nation members that live off reserve. These returnees might obtain jobs instead of the on-reserve population, and put pressure on supplies and services, particularly housing.

Public Participation Processes

Public expectations have evolved over the last few decades to a point where the public now expects – rightfully – to participate in natural resource decisions that may affect their communities, the environment, and the public common of which a region’s natural resources are part.

Over the last decade and a half, the public response to the environmental damages and social impacts of mining has become increasingly more informed and more determined to push industry and government to more responsible practices.

“One of the fundamental prerequisites for the achievement of sustainable development is broad public participation in decision-making...”

(Zillman, Lucas and Pring, 2002)

The public and Aboriginal peoples

have been challenging mining across the country, using as venues the courts, consultation processes, environmental assessments, and community organizing. They are working to resolve the failings of the regulatory system and the refusal of responsible agencies to protect communities and the environment from the often negative effects of mining.

In Canada, the federal government broadcasts internationally its practice of including civil society in decision-making, and fifteen years ago was one of the signatories to the Rio Declaration on the Environment – signed at the United Nations Earth Summit in Rio de Janeiro in 1992 – which included a commitment to public participation and to the use of the precautionary principle in environmental decision-making.

Internationally, public participation has been defined as a human right. A recognized human right since the 1940s, public participation in today’s world comes in many different legal and political forms – citizen involvement, indigenous peoples’ rights, local community rights, sustainable development agreements, public hearings, consultation, advisory councils, right to information, right to justice, decisional transfers, benefits sharing, and more.²⁷⁵

According to international experts in natural resource law, the right to be heard is a fundamental principle of public law in most of the world’s legal systems. However, there persists a significant gap between the principle and the practice, in Canada as elsewhere.²⁷⁶

Public participation opportunities certainly do exist within Canada, but they are inconsistently available from one jurisdiction to the next and from one project to the next.

For a large mining project (one on the

Comprehensive Study List), public participation is legally required under Section 21 of the Canadian Environmental Assessment Act before the assessment track can be determined. This is discussed in more detail in the section in the federal government as regulator.

A number of challenges to public participation in mining projects can be summarized as follows:

- The public may have the right to comment on a particular permit, but the comment periods are frequently very short, access to information is often limited or absent, and the permits are often only one piece of a set of regulatory instruments, making it difficult to assess the project in full.
- Many aspects of mineral development have no associated public participation rights; this is particularly true of the mineral exploration stage, where many of the activities take place without the requirement of any government permit or approval, resulting in a de facto absence of any public opportunities to participate in decisions about whether or how the activity should proceed.
- There are usually gaps between decision-making processes in different jurisdictions and different regulators. For example, a mine project might be assessed under the Canadian Environmental Assessment Act (CEAA) in a process which lacks the detail of a provincial permitting process, such as for a certificate of approval for the treatment and release of mine effluent, but the permitting process for the certificate of approval will lack the broader social and environmental context – such as cumulative effects – which will be required by CEAA.

In other natural resource management sectors, there are extensive and detailed public participation processes in place. Granted, the approaches vary from one jurisdiction to another, but the public participation processes are more developed in forest management, energy procurement and watershed planning.

Public participation is a key component of forest management, including forest management planning and policy development. Acknowledgment of the need to involve the public in the management of crown lands has resulted in the development of various public processes and legal requirements, including surveys, open houses, advisory committees, and public review processes. Local advisory committees – also known as citizen committees or stakeholder committees – are central to many forest planning processes across the country. Although their outcomes are rarely binding, these committees are intended to provide public oversight and guidance to the decision-makers responsible for the management of public resources. In some jurisdictions, advisory committees are required by law.

Market-based forest certification initiatives such as the Canadian Standards Association's Sustainable Forest Management system (CSA 2002) and the Forest Stewardship Council's National Boreal Standard (FSC 2005) also have strong requirements for ongoing public consultation on forest planning and monitoring as a condition for certification.²⁷⁷

Within the mineral sector, there exist some examples of processes involving the public. Among them:

- Public involvement is one element included in the

Environmental Effects Monitoring program (EEM) required by the Metal Mining Effluent Regulations (MMER) under the federal Fisheries Act 2002. As part of EEM, mines are strongly encouraged to provide opportunities for public involvement in all aspects of the program. Public input can play an important role throughout EEM, from the early planning steps prior to the initiation of EEM, to the preparation of the site characterization and the first study design, as well as data interpretation for each EEM study at a site, and decisions regarding next steps in the EEM Program at a site.²⁷⁸

In particular, the EEM Technical Guidance Document strongly recommends that that Public Liaison Committees (PLCs) be formed, and mines are encouraged to prepare public involvement plans, with the objective of outlining how the mine will provide information on EEM to the public, and seek and respond to public input.²⁷⁹

A review of the EEM's first few years' of implementation concluded that, in general, the public involvement component of the program has not worked well to date, and recommended that "Environment Canada should encourage mine operators to engage the public in EEM..."²⁸⁰

- Base metal smelters are required to prepare and implement comprehensive Pollution Prevention Plans under the Canadian Environmental Protection Act (CEPA). For the Pollution Prevention Plans, base metal smelters are required to develop and implement Community Air Quality Protection Programs

and Smelter Emission Reduction Programs.²⁸¹

As part of developing their pollution prevention plan, each facility is “encouraged” to establish a Community Advisory Panel with representatives from the surrounding community, in order to provide a forum for the review and discussion of facility operations and associated environmental and other concerns. The stated objective of these forums is to “address community concerns related to the potential adverse environmental, health, and safety impacts that may arise as a result of the operational activities of the facility,” They are to be used to provide a venue for community concerns and input to the company.²⁸²

- British Columbia has established “Regional Mine Development Review Committees” which include representatives of various federal and provincial government agencies. The RMDRC is legislated under the Mines Act and normally includes many of the same government agency technical reviewers as review projects under the Environmental Assessment Act. A proponent may be required to publish a notice of application for a mine permit in the B.C. Gazette and in local newspapers, but this requirement is at the discretion of the Regional Manager. When notice is required, copies of the Mines Act Permit application must be made available in the local library(ies) for the duration of the review period. A Major Mine application may also be required to undergo an enhanced Mines Act review process involving a greater level of public consultation, but

this is also discretionary.²⁸³

As described above, the basic elements are in place for public involvement in decisions around mine development: a regional committee structure is in place, albeit without community or First Nation representation; mechanisms for public notice are identified; and a review process for mine development is already established. If public and First Nation representation were added to the regional committee, and if bureaucratic discretion were removed, the fundamentals would be in place.

- In May 2006 the government of Québec announced the creation of regional commissions on natural resources and land. One of their main tasks is to develop regional integrated development plans. The Québec Mineral Strategy refers to these commissions as means of involving the regions in the land allocation and mineral resource development process, and to provide citizens in the regions with an institution that can help rally all regional communities concerned around sustainable resource development objectives.²⁸⁴ While the structure, priorities and degree of public involvement for these regional commissions are not yet clear, they do provide a regional mechanism for public involvement, and they do invoke the language of sustainability – as does the Mineral Strategy itself – which provides a forum for the public to debate the sustainability and environmental acceptability of specific mining operations and/or mining practices.

Finally, some individual companies have made commitments to

community involvement in the oversight of their operations.

None of the several public participation approaches outlined above is without serious flaws, but each of them has some of the elements which are key to effectively engaging the public. Clearly, though, the human right to public participation is being denied in decision-making around mineral exploration, development and exploitation.

4.2 The Governments

There is no one “Canadian Mining Law,” Mining is largely provincial and territorial jurisdiction, so there are effectively 13 different sets of laws. Coal, uranium, and quarries all have separate and different laws from metal mining, and in most jurisdictions there are laws and regulations not only related to mining itself, but also for the protection of air and water.

Mining laws have been set up to protect the interests of the mining industry and to minimize the conflicts between mining companies by giving clarity to who owns what rights to mine. They were never intended to control mining or its impact on land or people. We have to look to other laws to protect these interests.

Canada’s legal structure relies on four kinds of law: criminal law, constitutional law, administrative law, and civil law. Under the Common Law system in English Canada, the interpretation of any of these kinds of law depends on the decisions of cases that went before, or “precedent.”²⁸⁵

Aboriginal rights and title issues are part of the constitutional law of Canada, and are found in specific court decisions: Delgamuukw, Sparrow, the Haida/Taku case.

The Red Chris Project

The Red Chris Project, a proposed open pit mine in northwestern British Columbia would turn the headwaters of three creeks into a tailings dump, destroying fish habitat and risking contamination of the Stikine watershed.

The mine will have two huge open pits and will leave behind approximately 183 million tonnes of toxic tailings and 307 million tonnes of waste rock, which will likely need to be treated for acid mine drainage for over 200 years. The mine is located in the Klappan area of Tahltan traditional territory in an area that has come to be known as the Sacred Headwaters.

In 2004, DFO first announced that it would conduct a comprehensive study of Red Chris, including public participation, but then it excluded the mill from the scope of the project, so that such a study was no longer required. Metal mine developments producing 3,000 tonnes or more of ore per day are subject to a comprehensive assessment that includes public participation under the Canadian Environmental Assessment Act and Cabinet regulations. However, even though the Red Chris proposal could produce 30,000 tonnes of ore per day, DFO and Natural Resources Canada undertook a simple screening assessment which did not include public participation.²⁸⁶

In July, 2006, the Sierra Legal Defence Fund launched a lawsuit on behalf of MiningWatch Canada challenging a federal government approval of the Red Chris Mine.

On September 25, 2007 a Federal Court upheld the fundamental right of Canadians to be consulted during the environmental assessment of large mines on the Comprehensive Study List. In a precedent-setting decision, Mr. Justice Luc Martineau condemned the federal Department of Fisheries and Oceans (DFO) and Natural Resources Canada for unlawfully evading a comprehensive study environmental assessment of the Red Chris Mine, and unlawfully preventing the public from participating in the federal assessment.

In his decision, Mr. Justice Martineau ordered that the Red Chris mine be denied any federal permits on the basis of unlawful environmental assessment, and observed that the federal Department of Fisheries and Oceans' re-scoping of the project from a Comprehensive Study to a screening in December of 2004 "has all the characteristics of a capricious and arbitrary decision which was taken for an improper purpose."

These cases restrict the rights of the Crown and mining companies on traditional Indigenous lands, and assign a "fiduciary responsibility" to the Crown to protect the rights and interests of Aboriginal people.

A Summary of the Federal-Provincial Division of Powers

Canada has a federal government, ten provinces, and three territories. The Constitution Act of 1867 sets out that in many respects the provinces are not subordinate to the federal government. Provinces have full power over mineral exploration, development, conservation and management. Territories increasingly have the same powers as provinces when it comes to mining, although some are still in a process of "devolution,"

The federal government retains powers to legislate, among other things, ocean and inland fisheries, navigable waterways, criminal law, inter-provincial trade and commerce, and "Indians and lands reserved for Indians" (including Métis and Inuit). It can establish National Parks. It can also spend federal funds as it wishes and engage in any form or mode of taxation. Regulation of uranium mining falls under the federal government. The Canadian Environmental Protection Act regulates mercury, asbestos emissions, smelter emissions, and some other toxins.

In January 1998, the federal government and the provinces (except Québec) signed the Canada-Wide Accord on Environmental Harmonization. This accord devolved even more responsibility to the provinces for Environmental Assessment and – through sub-agreements – has diminished federal powers.

In Canada, with very few exceptions, mineral rights (also called

subsurface rights) belong to the government (the Crown), and are leased by the Crown to prospectors for exploration and to mining companies if and when mineable minerals are found. With respect to mineral rights, the "Crown" is the provincial government south of the 60th parallel and the federal government in the North. Generally, the right to stake mining claims in Canada is given to anyone who holds a prospector's licence, obtained by paying a small fee to the province or territory. In most cases, it is "first come, first served." Mining claims are usually for one year and have to be maintained by carrying out a minimum of work on the property. If a prospector's claims are adjacent to each other, then work on one claim can usually stand for work on neighbouring claims.

Environmental Assessment (EA)

Before mine permits can be issued, federal, territorial and provincial laws may require that an Environmental Assessment be done. The EA is used to determine if there are likely to be "significant adverse environmental effects." Some provinces require a certificate of environmental compliance before a project can proceed. Most don't.

Federal EA and most provincial EAs may not be legally binding, but they are an important step in exposing any problems with the mine proposal. In most cases, the material that the mine proponent has to produce for the EA will discuss many of the issues that the community will be concerned about. Most EA Acts provide for public participation at different stages of the review, but only the federal government has a provision for intervenor funding at the comprehensive study and panel review levels.

The federal EA Act is "triggered" by the need of the proponent for

a permit or authorization of some kind from the federal government, or by federal funding. There are different levels of EA which are determined by a "scoping" process: at the federal level the options are screening, comprehensive study, and panel review and/or mediation. Which level will be used is determined by a list that is part of the Environmental Assessment Act of the jurisdiction. The federal Environmental Assessment Act has a "Comprehensive Study List" which includes most large mining projects. EA may also be required before cleanup of large abandoned mine sites.

Federally, the department that has to issue the permit becomes a "Responsible Authority" for the EA. All jurisdictions have a registry of all the documents submitted regarding the EA, which is supposed to be open to the public.

In Ontario, an environmental assessment review of privately owned projects is only required if the project is designated by the Environment Minister. The BC Act applies only to projects of a certain size.

Although most EA Acts have provisions for monitoring and follow-up on mitigation measures, there have been substantial cuts to the government departments that monitor and enforce compliance, making it difficult to evaluate how effective the mitigation measures have been.

Pollution Prevention and Control Measures

There are a number of Acts and regulations in all jurisdictions that set limits for pollution from mines, mills and smelters. As discussed in the following pages, the key federal laws in this regard are the Fisheries Act and the Canadian Environmental Protection Act.

The Fisheries Act's Metal Mining Effluent Regulations (MMER) sets limits for nine pollutants in effluent water from mines. The limits are set in accordance with an approach called "Best Available Technology Economically Achievable" or BATEA. This means that, at the point where it leaves the mine site, the effluent must not be more polluting than what was agreed could be achieved by technology that was "economically" available to mining companies in the 1990s. The MMER also includes an "acute lethality test": if more than 50% of fish die when exposed to the undiluted mine effluent for 96 hours, it is deemed to be "acutely lethal." Any plan to dispose of tailings into fish-bearing waters requires an amendment to the Regulations, and so must be approved by Cabinet. The MMER also requires that companies conduct Environmental Effects Monitoring (EEM) and report the results.

The Canadian Environmental Protection Act (CEPA) sets limits for emissions of toxins such as mercury. CEPA also covers emissions from smelters, although there is not yet a regulation for enforcing this provision. Under CEPA there is also a public-right-to-know instrument called the National Pollutant Release Inventory²⁸⁷ (NPRI), which reports on pollutant releases in Canada. At present, the NPRI does not require reporting of CEPA toxins disposed of in waste rock and tailings.

Provincially, the rules differ considerably from one province to the next. For example, in Ontario, mines are covered by the Environmental Protection Act, the Ontario Water Source Protection Act²⁸⁸ and the Metal Mining Sector Regulations (part of MISA, the Municipal Industrial Strategy for Abatement) which set limits on discharges from

mining operations. and. In British Columbia, the Waste Management Act, the Environmental Management Act, and the Water Act are all significant.²⁸⁹

Other Laws

There are a number of other laws and regulations that affect mining:

- The Securities Acts for each province
- The various federal and provincial tax acts
- International treaties and enforcement bodies like the International Joint Commission and the Commission for Environmental Cooperation. (NAFTA)
- Public Access to Information legislation

The Federal Government as Regulator

Mining is primarily regulated by the provincial and territorial governments, with the federal government having a lesser, albeit potentially important role. Federal players include Natural Resources Canada, Environment Canada and the Department of Fisheries and Oceans. Provincial and territorial departments involved are those charged with management of natural resources, lands, water and air quality.

The primary areas of responsibility and authority of the federal government with respect to mining can be summarized as follows:

- The regulation of activities which may impact on fish or on waters where fish are found, in accordance with the federal Fisheries Act.
- Environmental Assessment of certain projects under the Canadian Environmental Assessment Act.
- Natural Resources Canada has a relatively minor role as a regulator based on their authority over

the explosives used in mining operations, but are frequently the lead Responsible Authority in Environmental Assessments.

- Through the Canadian Nuclear Safety Control Act, the federal government and its regulatory Nuclear Safety Commission have authority over uranium mines, mills and refineries, including their development, operation and closure.
- The federal government has responsibilities for transboundary waters, navigable waters, and import and export of hazardous wastes.
- The Canadian Environmental Protection Act provides the federal government with some regulatory control of toxic substances.

The federal government also has responsibility for the Territories, and has been overseeing a process of devolution of powers to them. In the interim, Acts such as the MacKenzie Valley Resource Management Act (MVRMA) have been passed, which implement obligations under devolution land claims agreements and agreements with the Territories.²⁹⁰

The federal government also plays a facilitating and a research role in several key areas related to the mineral sector. For example, the annual meeting of Mines Ministers and several intergovernmental working groups provide national venues for the discussion of the mineral sector. Important multi-stakeholder initiatives such as Mine Environment Neutral Drainage (MEND) or the National Abandoned / Orphaned Mines Initiative (NAOMI) are supported by secretariats housed within the federal department of Natural Resources. Natural Resources Canada also does extensive research and analysis of both environmental and economic

matters, and hosts the most extensive set of on-line mining-related information in Canada.²⁹¹

Federal Regulation of Smelters

In September 2002, the releases from primary and secondary copper and zinc smelters and refineries were declared toxic under the Canadian Environmental Protection Act. The CEPA toxic substances include sulphur dioxide, lead, mercury, arsenic, cadmium and nickel. Once a release is declared to be a “toxin,” the Canadian Environmental Protection Act (1999) requires the company to develop a risk management strategy and an instrument to address the toxic substance. This must be finalized within two years of the substance (in this case the release from the smelter or refinery) being declared toxic.

After lengthy negotiations between Environment Canada and the mining industry, the “instrument” selected was “pollution prevention planning.” This meant that pollution prevention plans had to be developed for each of the 10 base metal smelters across the country, including the 5 located in the Boreal forest region: Corefco/ Sheritt’s Fort Saskatchewan Nickel and Cobalt Refinery in Alberta, Hudson Bay Minerals copper smelter and zinc plant and CVRD Inco’s nickel smelter and refinery in Manitoba, Xstrata’s Kidd Creek copper smelter and refinery and zinc plant in Ontario, and Xstrata’s Horne Copper Smelter in Québec.

In April 2006 two related notices appeared in the Canadian Gazette. The first indicated that an Environmental Code of Practice for Base Metals Smelters and Refineries was now available.

The second notice was one “requiring the preparation and implementation of pollution prevention plans in respect of specified toxic substances released from base metals smelters and refineries and zinc plants.” The Notice announced the risk management objective, “reducing the overall risk to the environment or human health,” and the recommended practices contained in the CEPA 1999 *Environmental Code of Practice for Base Metals Smelters and Refineries*. It then went on to announce “the intention of the Minister of the Environment and Minister of Health to establish regulations limiting releases from base metals smelters and refineries and zinc plants, effective 2015, and provision for “Studies on environmental, health, pollution prevention and control techniques, greenhouse gas emissions, engineering and economics that relate to smelter emissions and ambient air quality.”

The “pollution prevention” Notice identified the “factors for consideration in preparing the pollution prevention plan” by affected companies, including:

- Development and implementation of a Community Air Quality Protection Program, and

- Development and implementation of a Smelter Emissions Reduction Program, “taking into account annual limit targets identified in the Notice for air releases of sulphur dioxide and particulate matter from process sources identified in the Notice and for the release of mercury and dioxins and furans from process sources identified in the Notice and the annual air release reduction limit target for the base metals smelting sector as set out in Recommendation No. 1 of the *Base Metals Smelting Sector Strategic Options Report* published in June 1997, as well as achievement of the environmental performance guideline for mercury as set out in the Canadian Council of Ministers of the Environment (CCME), *Canada-wide Standard for Mercury Emissions Base Metal Smelting.*”

The Notices published in April 2006 were many years in the making. In May 1996 an “issue table” was convened for the Base Metal Smelting Sector Strategic Options Process (SOP) to identify and evaluate options for reducing the release of several substances declared toxic under CEPA, including lead, mercury, arsenic, cadmium and nickel. The issue table subsequently recommended reductions of 80% from 1988 levels by the year 2008, and of 90% beyond 2008. This same recommendation is referenced in the April 2006 notice in the Canadian Gazette. Yet the gap between the

Comparison of Actual SO ₂ Emissions, SOP Targets and Pollution Prevention Targets (in tonnes)						
Year	Actual 1988 ²⁹²	Actual 2002 ²⁹³	Actual 2005 ²⁹⁴	SOP Target 2008 ²⁹⁵	PP Target 2008 ²⁹⁶	PP Target 2015 ²⁹⁷
Hudson’s Bay	265,804	177,887	203,145	53,160	187,000	33,500
CVRD Inco Thompson	283,180	196,419	180,736	56,756	187,000	22,800
Horne	420,000	62,180	22,656	84,000	45,000	43,500
Kidd	6,900	5,995	6,492	1,380	7 525	7,525

Strategic Options Process recommendations and the so-called “pollution prevention” targets stated in the Notice is startling, as demonstrated in the table above.

The “pollution prevention” Notice fell far below the expectations of the Strategic Options Process issue table, and below the needs of people living in the affected smelter communities. While the Notice lists facility-specific targets for emission reductions of SO₂ and respirable particulate matter (PM) for the years 2008 and 2015, these targets are not enforceable.

Mercury is being addressed only for the HudBay facility, using a number for 2008 that is based on a non-regulatory unenforceable program known as the Canada-wide Standard for mercury.²⁹⁸ Only after 2015 would the targets reduce overall SO₂ emissions from the sector by about 75%, and only then would the likelihood of regulation rear its head.

The 2008 targets prescribed in the Notice for SO₂ emissions are completely insignificant, particularly in regard to the largest emitters.²⁹⁹ What’s more, emissions reduction targets for releases of toxic metals such as arsenic are to be determined by the companies, setting release limits through a voluntary Code of Practice.³⁰⁰

Federal Regulation of Fisheries

There are three key issues with respect to the federal Fisheries Act and its efficacy in protecting fish and their habitat from the deleterious effects of mining. These are detailed below.

The first is a recent proposal by the federal government for a complete overhaul of the Act, devolving considerable powers to the provinces. The second is the increasing use of

Schedule 2 under the Metal Mining Effluent Regulation to allow fish-bearing waters to be “redefined” as “Tailings Impoundment Areas” and filled with mine tailings. The third is the long-standing question of whether the Metal Mining Effluent regulation adequately protects fish habitat from the contamination of mine effluent discharge, even with the regulation’s companion Environmental Effects Monitoring (EEM) program.

Overhauling the Federal Fisheries Act

In the spring of 2007, the federal government responded to pressure from many of the provinces and some corporate sectors to overhaul the Fisheries Act. Bill C-45 was introduced into the House of Commons on December 13, 2006 without public consultation. In fact, Department of Fisheries and Oceans (DFO) senior officials actually refused to meet with environmental organizations to review and comment on the bill before it was tabled.³⁰¹

The Act was withdrawn before second reading when Parliament prorogued in the summer, but was reintroduced unchanged later in 2007.

The mining industry associations, particularly in BC, have been the most vociferous advocates for this overhaul. They want an end to the federal role in protecting fish and fish habitat from mining development impacts, particularly at the EA stage. They claim that the role of the Department of Fisheries and Oceans slows down mining projects and requires redundant Environmental Assessments.

ENGOs list the following as the key problems with the proposed Fisheries bill (C-45)

- *There is a focus on economics*

over ecosystems. Although the Preamble to the bill gives the false impression that an ecosystem approach to the management of Canada's fisheries will prevail over all else, the Bill itself does not create any mandatory requirements for such an approach. Instead, economic considerations can override conservation concerns. For example: The precautionary approach is constrained by cost-effectiveness. Section 6 (b) seeks to apply the precautionary approach but then states that actions should be guided by cost-effective measures. Section 25 (2) (e) refers to the, "best use of fish," but does not take into consideration environmental uses of those fish. Instead, the primary purpose of the Bill is one of sustainable development of the resource for the sake of economic gain.

- *Bill C-45 grants the Minister the power to delegate the conservation, protection and management of the fishery to other levels of government, undefined "classes of people," and organizations. Section 23 allows Cabinet to delegate to the provinces all of its powers and authority over proper fisheries management and the conservation and protection of fish.*
- *Bill C-45 is riddled with loopholes, providing for conservation in one clause and negating it in the next. The Minister is granted far too much discretion through the use of "may" versus "must,"* The Bill fails to respond to long-standing requests that Fisheries Authorizations with the potential to harm fish habitat be subject to some level of environmental assessment.

to protect fish and fish habitat. Section 36(3) says that: "No person shall permit the deposit of any deleterious substance into water frequented by fish..." The only way anyone, including mining companies, can legally pollute water or destroy fish habitat is if it is authorised by regulations. From 1977 to 2002, those regulations were called the *Metal Mining Liquid Effluent Regulations* (MMLER); in 2002 they were revised and replaced by the current *Metal Mining Effluent Regulations* (MMER).

A new provision, added to the regulations in 2002, allows the federal Cabinet to redefine a fish-bearing water body as a "Tailings Impoundment Area." This would allow a mining company to use productive lakes as a mine waste dump, and would be accomplished by adding the water body to Schedule 2 of the MMER.

The designation of a fish-bearing water body as a Tailings Impoundment Area requires the issuance of a Fisheries Authorization and is therefore subject to the habitat compensation provisions of Section 35 of the Fisheries Act and the DFO *Policy for the Management of Fish Habitat*. Generally, responsibility for the administration and enforcement provisions of the Fisheries Act is shared by the Department of Fisheries and Oceans (DFO) and Environment Canada (EC). EC has the lead for the administration and enforcement of the MMER.

Adding a mine to Schedule 2 of the MMER is a regulatory change that requires an Order in Council (a Cabinet order; technically, the Governor General acting on the advice of Cabinet). Since it requires a Fisheries Authorization, it would trigger a federal environmental assessment (EA) under the Canadian Environmental Assessment Act. A

habitat compensation plan must also be in place before any federal permits are issued for the mine, and has also to be approved by DFO and any First Nation involved.

The process is as follows: once the Screening, Comprehensive Study, or Panel Review that constitutes the EA is complete, the Federal Minister of Fisheries determines whether the project has "no significant environmental effects after mitigation" or whether the effects are "justified under the circumstances." This determination is not binding; it only "informs" the decision by federal permittees, or the decision by Cabinet (for an order in Council).

Environment Canada is then asked by DFO to prepare the amendment for publication in Gazette 1 for a 30-day public comment period. Then, after considering public comments and making any desired changes to the amendment, Cabinet approves or rejects the amendment. Publication in Gazette II indicates that the approval process is complete and that the lake is now a tailings impoundment area.

In 2006, the first lakes to be changed into Tailings Impoundments were added to Schedule 2. They were at the headwaters of the Exploits River in Newfoundland, and there was a storm of opposition from across the country to the move, including from the First Nations Summit and the Tse Keh Nay in British Columbia.

There are twenty or more fish-bearing waters proposed or waiting in line to be added to Schedule 2. In September 2007, the first on this list became the first mine proposal to be turned down by a federal environmental assessment under CEAA. The Joint Panel reviewing the Kemess North Mine, found that the mine was 'not in the public interest,' In good part their decision

Turning Live Lakes into Tailings Impoundments
The federal *Fisheries Act* is supposed

was based on the adamant opposition of the Tse Keh Nay First Nation to the use of Amazay Lake for tailings disposal.

Federal Metal Mining Effluent Regulation (MMER)

As already noted, the federal Fisheries Act prohibits any person from depositing “a deleterious substance into any type of water frequented by fish,” except as permitted by a regulation under the Act.³⁰² The regulation which sets out the exceptions was formerly the Metal Mining Liquid Effluent Regulation. In December 2002, after almost a decade spent in a review which promised to “modernize” the regulation, it was repealed and replaced with the Metal Mining Effluent Regulations (MMER).

The MMER, which defines limits on how much of each toxic substance can be released by a mine operator, sets out only a partial list of the contaminants of concern. Moreover, the allowable levels are not based on an assessment of toxicity or potential for harm to the environment, but rather on a determination of what water treatment can be achieved through the BATEA concept described earlier - the “best available technology economically achievable,”³⁰³

In the course of the regulatory review to develop the revised regulation, by consultants hired by the federal government conducted an international comparison of BATEA technologies. Their review identified technology-based standards in several other countries that were far more protective than the Canadian standards (see chart opposite). However, the BATEA standard adopted as the basis for the federal regulation redefined “best” to mean the average performance of the top 50 percentile of operating Canadian mines.³⁰⁴

The amendments to the regulation in 2002 made the compliance requirements somewhat more stringent than when they were first put in place in 1977, primarily through the introduction of a requirement that effluent be non-acutely lethal to rainbow trout, the lowering of the allowable level of total suspended solids from 25 to 15 ppm and the addition of an upper limit for pH levels of 9.5.

The addition of a requirement that mine effluent pass a test for acute lethality was a significant improvement. This means that at least 50% of the rainbow trout used to test a sample of the mine effluent must survive for more than 96 hours. A similar test for *Daphnia magna*, a water flea, was added for the purposes of monitoring, but there is no requirement that the effluent be non-acutely lethal to the water flea. The changes also meant the end of an exemption that gold mines had been operating under since the regulation first came into force.

Reports summarizing industry performance during the first two decades of the MMLER indicate that on average 25% of the mines were out of compliance, but between 1977 and 1998, not a single charge was laid nor prosecution brought under the Regulation.³⁰⁵

The federal government’s 1998 report on water pollution control in the mineral sector – the report is only published every 4 years – also indicates that 25% of the metal mines subject to the regulations were out of compliance. Of the mines subject to the guidelines (gold mines are exempt from the regulations, but subject to a “guideline”), almost half were out of compliance.³⁰⁶ In 1999, Environment Canada conducted 14 site inspections and verified 43 reports of mines, as required under the MMLER. Only one mine

International Comparison on Metal Mining Liquid Effluent Monthly Average Limits***

Country	Nickel	Copper	Lead	Total Cyanide
Canada	0.5	0.3	0.2	1
Sweden	0.1	0.1	0.1	n.a.
Finland*	0.3-1.0	0.05 – 3.0	n.a.	0.5
Vietnam	0.1	0.1	0.05	
Papua New Guinea	n.a.	0.03	0.005 / 0.004**	0.005 / 0.01**

* Range of limits in effect at 6 mines in Finland

** Values of discharges into freshwater system and marine environment respectively

*** Comparative Summary provided by the Canadian Environmental Defence Fund, 2001

was prosecuted under Section 36 of the Fisheries Act, although 3 closed mines were prosecuted under Section 33.³⁰⁷

More recent data show some improvement in performance, although companies persist in failing to pass the grade, even though the bar for the MMER tests is set so low. In 2001, of the 56 metal mines that were subject to the MMLER and associated guidelines, only 36 were consistently in compliance. In total, there were 196 incidents of discharge exceeding the limits set in the 1977 Metal Mining Liquid Effluent Regulation.³⁰⁸

Federal Environmental Assessment

For over a decade, the language of “streamlining” has been cast about by some federal departments and some mining industry representatives as the code word for further constraining or limiting the reach of environmental assessment processes and their evaluation of mining projects.³⁰⁹

The 2005 Speech from the Throne announced the government’s plans to consolidate the EA process. The plan is to centralize the assessment of major projects within the Canadian Environmental Assessment Agency rather than having the assessments done by the departments with

regulatory authority over the project. A reduced number of screenings would continue to be done by departments. Risk analysis would be used to triage projects by their projected size and impact to eliminate about two thirds of projects currently assessed, and to use a class screening process to eliminate assessments for a multiplicity of small projects. New bilateral harmonization agreements with the provinces and territories would set out what the arrangements would be when a joint EA is required. One of the dangers, of course, is that the lowest common denominator could be applied rather than the highest available standard.³¹⁰

Although the federal government changed since 2005, the approach to “streamlining” has not.

None of these proposals to reform a flawed system will produce an approach to environmental assessment which is rigorous, transparent and accountable.

Both the federal and provincial governments have environmental assessment legislation, although with many differences of approach among the provincial, territorial and federal regimes. Since the passage of the Canada Wide Harmonization Accord in the late ‘90s, the federal government has been developing

“harmonization” agreements with the provinces.

The Canadian Environmental Assessment Act is administered by the Canadian Environmental Assessment Agency, which reports to the Minister of the Environment. However, most environmental assessments done under CEAA are done as “screenings,” the simplest level of “self assessment” undertaken under the Act.

The “self-assessments” carried out under the CEAA are often done by the private sector proponent, particularly in the case of mining projects, and the resulting reports and conclusions are adopted by the responsible federal department. The Department of Fisheries and Oceans is most often the department responsible for issuing a permit for the project, thus becoming the “responsible authority” in the language of the Act.

Among public interest groups there is a very low level of satisfaction with the effectiveness or fairness of environmental assessments of mining projects done under CEAA.

In some of the few cases where the review of a proposed mining project has been conducted by an independent panel, the federal government has ignored key recommendations. One such case is the McLean Lake Mine in northern Saskatchewan, where despite the review panel recommending a five-year delay to permit further studies, the provincial government proceeded with an approval without delay.³¹¹ In the Cheviot Coal Project in Alberta, the joint provincial-federal panel approved the project without requiring a full environmental assessment to be done. A legal challenge was filed and the Federal Court found that the EA had failed to consider cumulative



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impacts and alternatives to the project - two key elements of the EA process. The Court ordered the approval quashed and the review reconvened.³¹² That project has since been approved and permitted, and is now in operation.

How cumulative effects are assessed is another matter of serious concern. A “comprehensive study” report – the most rigorous class of self-assessment – of the Aquarius Mine illustrates this problem. This gold mine, projected to operate for only 5 years, is going to impact on a provincial park, a remote cabin, trap lines, moose habitat and a bear management area. The project includes filling a small valley which is host to a fish-bearing cold-water stream, and is located in the same watershed as other mines, industrial operations and transportation routes, none of which were considered in terms of assessing cumulative impacts.

The mine proponent claimed that effluent from other mines in the area discharging into a common water body met provincial standards, and that the effluent from the Aquarius mine would as well. Further, the proponent put this information forward as their assessment of cumulative effects. In fact, area mines were not consistently in compliance, and the Aquarius was also expected to have some exceedences of the provincial standard. More significantly, simply establishing pass/fail on water quality standards does not constitute a cumulative effects assessment.³¹³ The “comprehensive study” was approved. The mine has since changed hands, and has never been issued provincial permits or brought into production, but it still has that CEAA stamp or approval.

Despite the significant probability – even certainty – of environmental impacts, some mine projects escape

environmental assessment reviews altogether. Such was the case with the expansion of the Lac Des Iles palladium mine, in the north end of the Lake Superior basin. The expansion will quadruple the production at the mine, and will involve a major expansion of the mine’s footprint, including additional effluent discharge points, dewatering of a bog, water taking of up to 30 million litres per day, and creation of waste rock piles twice the height of the highest point of land in the area. The Department of Fisheries and Oceans has reportedly “worked things out” with the company in order to avoid issuing a permit, and so avoided triggering an environmental assessment review.³¹⁴

Given that it is so often a loss of fish habitat that triggers a review under the CEAA, the federal Department of Fisheries and Oceans is most often the “responsible authority” for CEAA reviews of mine projects. For almost a decade, there has been increasing concern among public interest groups about the Department’s willingness to provide “letters of advice” as a means of avoiding the triggering of environmental assessments.³¹⁵

In the case of the Ekati Mine – an open pit and underground diamond mining project in the North West Territories – the review panel recommended that the project be approved, and produced 29 recommendations. None of them addressed such key areas as cumulative effects; mine closure and reclamation, or mining impacts on traditional resource harvesting activities. These and related gaps raised questions about the ability of the process to deliver sound decisions, particularly in connection with resource development issues in northern Canada.

Overall, the CEAA suffers from

numerous weaknesses and limitations, which are both singular and cumulative in their effect. While the Act is Canada's third generation of federal environmental assessment legislation, it still fails to meet the potential or the need for sound and informed process that will serve as both a planning tool and method of project evaluation.

However, the process has recently provided meaningful results.

In September 2007 the Kemess North Mine Joint Review Panel concluded that the mine "in its present form" would not be in the public interest. A joint federal-provincial panel has been reviewing Northgate Minerals' plan to use Amazay Lake to contain tailings from its proposed Kemess North copper-gold mine expansion, located 425 kilometres northwest of Prince George. The Panel says that any economic and social benefits from the project are outweighed by its long-term risks to the environment and by its social and cultural impacts on Aboriginal people. It has recommended to federal and provincial environment Ministers that the project not be permitted.³¹⁶

As of the fall of 2007, a panel review for the Lac D'or Vanadium Mine Project in Chibougamau, Québec is pending, and there are four active mining-related comprehensive study processes underway under CEAA:

- Cameco Corporation's "Vision 2010 Decommissioning Project," a redevelopment of its uranium Conversion Facility located in Port Hope, Ontario,
- Former Gunnar Mine Site Rehabilitation Project in northern Saskatchewan,
- The High Lake Mine Project in the Kitikmeot Region of Nunavut, and
- The Mine and Mill for the Midwest Uranium Project in

northern Saskatchewan.

The Canadian Nuclear Safety Commission

The federal government has jurisdiction over nuclear matters, including uranium mining and milling. Uranium mining is a federal responsibility in light of the division of powers set out in the Constitution Act (1867). A series of court decisions in the early 1990s confirmed Parliament's jurisdiction over nuclear energy, which includes uranium mining.³¹⁷

The courts reasoned that nuclear energy comes under exclusive federal authority for two primary reasons:

- it is considered a matter of national importance and therefore covered by the federal basket clause found in Section 91 of the Constitution Act (1867) to make laws for the peace order and good government of Canada (POGG); and
- it becomes federal when specified in legislation that declares certain works and undertakings to be for the general advantage of Canada.

On May 31, 2000, the former Atomic Energy Control Board became the Canadian Nuclear Safety Commission (CNSC). Under the Nuclear Safety and Control Act (NSCA), the CNSC's mandate involves five major areas:

- regulation of the development, production and use of nuclear energy in Canada;
- regulation of the production, possession and use of nuclear substances, prescribed equipment and prescribed information;
- implementation of measures respecting international control of the use of nuclear energy and substances, including measures respecting the non-proliferation

of nuclear weapons; and

- dissemination of scientific, technical and regulatory information concerning the activities of the CNSC; and
- the undertaking of special projects.³¹⁸

The CNSC and its regulations are predicated on the principle known as "ALARA": that radiation exposures should be kept "as low as reasonably achievable (ALARA), social and economic factors being taken into account,"³¹⁹

Section 71 of the NSCA is the declaratory provision for nuclear works and undertakings:

71. Any work or undertaking constructed for the development, production or use of nuclear energy or for the mining, production, refinement, conversion, enrichment, processing, reprocessing, possession or use of a nuclear substance or for the production, possession or use of prescribed equipment or prescribed information is declared to be a work or undertaking for the general advantage of Canada.

Consequently, any of the activities and facilities licensed by the Canadian Nuclear Safety Commission fall under federal jurisdiction (more specifically under the CNSC's jurisdiction). Not only is it deemed a federal jurisdiction, but any provincial legislation purported to affect the "nuclear aspect" of the facility or activity under license by the CNSC would be ultra vires - outside the jurisdiction of the province - and could not legally apply.

For uranium mines, the CNSC issues license for a series of stages in the mine's operation:

- Licence to Prepare Site and Construct
- Licence to Operate

- Licence to Decommission
- Licence to Abandon

Operating licences for uranium mines and mills are for specific periods of time, usually between two and five years, and are subject to licensing renewal decisions before the end of each licence period.³²⁰

While the CNSC oversees the operation of uranium mines and refineries and the use of radioactive sources for oil exploration³²¹ the mandate of the CNSC does not include approving or overseeing mineral prospecting or exploration. As far as the CNSC is concerned, the licensing process for new uranium mines is initiated following the exploration stage to identify a potential ore body, and before specific physical activities are carried out to evaluate the best approaches for mining, ore processing, and milling for the ore body.³²²

Uranium removed during exploration, as a “naturally occurring nuclear substance,” is exempt from the Nuclear Safety and Control Act (NSCA), and uranium prospecting or surface exploration activities are exempt from the application of the Uranium Mines and Mills Regulation.

But while exploration activities are exempt, regulations under the NSCA stipulates that “no person shall, except in accordance with a licence, mine and process nuclear substance (or) prepare a site for, construct, operate, decommission or abandon a nuclear facility,” Further, the “Uranium Mines and Mills Regulations” under the NSCA states that the definition of a mine includes an excavation site, i.e. a “place at which uranium is moved by underground activities for purpose of evaluating a potential ore body” and “removal site,” i.e. a “place at which uranium is

removed from natural deposit by surface activities for purpose of evaluating a potential ore body,”

CNSC staff have attempted to address this regulatory gaffe by defining the evaluation of a potential ore body as being what happens after there is “sufficient information known about mineral deposit to be reasonably confident that it could proceed to be mined economically,” At the same time, they acknowledge that the “transition from exploration to evaluation is not clearly defined in the Act and Regulations.” And they indicate that it is the responsibility of the mineral exploration project owner or operator to identify to the CNSC the intent to carry out “specified activities,”³²³

National Parks and Marine Protected Areas

The federal government has the responsibility to protect natural environments that are representative of Canada’s natural heritage. Parks Canada is supposed to manage national parks to maintain their ecological integrity while providing opportunities for public understanding, appreciation and enjoyment. The National Parks Act was officially enacted in 1930.

A five-zone system provides a management framework for national parks and area-specific application of management policies. Zone I (Special Preservation) includes areas to be protected because of their representativeness of the natural region or the presence of unique features. Zone II (Wilderness) areas are also good representative examples of the natural region and are to be conserved in a wilderness state. Zone III (Natural Environment) areas are managed as natural areas for outdoor recreation requiring minimal services and limited motorized access. Zone

IV (Outdoor Recreation) includes limited areas for more intensive forms of recreation, with related services and direct access by vehicles. Zone V (Park Services) is a special zone reserved for communities in national parks that contain a concentration of visitor services and support facilities.

The National Parks Act states that public lands within the parks shall not be disposed of and no person shall occupy them except under the authority of the Act or the regulations. Ecological integrity is the first consideration in management planning. Human activities that threaten the integrity of a park's ecosystem are not permitted. Generally this includes mining claims and activity.³²⁴

Provincial and Territorial Regulation – A Summary

Since the provinces are responsible for the management of the mineral resources, they are also responsible for most mine permitting. The specific regimes in each province/territory are discussed under the headings for each jurisdiction later in this report.

There are different requirements in different provinces. Since most provinces bend over backwards to encourage mining, most Ministry of Mines websites set out the rules quite clearly.³²⁵

Historically, provincial mining laws have shared many of the same characteristics due to the fact that they are based on Crown ownership and exploitation of mineral resources under the Canadian Constitution. Most mining laws set out the manner in which the Crown may dispose of its minerals and others may obtain rights to them.³²⁶

- In Ontario, once the mining lease is secured, the proponent files a closure plan with the Ministry

of Northern Development and Mines, and then begins applying for permits to build the mine from other government ministries. There is no actual mine permit required.³²⁷

- In BC, proponents need a Major Mines permit under the Mines Act after obtaining an Environmental Compliance Certificate.³²⁸
- In the Yukon, proponents need a Mining Licence under the Quartz or Placer Mining Acts.
- Alberta requires a Metallic and Industrial Minerals Licence or Lease.

Regulatory controls over the environmental and social impacts of mining are generally enshrined in other laws: Environmental Assessment, Water Acts, Planning Acts, etc.

Almost all provincial land-use planning acts exempt mining from most land use plans and treat it as the highest and best use of land. In Ontario, in areas of significant mineral potential, ideas for other kinds of economic activity or development have to get special approval to proceed.

In many provinces, there has to be some kind of public notice that the permit is going to be considered. For example in the Yukon and the NWT, permits for advanced exploration are subject to public consultation, as are water permits and land use permits. In Ontario, applications for permits with environmental impacts have to be posted under the Environmental Bill of Rights.

Types of provincial and federal permits that may be required to develop a mine include:³²⁹

- 1) permits for exploration work
- 2) permits to destroy fish habitat
- 3) amendment to federal

regulation to use fish-bearing waters for tailings disposal

- 4) permits for works in navigable waters
- 5) for uranium – construction and operation permits from the Canadian Nuclear Safety Commission
- 6) permits for storage and use of explosives
- 7) permits for archaeological disturbances
- 8) transboundary shipment of hazardous waste
- 9) permits to take water
- 10) mine closure plan
- 11) approvals for roads and transmission lines (which may also require some of the other permits also)
- 12) work permits
- 13) approval of fuel handling
- 14) aggregate permit
- 15) permits to discharge toxins into water
- 16) industrial/private sewage works
- 17) approval of waste management system
- 18) registration of generators
- 19) approval for air emissions
- 20) approval of drinking water system
- 21) permits under the Migratory Birds Act
- 22) permits for land use (can include approval from agricultural commission in Québec)
- 23) approval under a municipal official plan

Generally, there is more commonality among provinces and territories is in their approach to the allocation of mining rights than there is in their regulatory application of sustainable development principles and of environmental assessment outcomes.³³⁰

Some provincial approaches to the conflict between sustainability and mining can be seen in the following examples:³³¹

- British Columbia's Mines Act imposes permit requirements and authorizes permit exemptions for those proposing to establish mines in the province. As a condition of permit issuance, the chief mine inspector may require security to ensure mine reclamation and to provide for protection and mitigation of damage to watercourses affected by the mine. The Act also authorizes the establishment of a mine reclamation fund to ensure sufficient revenue to provide for reclamation after a mine has ceased operating. The Mining Rights Amendment Act came into force in early 1999 and establishes a right of access for holders of mineral claims to all areas outside of parks and a right to compensation to holders of mineral tenure where a government expropriates that tenure right to establish a park.
- Saskatchewan's Crown Minerals Act requires the responsible minister to cancel any Crown disposition of resources where an environmental assessment determines that the development should not proceed, and where the provincial cabinet, on the advice of the environment minister, so directs the minister. Upon cancellation, the former holders of the Crown disposition are entitled to compensation, but no other remedy against the Crown.
- Manitoba's Mines and Minerals Act declares as its object and purpose: to provide for, promote, encourage, and facilitate exploration, development, and production of minerals and mineral products in Manitoba, consistent with the principles of sustainable development. The Act authorizes the establishment of a mine rehabilitation fund, and the promulgation of rehabilitation regulations to ensure environmental protection.
- Ontario's Mining Act's purpose is to encourage prospecting, staking, and exploration for the development of mineral resources and to minimize adverse effects on the environment through the rehabilitation of mining lands in Ontario.
- Québec's Mining Act now imposes greater obligations on the Québec mining industry to rehabilitate and restore the environment from the adverse effects of mining activities. The environmental restoration obligations apply to open pit or underground mines and tailings areas, identify who must carry out such work, and specify what must be done.

Devolution

The term "devolution" is generally used to mean the transfer of authority by the federal government over lands and resources to the northern territories – the Yukon, Northwest Territories and Nunavut – but both Québec and Newfoundland-Labrador have also devolved some of their provincial authorities to emerging Aboriginal governments. The devolution of powers is linked to the respective land claims agreements and negotiation processes, and the self-government aspirations of the indigenous peoples of the respective territories.

Transferring province-like responsibilities to the governments of the northern territories has been a longstanding and common goal of both the Canadian and territorial governments. The federal government has been in the process of transferring its decision-making powers to northern governments since the 1970s, including responsibilities for

forestry and mining.³³²

After several years of negotiation, in October 2001 the Devolution Transfer Agreement between the Yukon Government and Canada was finalized, and on April 1, 2003, responsibilities for public lands, water, forestry, mineral resources and environmental assessment devolved to Yukon government.³³³

Over the last 30 years responsibilities for the delivery of health care, social services, education, administration of airports and forestry management have been transferred to the government of the Northwest Territories. More recently, the governments have been negotiating the transfer of remaining provincial-type responsibilities in the NWT. These include programs and responsibilities for land and resources associated with the Northern Affairs Program (NAP) of Indian and Northern Affairs Canada (INAC). They relate to the management and regulation of surface and subsurface natural resources, mining and minerals (including oil and gas) administration, water management, land management and environmental management.³³⁴ A devolution agreement between the governments of NWT and Canada was completed in 2006.

The Nunavut Land Claims Agreement (NLCA) is the basis for resource management in Nunavut. The Nunavut Act, which created the Territory of Nunavut, flows from the NLCA. The territorial government has responsibilities for wildlife management, conservation, health and social services, education, infrastructure development, land administration and tourism, while the federal government retains responsibilities for approval of mineral exploration and mining projects. The federal government

retains the final authority for mining approvals in Nunavut. The environmental assessment process in Nunavut is administered and coordinated by the Nunavut Impact Review Board (NIRB).³³⁵

The Minister of Indian and Northern Affairs has the ultimate responsibility for natural resources management in Nunavut in terms of board appointments, and for regulatory approvals such as water licenses. However, the federal government has indicated its commitment to devolving its responsibility for management of mineral resources, by 2008.³³⁶

There are also devolution agreements between the respective provincial governments and Inuit peoples within the province of Québec, – to establish Nunavik – and the province of Newfoundland and Labrador – to establish Nunatsiavut.

In June 2003 the Inuit corporation Makivik signed a framework agreement with the Province of Québec establishing a formal process of negotiations.³³⁷ An Agreement in Principle was initialed by the negotiators for the three parties – Canada, Québec and Makivik – on August 9, 2007. The next step will be to negotiate a Final Agreement which will be legally binding and will include a detailed Implementation Plan. The Final Agreement will have to be ratified by the Nunavik population, the Québec Government and the Federal Government. The parties to the negotiations are optimistic that they will see the creation of the Nunavik Government by the year 2011.³³⁸ The regional government will also have rights to the region's natural resources, including royalties from the various mines in the region.

In January 2005, the Labrador

Inuit Association, the Federal Government and the Government of the province of Newfoundland and Labrador signed a comprehensive land claims agreement. On December 1, 2005 Nunatsiavut (“Our beautiful land”) and the Nunatsiavut government, (which will consist of an Inuit self-governing regional authority and five Inuit community governments) became a legal and constitutional reality.³³⁹ They have yet to finish their land use plan, and are faced with conflicts over mining claims on the land.

Throughout the North, First Nations have also signed self-government agreements for more control over their own territories. The Grand Council of the Cree in Québec signed the James Bay Northern Agreement and the Paix des Braves; the Sahtu and Tlicho have signed agreements in the Northwest Territories. The Council of Yukon First Nations has an Umbrella Final Agreement in the Yukon.

4.3 The Mining Industry

Demand and supply

It's been a tremendous decade for the mining industry in Canada, with a downward slide in markets and commodity prices that started in 1997, and a frenetic boom over the last three years.

From 1997-2004 economic activity was affected by political tensions, high energy prices, international trade disputes and weak economies in many countries around the world. These factors caused a down-turn in both prices and demand for metal, which reduced mining activity and spending for mineral exploration in Canada.

The mining industry in Canada responded through cost-cutting measures, especially workforce



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reductions. Cost savings also came from changes in mining methods, operational improvements and joint operations, and corporate mergers.

By 2005, a resurgence in demand for minerals and metals strengthened prices. The Canadian mining industry went from bust to boom. Over the next few years, mineral exploration exploded and a new generation of mines began coming on-stream, while several older mines were re-opened or expanded. A sweeping set of foreign acquisitions and mergers have literally changed the face of the industry in Canada.

The Canadian mining industry is currently in a period of great expansion, as evidenced by record spending and record profits. Corporate operating profits in the Canadian mining industry were \$7.0 billion in 2005, compared to \$4.2 billion in 2004, \$1.6 billion in 2003 and \$1.7 billion in 2002.³⁴⁰

Price might not be everything – its traveling companions “demand” and “supply” share its glory – but it has been the most significant factor in the calculation of corporate profit.

Copper’s average price from 1994-2004 was about \$1 a pound. In 2005 it sold for an average of \$1.71. A year later, the price was almost \$2 higher. In 2006, for every 5-cent increase in copper, copper producer Falconbridge (now owned by Xstrata) could add about \$37-million to their bottom line.³⁴¹

Similar tales could be told about other metal commodities.

However, the present boom needs to be regarded cautiously, especially by mining-dependent communities. Although some analysts believe it is a long-term phenomenon, the following factors should

be carefully considered:

- Despite large expenditures in mineral exploration in recent years, Canadian mineral reserves are relatively limited and the net size of the mineral reserve is shrinking; in 2004, Canadian reserves of copper, nickel, lead, zinc, molybdenum, silver and gold decreased by amounts that varied from 3% for molybdenum to 22% for silver, continuing a trend of declining ore reserves that began in the early 1980s
- With 85% of Canada’s exports destined for the United States, a weak American economy is a large factor for Canada and Canadian exports, including mineral exports; moreover, a strong Canadian dollar works against Canadian exports to the U.S., even should the U.S. economy begin to recover.
- The current boom in commodity prices is largely attributed to booming economies and expanding production in Asia, and particularly in China and India. However, China is not only emerging as the world’s largest consumer of raw materials but may also become one of the world’s largest mineral producers. Industry analysts point to the potential for China to become the world’s largest gold producer by as early as 2010.³⁴² In China, the cost for developing a new mine are estimated to be a fraction of the cost in Canada, given that minerals are being identified near surface and labour costs are low, with mine operators paid only \$4,000 per year and chief geologists \$500 per month.³⁴³
- Increased production and labour shortages in Canada have resulted in 30-40% increases in operating and capital costs, and long delays in going into development. The proposed Galore

Creek Mine was shelved after capital costs zoomed from \$2 billion to \$5 billion in only two years.

Mergers and Acquisitions

The dominant companies at home in Canada and in Canada's boreal are also the big players abroad. Just a few years ago, the list of companies would have included Noranda, Teck-Cominco, Inco, Placer Dome, Barrick Gold and Cameco. By mid-2007, only half of those companies remained, with Noranda, Inco and Placer Dome swallowed in an international corporate eating frenzy.

2006 was "The Year of the Merger," with mergers and acquisitions transforming the corporate mining map in Canada. After numerous plays, considerable drama, and several failed takeover attempts, the year ended with the following outcomes in place:

- Barrick Gold had completed a takeover of Placer Dome Inc., including Placer Dome (CLA) Limited in March 2006. Barrick took over properties in Tanzania, the Philippines, Papua New Guinea, Chile, Peru and elsewhere. It also bought out Pioneer Metals Corporation
- As part of the deal, all the Canadian Placer Dome properties were sold to Goldcorp Inc. for US\$1.6 billion, including Placer's 51% interest in the Porcupine Joint Venture (with Kinross Gold Corporation), which was the most lucrative of these mines.
- Goldcorp Inc. also acquired Wheaton River Minerals Ltd. and Virginia Gold Mines Inc.'s Éléonore gold project in James Bay, Québec.
- Later in the year, Goldcorp acquired Glamis Gold Ltd, in a reverse take-over, making it the world's third-largest gold

company by market capitalization and fifth-largest by production.

- Kinross Gold Corporation's stake-over of Bema Gold Corporation moved Kinross into the upper ranks of mid-tier gold miners. Previously, in 2002, Kinross Gold Corporation, TVX Gold Inc., and Echo Bay Mines Ltd. had merged to make Kinross the world's seventh largest primary gold producer.
- Switzerland-based Xstrata Plc bought Falconbridge Limited. In 2005, Noranda Inc had increased its shares in Falconbridge so that it effectively was one company.
- Companhia Vale do Rio Doce (CVRD) of Brazil took control of Inco Limited, the western world's largest nickel producer. CVRD also bought Canico, a junior resource company.
- Iamgold Corporation acquired Cambior Inc. for \$1.1 billion. As Iamgold did not have producing mines in Canada prior to the transaction, the acquisition made the company a mid-tier miner in Canada.
- Lundin Mining bought LionOre
- Shore Gold and Kensington Resources Ltd. merged
- Gold Fields Ltd. of South Africa bought Toronto-based mining company Bolivar Gold Corp
- Yamana Gold bought Viceroy Exploration Ltd for \$577-million
- Denison Mines and International Uranium Company (IUC) merged operations and assets.

Canadian steel companies also faced mergers and acquisitions in this period. Hamilton Steelmaker Dofasco was bought by Arcelor SA of Luxembourg, the world's second largest steelmaker, for \$5.6 billion; but later in the year, Arcelor itself was sold to Dutch giant Mittal, becoming Arcelor-Mittal. The new

company planned to divest itself of the Dofasco plant and had met strong resistance from the union. Stelco of Hamilton was sold to US Steel. Ipsco Inc., a company that originated in Regina and continues to operate there was purchased for US\$7.7-billion by SSAB Svenskt Stal AB of Sweden. Algoma Steel Inc. of Sault Ste. Marie, Ont. was bought for \$1.85 billion in June by Essar Steel Holdings Ltd. of India. Harris Steel Group Inc. of Toronto was purchased for \$1.25 billion in March by Nucor Corp. of the United States.

In 2005, HudBay Minerals Inc. took over Ontzinc which had acquired Hudson Bay Mining and Smelting Co., Limited (HBMS) from South African Anglo American plc. Anglo-American had been anxious to sell the zinc and copper mines and smelters, as they were near the end of their useful lives. The company had controlled the Manitoba- and Saskatchewan-based operations for 75 years.

The mergers and acquisitions have made foreign ownership more pronounced, and have changed the stratification of the industry with the emergence of new middle-sized players. Although there has been some debate about the role of foreign companies in the exploitation of public resources, the political leadership at both the provincial and federal levels has not engaged.

Canadian laws and regulations facilitate foreign ownership. There are no restrictions on foreign exchange, or on the repatriation of capital or profits. A foreign owner can obtain Canadian resource tax treatment by incorporating a company whose activities could qualify as a Principal Business Corporation. Equity capital can be repatriated tax-free. Withholding tax rates are low and declining.³⁴⁴

Most jurisdictions have few limits on foreign directors.

Currently, following the Falconbridge and INCO takeovers, nearly all of Canada's nickel and cobalt, the bulk of its silver, zinc and platinum group metals, as well as half of its copper-producing mines, are owned by off-shore interests. Teck Cominco is now the only major Canadian-owned base-metal company operating in Canada.

There is speculation that there is more to come. Analyst Eric Reguly describes Canadian mining companies as ripe for the picking:

Foreign mining companies consider Canada a shopper's paradise. The targets are ideal: They're big enough to matter but not so big as to be effectively takeover-proof. For that reason, Canada's mining stalwarts will likely vanish as the last great round of the global consolidation game gathers momentum.

Several executives of international mining companies talk of carving up Canada's mining industry like a plump Thanksgiving turkey. Of course, none of them want to be identified. Canadian investors don't seem to mind. They are getting so fat on juicy takeover offers that they can barely waddle away from the table. But the profits come at some cost. Long-term opportunities disappear when companies are eradicated from the stock exchange. Fewer head offices translate into fewer high-paying careers, lower tax receipts and a blow to local and national prestige -- no one wants branch-plant status.³⁴⁵

The junior mining companies find the deposits, do the initial exploration and development, and might

even bring a mine into production, although usually just the smaller operations. In most cases, as a project goes into production the junior company will sell to a senior company.

What is growing in Canada in recent years is the middle tier of companies, who are neither the mining giants nor the upstart juniors. Inmet Mining and Hudbay Minerals are long-standing members of the mid-tier club. Kinross's friendly merger with Bema Gold entrenched Kinross in the upper echelon of mid-tier gold miners, and Lundin's acquisitions and mergers have gained it recognition as a rapidly growing mid-tier mining company. Crew Gold Corporation is an example of an international mid-tier mining company focused on identifying, acquiring, developing and operating resource projects worldwide. For some of the juniors like FNX Mining Company, which has a growing presence in the Sudbury basin, the objective is to join those mid-tier ranks.

Junior Mining Companies and the Exploration Boom

Many of the junior mining companies creating havoc in communities these days have no real expectation of developing a mine. Instead, they are "inspired by market trends and taking advantage of the madness of crowds when faced with an effective market hype program that permits these companies to raise millions in equity from naïve (or blindly greedy) public investors to keep their exploration programs going,"³⁴⁶

Their balance sheets often show nothing but operating losses, as the only cash they generate is from the shares they sell (which shows up on the assets-liabilities section of their financial statements).

The ability to raise money for exploration is enhanced by two federal programs: the Accelerated Capital Cost Allowance (ACCA) and the Super Flow-through Share Program. Mining exploration also enjoys a special incentive called “Canadian Exploration Expenses” (CEE).

Super flow-through shares, tax credits, and their provincial equivalents enrich speculative investors by reducing the after-tax cost of a \$1,000 investment in mineral exploration in Canada to as little as \$284 in Québec and \$382 in BC. The Prospectors and Developers Association of Canada annually provides a leaflet that shows how these numbers have been calculated.

It is important to note that most provinces also offer flow through shares and tax incentives for mines in remote areas (e.g., ten year tax holidays) in addition to the federal program. A study of these programs can be found in *Looking Beneath the Surface: Assessing the Value of Public Support to the Canadian Metal Mining Industry* (2001), which is available on the MiningWatch Canada website.

There has been a proliferation of limited partnerships where investment dealers broker the relationship between individual investors, who want the tax losses, and companies that are willing to give up portions of their CEE tax pool in return for the investment. These dealers make anywhere from 20-40% in fees for the transactions, so they have their own interest in maintaining the program.

The combined effect of all this is a net upsurge in companies that want to create exploration costs and hype their claims, even when the mine may have no real chance of ever going ahead. The intention of these

companies is to mine investors and the tax system, not the land. It must be noted, however, that exploration itself creates substantial environmental damage.

Junior mining companies are represented by the Prospectors and Developers Association and various provincial prospectors groups that are often government-funded.

Canadian Mining Companies Abroad

There are more mining companies based in Canada than any other country in the world. In 2005, 155 of the world’s 304 larger mining companies were based in this country. The value of the exploration programs that the larger Canadian-based companies planned to undertake in Canada and elsewhere around the world increased in that year to more than \$1.9 billion.³⁴⁷

Roughly two-thirds of the worldwide budgets of the larger Canadian-based companies were allocated to programs abroad in 2005, about the same proportion as in each of the previous three years. Almost 70% of the 155 larger Canadian-based companies planned to work abroad during 2005. Of these 155 companies, half planned to work only abroad, while 21% planned to work in both Canada and abroad and 30% planned to work only in this country.³⁴⁸

Canada continues to be a world leader in raising equity capital for exploration and mine development. Of the \$24 billion raised in equity financing for global mineral exploration and development between 1998-2002, 41% was raised in Canada, compared to 12.5 % in the United States, 13.6% in Australia, 5.8% in South Africa, 10.4% in the United Kingdom, and 16.5% in other countries.³⁴⁹

According to a Price Waterhouse Coopers (PWC) report, “Mine: Riding the Wave,” global net profits in the mining sector rose by 64% in 2006, 15 times higher than in 2002. The number of Canadian companies among the world’s 40 largest public mining concerns, however, fell from 12 in 2003 to six in 2006.

Canadian companies still on the “top 40 list” included Agnico-Eagle Mines Ltd., Barrick Gold Corp., Cameco Corp., Goldcorp Inc., Kinross Gold Corp. and Teck Cominco Ltd. CVRD, which bought Inco, was the fastest growing company among the top four by market value, increasing by 56 per cent in 2006.

For 2006, the companies in the report made \$67 billion on revenues of \$249 billion.³⁵⁰

Mining Industry Associations

Many – but certainly not all – of the companies currently operating mines in Canada’s boreal are members of the Mining Association of Canada, which is the industry’s main lobby group and industrial organization.

Mining Association of Canada (MAC)

The Mining Association of Canada, headquartered in Ottawa, plays a major role in supporting its members in their efforts to affect Canadian regulation of the mineral sector, as well as public and government’s perception of the mining industry.

The Association’s 29 members represent the major players in the base and precious metals market. While MAC has traditionally represented the senior mining companies primarily, their membership has diversified over the last decade, and now includes a mix of senior companies such as Barrick Gold,

mid-tier companies such as Aur Resources, and junior companies such as Canadian Zinc.

MAC has also brought in some of the industry outliers in recent years, such as major uranium producer Cameco and regional players such as Iron Ore of Canada Ltd and North American Palladium. The net effect of this can be expected to be positive for two reasons:

- In general, the Mining Association of Canada presents the more progressive face of the mining industry, particularly on social and environmental concerns; while many mining practices may still be problematic, the Association has gone to considerable effort and developed considerable expertise in “best practices” and it can be only helpful to have the broader constituency of mine operators exposed to and committing to improved practices; and
- In past years, the industry was often able to increase their representation at multi-stakeholder consultative tables, arguing that those companies which were not members of MAC were not being represented, and so required additional seats at the table. For example, during the lengthy process to review and revise the federal mine effluent regulation, the industry was represented not only by the Mining Association of Canada, but also by representatives of non-MAC-member companies, who argued that their interests were unique enough to warrant additional industry seats at the table.

Dating back to the mid-thirties when it was known as the “Canadian Metal Mining Association,” MAC describes its mission as being “to promote, through the collective action of members, the growth and

development of Canada’s mining and mineral-processing industry, for the benefit of all Canadians.”

The Association can play a positive role in some consultative processes, working with its members to develop positions that may find some support with other stakeholders. For example, the Mining Association has made significant contributions to the National Orphaned/Abandoned Mines Initiatives, providing financial support, administrative support, and constructive representation on the Initiative’s steering committee and working groups.

In 2004, the Mining Association of Canada launched their “Towards Sustainable Mining” (TSM) initiative. MAC describes it as being about the industry earning its social license to operate, improving mining’s reputation by improving performance, and aligning the industry’s actions with the priorities and values of its communities of interest. There is a TSM Communities of Interest (COI) Advisory Panel with a multi-stakeholder membership which meets twice a year.

In the TSM Annual Progress Reports, MAC’s member companies report on four key performance areas: tailings management, energy use and management of greenhouse gas emissions, external outreach, and corporate crisis management planning. Companies also publish their overall releases as required by the National Pollutants Release Inventory (NPRI), as well as energy use and GHG emissions data. The objective is to show Canadians the industry’s current performance and ways of improving it.

The TSM results in these two reports are based on self-assessments conducted internally by each company. MAC has developed an

external verification system which will be launched in 2007 that will require that companies and facilities to have their TSM performance indicator assessments externally verified. The TSM Annual Report for 2004 and 2005 also presents the results of progress in designing a TSM verification system and the work of the COI Advisory Panel. MAC requires all member companies who have adopted TSM, its guiding principles and its obligations to report on key performance areas within three years.³⁵¹

At the same time, MAC's primary purpose is to act as an advocacy agency for industry's interests, which are frequently at odds with the public interest. For example, MAC played a key role in the "Keep Mining in Canada" campaign, which promoted an industry agenda of deregulation and increased subsidies. Now flying under the banner of the "Mining Works for Canada" the re-packaged campaign's goal is to "facilitate the growth and development of the mining industry by enhancing the industry's reputation with key federal decision-makers." Other campaign priorities are to reduce regulation, reduce taxes, and increase public subsidies to the mineral sector. It is the primary communications arm of the Mining Association of Canada.

One of the "Mining Works for Canada" campaign's annual events is a lobby day in Ottawa, when mining executives take the Hill and meet with 50-60 federal decision-makers, including several Ministers and Caucus Chairs. Messages over the last several years have settled into a few key themes: excessive regulation, declining mineral reserves, and tax reform. MAC organizes the lobby day and reception on Parliament Hill each November.

In September 2007, MAC intervened in the decision by the Mackenzie Valley Environmental Impact Review Board (MVEIRB) to refuse a permit for uranium exploration to Ur-Energy in the Thelon watershed. Without consulting the Communities of Interest Panel, MAC wrote to the Minister of Indian and Northern Affairs urging him to grant the permits for uranium exploration. The MVEIRB had shocked the mining industry when it denied Ur-Energy's plan to drill up to 20 holes near the Thelon River because it threatened the spiritual and cultural well-being of the area's Akaitcho Dene.

"If implemented, the recommendation of the review board would effectively terminate mineral exploration in an important part of the N.W.T.," MAC wrote to then-minister Jim Prentice after the original decision. Many of the COI members were outraged by this position.³⁵²

Prospectors and Developers

The Prospectors and Developers Association of Canada (PDAC) is another major, country-wide industry organization. Based in Toronto, the PDAC represents the interests of the Canadian mineral exploration and development industry. In existence since the early '30's, PDAC purports to speak on behalf of 6,000 individual and 800 corporate members. There is considerable overlap between PDAC's 59 "senior" corporate members and the Mining Association of Canada's membership. PDAC's 48-member board includes a wide range of representation, from individual prospectors or consultants to the likes of Barrick Gold and Teck-Cominco, along with a grab bag of law firms, junior and mid-tier companies, and mining industry service providers, plus a few Aboriginal representatives.

An aggressive lobbying organization, PDAC describes its mandate as being threefold: advocacy, information, and networking.

PDAC claims numerous lobbying successes over the years, including the introduction by the federal government of the 'super' flow-through exploration investment tax credit, the increased focus on geoscientific activities across Canada, the decision of the Ontario Securities Commission to retain its rule on exempt distribution, and the creation of a "special industry-government committee" to "resolve regulatory problems in northern Canada." Another coup for PDAC was the award of funding from the Government of Ontario for the industry group's "Mining Matters" program. A registered charity, "Mining Matters" is an "information" campaign promoting mining to school children.

Still not satisfied, PDAC claims that "raising working capital, access to land, and onerous regulations are just some of the continuing challenges."

Other national organizations that promote the interests of the mining industry include the Canadian Association of Mining Equipment and Services for Export, the Canadian Institute of Mining, Metallurgy and Petroleum, the Canadian Mining Industry Research Organization, and the Coal Association of Canada.

Canadian Aboriginal Minerals Association (CAMA)

The Canadian Aboriginal Minerals Association (CAMA) has been around for fifteen years, delivering its message of "participation" for Aboriginal communities in mineral exploration and development.

CAMA describes itself as an “Aboriginal, non-profit organization which seeks to increase the understanding of the minerals industry, Aboriginal mining and Aboriginal communities’ paramount interests in lands and resources,” However, its membership is comprised of “interested Aboriginal communities,” plus mining companies, governments and suppliers.

While CAMA describes itself as being “an instrument for the advancement of Aboriginal community economic development, mineral resource management and environmental protection” there have been concerns raised about the relationship between CAMA and its industry partners (and industry members and funders). In essence, the concern raised is whether the net outcome of CAMA’s efforts is the facilitation of Aboriginal communities’ participation in economic benefits and decision-making, or the delivery of Aboriginal communities to mining interests.

A case in point is the Aboriginal Toolkit, funded by industry and government and developed by CAMA. Even in its announcement, the Toolkit became suspect. It emphasized that the kit’s purpose was to increase Aboriginal participation in mining, while industry’s pronouncements anticipated that the Toolkit would lead to more mining on Aboriginal territories.³⁵³

For its part, the mining industry believes the tool kit will facilitate new mining development.

- MAC PDAC CAMA NRCAN News
Release March 17, 2004

The product, unfortunately, bore out that promotion. Although the Toolkit provided a primer on activities at the stages of mine

exploration, development, operation and closure, it glossed over the serious environmental, social and cultural impacts of mining on Aboriginal governments and communities, omitted any discussion of the relationship of mineral staking and exploration to questions of Aboriginal Rights and Title, and provided no resources, links or bibliography for Aboriginal people and organizations.³⁵⁴

While the need was real, and the opportunity was there, the product reflected CAMA’s industry roots rather than responding to the needs of Aboriginal communities dealing with mining and mineral exploration.

Other organizations

In addition to the national organizations, each province or territory has at least one and often several industry organizations, operating at a regional or provincial / territorial level, including groups like Alberta Chamber of Resources, B.C. and Yukon Chamber of Mines, the Mining Association of British Columbia, the Mining Association of Manitoba, the Northern Prospectors Association, the New Brunswick Mining Association, Northwest Territories and Nunavut Chamber of Mines, the Ontario Mining Association, the Ontario Prospectors Association (recipient of a \$4 million start-up grant from the Ontario government in 2000), the Association for Mineral Exploration of British Columbia (AMEBC) the Northwest Mining Association, the Québec Mining Association, the Saskatchewan Mining Association, and the Yukon Chamber of Mines.

Some companies are members in several organizations, both provincial and national, and the mandates and activities of the provincial and national organizations are generally similar, albeit more focused

on their own particular level of government.

Not surprisingly, given the global reach of Canadian mining companies, these same players are also active in international organizations and pro-mining campaigns, such as the Global Mining Initiative, the Metals, Mining and Sustainable Development project, and exercises like the Asia-Pacific Economic Countries' Group of Experts on Mineral and Energy Exploration and Development (GEMEED).³⁵⁵

Singly and in combination, these exercises have the intention of "greening" the image of the mining industry, and recasting the fundamentally unsustainable extraction of non-renewable resources in a "sustainable development" framework. For example, prior to the convening of the 10-years-after Rio United Nations summit

on sustainable development in September 2002, the activity level among the industry associations and industry-sponsored initiatives became more focussed on producing public relations products and creating the right optics for the U.N. conference.



5.0 Aboriginal Peoples and the Mineral Sector

5.1 The First Peoples

Aboriginal peoples are the original inhabitants of the Boreal. They include the Innu of Labrador, the Mushkegowuk of Northeastern Ontario, the Cree of Northern Québec, Ontario, Manitoba, Saskatchewan and Alberta, the Dene and Cree of northern Saskatchewan, the Deline and Dene and Tlicho of the Northwest Territories, the Tlingit, Tse Keh Nay, Gitksan and Tahltan peoples of northern BC and the Dene of the Yukon, the Inuit of the far north. They have lived with the land since time immemorial.

In mineral development, impacts are borne first and foremost by Aboriginal peoples. In some cases, the First People may have been removed from the land or relocated to other parts of their traditional homelands many decades ago, such as the older mining “camps” of Timmins, Rouyn-Noranda or Yellowknife, where mining has been taking place for almost a century. These relocations were often motivated by mineral or other natural resource development interests. In other cases, the impacts are more recent. They may include relocation, or may mean a loss of the land – or an ability to live on the land – due to displacement, disposition, or contamination from mining.

During 150 years of mining in Canada, First Nations communities have gained considerable experience with the dramatic effects of mineral extraction on the landscape and their lives.

Some of this experience has been tragic, such as the exposure of the Deline people to radioactivity from uranium mining at Port Radium in the Northwest Territories. The

results, however, include a body of knowledge and expertise within the Aboriginal communities about the impacts of mining on indigenous culture and lifestyles. Some First Peoples have developed strategies to protect communities from some of the adverse effects and gain some economic benefits.

Many Aboriginal communities still find they face the mining company alone, and have to learn the same lessons that others learned before them, through bitter experience. In many cases, mining and exploration companies seek the path of least resistance, preferring to exploit weaknesses in legal, political, jurisdictional and other areas if it is advantageous or “more efficient.”³⁵⁶

First Peoples are interested in economic development, and by extension, are not necessarily opposed to all mine developments. At the same time, two common experiences repeat themselves. First, mining has had adverse impacts on the land and water upon which Aboriginal people rely, and, by extension, on the peoples and their cultures. Second, Aboriginal communities often lack the background information and technical support they need in order to deal with the mining companies on an equal footing when they are confronted with mine development proposals.

While these negative experiences are recurring, they are not inevitable. As case law has evolved so too could the regulations governing mining and mineral development. Canadian case law and international precedents exist in key areas where reform is most needed: the need for prior and informed consent, and for meaningful requirements for benefit-sharing/restitution where mines are already operating and/or have been permitted.

“Overall the levels of employment achieved have been limited in at least two respects. First, the proportion of Aboriginal people employed in industry such as mining is little better than the proportion of Aboriginal people in the community population despite the proximity of Aboriginal communities to the resource project and counting all Aboriginal people employed in the sector, not just those employed by non-Aboriginal companies. Second, evaluation reports consistently conclude that Aboriginal employment is restricted to less highly skilled lower wage occupations.”

Royal Commission on Aboriginal Peoples, 1996.

5.2 Issues and Impacts

Before the mine is established, before any assessment, and certainly before any agreement to share economic benefits is made, mineral exploration takes its toll on the land and the people who live with it. As discussed in Section 3.3 of this report, while the impacts of mineral exploration are significant, there are few rules in place. Environmental assessment of mining projects comes after the exploration activities, rather than before.

In 1995 alone, more than 250,000 claims were staked in Nitassinan, covering nearly half of the vast Innu territory. With the exploration boom came base camps, cut lines and fuel caches; then, a few years later the boom was over, leaving behind abandoned camps that now resemble garbage dumps.³⁵⁷ While they were active, the camps themselves, with their drilling rigs, helicopter flights and their occupation of the land, were affecting wildlife and the opportunity for people to continue to practice their traditional life style.

Ongoing tensions persist where expectations are being unmet: what may seem irrelevant to a mining or exploration company may prove critical to the survival of a cultural practice. For example, the people of the Muskrat Dam First Nation in Northern Ontario were adversely affected by the disruption of goose hunting for an entire season resulting from unexpected exploration activity.

The Innu also observed that mineral exploration alienates land. Where lands are explored and minerals found, their lands were no longer available for selection in the land claims process.³⁵⁸ This experience and concern is shared by many other First Nations, including

the Kaska Dene in the Yukon, the Missinabie Cree First Nation and Kitchenuhmaykoosib Inninuwug in northern Ontario.

“When people are afraid to eat their wild meats, we see more and more people are getting diabetes, heart disease and high blood pressure. They are also too poor to afford store bought foods.” (Yukon health worker)
Gaining Ground: Women, Mining & the Environment

From coast to coast to coast, Canadian mining operations have left behind a nasty legacy of contamination, which will impair water quality and affect fish and country food for the foreseeable future. There has been a decline in wildlife populations around the Faro Mine since operations began.³⁵⁹ Many First Nations have expressed concerns about contamination of wildlife, including the Little Salmon Carmacks First Nation, whose members have been concerned to see caribou, moose and bison drinking contaminated water from the tailings pond at BYG’s closed Mount Nansen gold mine.³⁶⁰

In response to similar concerns, the Crees of Northern Québec hired an independent expert to study ground water and environmental contamination coming from mines in the territory of the Ouje-Bougaumau Cree Nation. The study, released in October 2001, was undertaken to find out why the fish the Cree depend on for food have deforming mutations. It looked for traces of contaminants near three mining sites, and found high levels of arsenic, cyanide, lead, mercury and other heavy metals in the water, fish and human beings.

The report concluded that the problem dates back to the 1950s

when the mines started dumping their waste tailings into Lac Dore and Lac Chibougamau. It found that the mines are still leaching contaminants, and proposed that epidemiological studies of the Cree should be carried out to establish a clear link between the contaminants and the deaths they have caused. In examining sediments in Lac Dore where the Cree fish, the level of cyanide in the water was 40 times the allowable limit, while the sediments were found to have 101mg of arsenic per kilogram, compared to the Canadian environmental quality guideline for arsenic of 5.9 mg per kilogram. In Lac Chibougamau, the arsenic level was 243 milligrams per kilogram, or 41 times the allowable limit. The study also found high levels of heavy metals in fish caught in the lakes and in hair samples from Ouje-Bougaumau residents. All the metals detected are toxic to humans; they are known to cause cancers of the kidney, liver, lung and skin and have other negative effects on human health. The report author recommended that another 27 mines in northern Québec also be studied.³⁶¹

In addition to all of the environmental problems that come with a mine, there are social and cultural challenges that mines or other large developments pose, particularly for small or remote communities. They are often challenges that are faced by First Nation communities in whose territory mining is occurring.

In the “boom time” of a mineral exploration rush or a new mine’s construction and start-up, varying numbers of transient workers arrive, bringing with them changes in community stability and dynamics. Social problem may escalate, including alcohol abuse, spousal and child abuse, sexual assault and harassment, and erosion of cultural traditions and customs. Food

"I wish that everyone who works -- goes to work in Voisey's Bay would take a cross-cultural course. A course where they learn about native people in the area, how we live, how we eat and some of the values that we have. We don't need people coming into Labrador who have no understanding of native people. I don't want to always have to defend myself when this influx of people come to live in our area. I want Voisey's Bay Nickel to be proactive on this issue rather than making us reactive. I don't want to see racism showing its ugly face in Voisey's Bay." (Joyce Ford, Rigolet Women's Association, Voisey's Bay Mine and Mill Project Environmental Assessment Hearing Scoping Session, May 1997)

Another negative impact, although it stems from a positive impact, that being a family member has a job, is the stress women are put under when their husbands go off to work at Voisey's Bay. All of a sudden it seems as though those women become single mothers. Could Voisey's Bay Nickel Company not come up with a better work schedule? Even better yet, could they not give workers the option of moving their families up to Voisey's Bay to live while they work there?" (Joyce Ford, Rigolet Women's Association, Voisey's Bay Mine and Mill Project Environmental Assessment Hearing Scoping Session, May 1997)

sources are frequently threatened by increased hunting by outsiders, and by disruption of migration patterns and wildlife habitat. As traditional foods become harder to access, new financial and nutritional problems may emerge.³⁶² In some communities, elders have noticed more parasites and diseases in fish and wildlife found near mine sites, and, in these same communities, some elders have developed allergies to the fish and wildlife that they had eaten all their lives.³⁶³

Even the economic benefits of jobs and improved incomes may come with an unanticipated or unintended cost. For example, when community members become part of the industrial work force they may be more limited or unable to participate in traditional activities. First Nations employees may need to learn to speak a foreign language which can introduce subtle yet profound transitions in cultural traditions - for instance, as the number of people speaking traditional languages in the community begins to decline.³⁶⁴

Employment, while seen as an economic benefit, has a downside as well, particularly in situations where the miners stay at the mine site. This results in separation from home and family, leaving one parent at home with all of the responsibilities for child rearing.

Many First Nations people experience discrimination while on the job site. There are also difficulties in getting access to training. Language differences increase the challenge, often making the mine workplace a formidable environment.³⁶⁵

These social impacts can be avoided, managed or mitigated, but only with appropriate resources and attention.

5.3 Rights and Responses

While the "right to mine" may appear to be paramount in mining laws and in the attitude of regulators across Canada, Aboriginal peoples are asserting their rights under Section 35 of the Constitution, arguing that their rights trump mining rights.

Numerous court cases have upheld and are giving definition to Aboriginal and treaty rights, most notably the Sparrow decision in 1990, Delgamuukw in 1997, the Haida and Taku decisions in 2005, the Mikisew decision in 2005, and the Musqueam decision in 2007. Many challenges remain, however, in having those rights recognized and respected by both government and industry in the day to day struggles over mine development.

Treaty rights are those rights granted under specific agreements that have been entered into by particular First Nations and the Crown, most of which were signed during the 1800s and early 1900s. Under these agreements, according to the governments of Canada, large tracts of land were often ceded in return for monetary payments and hunting and fishing rights. The First Nations, in contrast, view these as treaties of peace and friendship, rather than as statements of surrender. Given the complexity of these legal documents, the differences between oral and written cultures, and the narrow interpretations made on the part of the non-Aboriginal governments, many of these agreements are contested by the First Nations signatories.

Land claims agreements are modern treaties establishing a First Peoples' rights over specified lands, and may also include the establishment of new institutions to regulate the land and resources, and

resolve disputes. Land claim settlement areas may include portions where the Aboriginal peoples own both the surface and subsurface rights, affording them full control over mining activities. Land claim settlement areas may also include portions where the First Peoples own only the surface rights, providing the Aboriginal peoples significant control over access to the land along with provisions to resolve conflicts where subsurface interests may conflict with surface access. This arrangement may often provide compensation for access provisions.

Despite established rights, a great number of outstanding land claims languish while business and governments move forward with the development of new mines in response to global markets and burgeoning commodity prices.

In the early 1990's, the mining industry initiated the Whitehorse Mining Initiative (WMI), a multi-sector process involving government, industry, labour organizations and aboriginal groups. Many hoped it would make significant progress in the recognition of Aboriginal rights and access to the economic benefits from mining, as well as improving standards for environmental care and mine-related decision making.

The two year process culminated in the signing of an Accord in September 1994. It included shared goals of settling land claims fairly and expeditiously, supporting

negotiation processes, ensuring open communication between the mineral sector and potentially affected Aboriginal communities, and removing barriers that prevent Aboriginal people from maximizing their benefits from mining activity. It was signed by representatives from federal and provincial governments, two of the national Aboriginal organizations,³⁶⁶ major mining companies and industry associations, labour and environmental groups.³⁶⁷

Almost a decade later, references to the Whitehorse Mining Initiative “commitments” have become infrequent, but every major mining company would describe itself – at least in principle – as being committed to consultation. Likewise, governments continue to give the principle lip service, for example through a variety of provincial ‘consultation frameworks’. Case law has largely outpaced the commitments of the WMI to consultation and benefits-sharing with Aboriginal peoples, and there is now increasing power on the part of many First Nations to set the agenda for mining proposed for their territories. Exploration activities, as noted elsewhere in this report, continue to be a problem point between First peoples and the mineral sector.

The *Sparrow* decision of 1990, and *Delgamuukw* seven years later, both set out the legal requirement for the Crown to consult with First Nations people on decisions that may affect their Aboriginal title or the exercise

of their Aboriginal rights. This includes resource development or mining proposals. This duty to consult not only requires the Crown to substantially address the concerns of First Nations, but may also require the Crown to obtain the consent of First Nations prior to any development on Aboriginal title lands.³⁶⁸ The *Delgamuukw* decision described a range of depth to this duty, from a duty to discuss decisions when the activity is of little or no effect on aboriginal title, to much more substantial engagement where the effect of the activity may be more profound. It acknowledges that “some cases may even require the full consent of an Aboriginal nation.”³⁶⁹

The 1997 decision of the Supreme Court of Canada in the case of *Delgamuukw v. British Columbia* was a turning point for treaty negotiations in British Columbia, and has broad implications for issues around resource development across Canada. The decision confirmed that Aboriginal title does exist in British Columbia, and determined that Aboriginal title is a right to the land itself. This right is not just the right to hunt, fish or gather, but means – among other things – that when dealing with Crown land, the government must consult with and may have to compensate First Nations whose rights may be affected.³⁷⁰ The *Delgamuukw* decision also ruled that, if a First Nation has Aboriginal title, it has exclusive use and occupation of the land over which the title applies, including sub-surface or mineral rights.

However, two constraints are placed on that right: the Court said that the land must be used in a manner consistent with the special connection between the people and the land; and non-Aboriginal governments may have an ability to infringe on Aboriginal title or use of the land,

Whitehorse Mining Initiatives Principles

- Aboriginal people have rights protected under the Constitution Act, 1982, which include, among others, rights to lands and resources.
- Aboriginal peoples are entitled to opportunities to participate fully in mineral development at all stages of mining and associated industries and at all employment levels.

Whitehorse Mining Initiative Leadership Council Accord, 1994

including for the development of a mine. However, the Crown also has a fiduciary obligation to act for the benefit of the First Nation, so it would have to demonstrate that the infringement, such as a new mine, would reflect and accommodate the interests of the First Nation. It also must engage in good faith consultation with a First Nation before making a decision that would affect them.³⁷¹

“There is always a duty of consultation.”
Delgamuukw v British Columbia

The Haida, Taku, Mikisew and Musqueam decisions have added considerably to these significant decisions of the 1990s, and the discussion has evolved from one where the focus is on fiduciary obligations to one that encompasses the important concept of the “honour of the Crown.”

The *Haida Nation* and *Taku* cases made clear that even if the Crown’s fiduciary obligations are not engaged, there is still obligation on the part of the Crown to consult and accommodate when the Crown knows - or ought to know - that an Aboriginal right or title may exist and an action is being considered that may adversely affect that right or title. The *Haida Nation* decision made clear that the Crown’s obligations are at the “strategic planning” level, and not just in the implementation of policy decisions already made.³⁷²

“In all its dealings with Aboriginal peoples, the Crown must act honourably, in accordance with its historical and future relationship with the Aboriginal peoples in question. The Crown’s honour cannot be interpreted narrowly or technically, but must be given full effect in order

to promote the process of reconciliation mandated by s. 35(1)” (Taku Court decision, at paragraph 24)

Subsequent decisions of lower courts have begun to fill in the general framework outlined by the Supreme Court of Canada.³⁷³

The November 2005, the Supreme Court of Canada decision in *Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage)* further affirmed the existence of a duty to consult in a post-treaty context. It ruled that governments are subject to a duty to consult in situations where the exercise of their authority would have an adverse effect on Aboriginal treaty rights.³⁷⁴

The *Musqueam First Nation v. Canada* decision was released in October 2007. This case addressed issues related to consultation, and whether the Crown had adequately consulted the First Nation prior to offering lands for sale in an area that is part of their traditional territory and also part of an area that is subject to an outstanding land claim. The court found that the Crown had a duty to consult, and in response to Crown arguments for deference to government responsibility to make and implement public policy in the public interest, the judge found that “on balance, the public interest in preserving the honour of the Crown outweighs the public interest, of a comparatively short to medium term nature, deriving from the essentially immediate sale of [the Properties].”³⁷⁵

In 2007, Justice G.P. Smith of the Ontario Superior Court ruled against Platinex, a junior exploration company, continuing its exploration activities on Kitchenuhmaykoosib Inninuwug traditional lands. While the eventual implications of this ruling are unknown, there are potentially a number of important

precedent-setting consequences. The ruling does confirm the inherent importance of the land to First Nations, demonstrating the Court's acknowledgement that "The land is the very essence of their being. It is their very heart and soul. No amount of money can compensate for its loss."³⁷⁶

In his ruling, Justice Smith faulted the company for 'disrespectful' and unprofessional actions. At the same time, it was the provincial government that received the harshest reprimand for failing to establish formal consultations amongst the parties.

As global markets press exploration companies further into more remote areas where unsettled land claims exist, an escalation of conflicts such as these becomes more likely. Clearly, there is a need for all parties to work towards acceptable land claims resolutions, while demonstrating respect towards the inherent rights of First Nations, and respect for the environment and culture.

The legal interpretation of Aboriginal rights is constantly evolving.

5.4 Impact Benefit Agreements (IBAs)

First Peoples are employing various strategies in their struggle both to limit the damages of mining to their land and lifestyle, and to gain some share in the economic benefits of mine development proposed or taking place on their territory.

Over the last decade, the negotiation of Impact Benefit Agreements (IBAs) and participation in environmental assessment processes have produced some positive results in addressing First Nations' concerns about impacts of mining on the

environment and on aboriginal lifestyles, and on the resource drain out of their territories. In some cases, such as that of the Inuit of Labrador, the potential for large scale mineral development may have sped up land claim negotiations, as the Inuit made the settlement a condition for allowing the mine to proceed.

Experience with Impact Benefit Agreements varies greatly from one First Nation to another, and from one company to the next. Generally speaking, IBAs are socio-economic agreements between the Aboriginal government whose territory is under mineral exploration or development, and the proponent or mine operator. IBAs may be sought not just when the mine is on the doorstep, but anywhere within a traditional territory. This may mean that more than one community or First Nation is involved, as territories may overlap. For example, Moose Cree First Nation successfully negotiated an IBA with the DeBeers Victor Project located approximately 200 kilometres from the First Nation, based on the project's impact and reliance on the Moose Cree homelands. DeBeers also recently concluded IBA negotiations with four different aboriginal groups (Tlicho Government, Lutsel K'e Dene First Nation, Yellowknives Dene First Nation and the North Slave Metis Alliance) affected by the Snap Lake project in the North West Territories.

Impact Benefit Agreements between Aboriginal communities and mining companies often begin as non-binding Memoranda of Understanding which are then later negotiated into full-fledged and legally binding IBAs. For the most part, these agreements are entered into voluntarily, but in Alberta, Saskatchewan and Manitoba, and in most areas under comprehensive land claims agreements, IBAs are

required, and must be negotiated prior to permits being issued.

Broadly speaking, Impact Benefit Agreements describe anticipated negative impacts of a proposed project and what will be done to mitigate the impacts and/or provide compensation. They also identify benefits the project is expected bring to a local community, and can include commitments from the company on local employment levels, revenue sharing, training programs and scholarship programs, and commitments that the company or mine operator will contract services or supplies locally.

A study prepared for the North-South Institute in 2002 indicated a number of issues and challenges related to IBAs and their negotiation and implementation, including:

- deficiencies in the legal framework for IBAs;
- lack of implementation;
- challenges for communities to learn from each other's experiences, due to confidentiality provisions and the lack of a clearinghouse IBA information;
- the process of negotiating IBAs is often lengthy and demanding of the First Nations participants (and others) in terms of time, expertise and decision-making;
- lack of understanding of the different cultures, expectations and worldview of the negotiating partners (e.g. the First Nation and the company);
- difficulties in reliably predicting and monitoring environmental impacts cannot be adequately accomplished without the inclusion, on an equal footing with science, of Local/Traditional Ecological Knowledge.

The report also identified a number of important elements in successful IBA negotiations:

- the inclusion of Local/Traditional Ecological Knowledge;
- early consultation, preferably before exploration and certainly before any early construction, such as for roads, camps, air-fields, etc.;
- a respectful, fair, honest, inclusive environment;
- an approach that takes into account cultural differences in negotiating and decision-making;
- an acknowledgement of the right of affected communities to say “No” to aspects of a project they find unacceptable;
- a participatory process for the affected community, in both the consultation and decision-making.³⁷⁷

IBAs generally include employment, training and other social and cultural commitments, and the sharing of economic benefits. Some Aboriginal governments have established development corporations to assist in appropriate consultation and communications.

IBAs may also include responses to environmental impacts and other environmental requirements such as establishing baseline data, monitoring, reporting and defining impact mitigations that expand or supplement those found in the Environmental Impact Assessment report. Both social and environmental measures may include defining roles, responsibilities and obligations, establishing such mechanisms and institutions as independent monitoring committees, a monitoring process, and contingency plans. Funding for any or all of these activities may be defined, as well as compensation or mitigation when necessary. Provision may also be made for ongoing consultation requirements.

Certain clauses may include specific

financial and equity provisions, such as royalties, profit-sharing arrangements, and cash or equity interests such as representation on a company’s board of directors. The Innu identified protection of land and animals, compensation and royalties, job quotas and training, management roles with respect to the mine, and a clear outline of Innu land rights as elements they would expect to negotiate in an impact benefit agreement.

Generally speaking, IBAs are negotiated in advance of a new mine opening, but this is not always the case. For example, at the Ekati Diamond Mine in the Northwest Territories, BHP completed negotiations with the North Slave Metis Alliance on July 14, 1998. The mine opened on October 14, 1998. It was not until December 9, 1998 that an IBA was signed with the Inuit of Kugluktuk and the Kitikmeot Inuit Association.³⁷⁸

At the Musselwhite Mine in Northern Ontario, an impact benefit agreement was signed with the Windigo and Shibogama Tribal Councils in advance of the mine opening, but with a limited term. Negotiation for the second term of the IBA was difficult, with a number of issues between the First Nations and the company, and with Placer Dome perhaps less motivated to find resolution once the mine was already operating. Musselwhite was the only one of Placer Dome’s four Ontario mines for which there was an impact benefit agreement in place as of 1999.³⁷⁹

In fact, it was the only impact benefit agreement in place for any operating mine in Ontario, although the Wahnapiitae First Nation has a Memorandum of Understanding with CVRD-Inco related to the closure of the Whistle Mine. Implemented in 1999, that

MOU establishes a list of principles designed to promote closer relations, promote the participation of Wahnapiatae First Nation community members as employees and contractors in the mine closure program, and create joint environmental management and monitoring systems.³⁸⁰

In an Economic Impact Study for the Victor Diamond Mine Project in northern Ontario, De Beers Canada Exploration Inc. described their intention with respect to the development of an Impact Benefit Agreement in this way:

“To assist in maximizing full employment and other benefits to the AttFN (Attawapiskat First Nation), an Impact Benefit Agreement will be negotiated between De Beers and the AttFN that will address labour force issues (i.e., education, training for careers in mining, business opportunities, site project employment and job opportunities) and other issues such as environmental protection and compensation for loss of traditional activities such as hunting and fishing.

Through the Impact Benefit Agreement, monies will flow from De Beers to the Band Council and be distributed throughout the community in a variety of ways. The monies will take a variety of forms (e.g., lump sum payments or yearly payments), and can be varied by type (e.g., compensation for taking resources out of the Band’s reserve, as a joint business venture, or as a facility such as the training centre which will be built by De Beers, given to the Attawapiskat First Nation and then leased back to the company for the life of the project for a nominal rent). Some monies may flow directly to a division of the Band Council (e.g., the

Development Corporation), but only with the approval of the Council.

Through the Impact Benefit Agreements between the Attawapiskat First Nation and De Beers, other project benefits will directly accrue to the reserve in the form of financial contributions/compensation as well as new buildings (e.g., the training centre). Within the Regional Impact Area, new and upgraded facilities (e.g., winter road, improved road, rail, seaport and airport facilities) will be required that, when built, will benefit all residents of the region.”³⁸¹

At the completion of the environmental assessment process and filing of the final report, IBA negotiations had still not been completed between De Beers and Attawapiskat or between De Beers and number of other First Nations in the area who are likely to be affected by the mining project.³⁸²

In some cases, companies may view IBAs as a means of securing First Nations’ support for their proposed development, and they may attempt – or even insist – on having this support stated within the agreement. Companies may also wish to include a clause which prohibits the First Nation from opposing a project during the permitting or environmental assessment processes. BHP’s model agreement includes a statement that the First Nation entering into the agreement “will not object to the issuance of any licenses, permits, authorisations or approvals to construct or operate the Project required by any regulatory body having jurisdiction over the Project.”³⁸³

5.5 Environmental Assessments

Environmental assessments should

provide a venue for First Nations to participate in an open decision-making process that considers environmental, social and cumulative effects of mine development. The reality, however, often falls short of that reasonable expectation.

The Environmental Assessment of the Voisey’s Bay Nickel Project saw a Memorandum of Understanding signed between the Innu Nation, Labrador Inuit Association, the provincial and federal governments to ensure that the EA process responded to local concerns and reflected the political and social realities of the First Nations. The MOU expanded the definition of the environment, required the Panel to make its recommendations to the four signatories, and provided a role for the signatories in appointing Panel members for the EA hearing. The MOU also enabled the Innu Nation to take control of the social and economic studies, giving them more control in the process.

The EA process was still not fully satisfactory, but the Panel’s report recommended that the project move to permitting only after the conclusion of land rights negotiations and impact benefits had been achieved with both the Innu and the Inuit.³⁸⁴ Other hearing outcomes from EA processes in Canada have included a requirement that the company negotiate Impact Benefit Agreements, as was the case with BHP and the Ekati Diamond Mine.

However, EA outcomes cannot be relied upon to fairly or adequately accommodate Aboriginal interests. The Government Response is the final outcome and is not bound by EA findings. During the review of the proposed Cheviot Coal Mine, the Smallboy Cree were denied the opportunity to participate properly in the hearing. The federal crown lawyer instructed Indian and

Northern Affairs Canada officials to not respond to the questioning by the Smallboy Cree, the native community living immediately adjacent to the proposed development. This instruction was reserved for the Smallboy Cree alone. In the April 2001 response to the report Joint Review Panel of the Cheviot Mine, the federal government's view on the loss of traditional land-use and lifestyle was bluntly stated:

The federal government accepts that should significant adverse effects on traditional uses and traditional sites occur, then these effects are justified. The federal government is confident that sufficient economic benefits will accrue to the surrounding communities, including the Alexis First Nation and the Mountain Cree Camp to warrant this justification.³⁸⁵

A 2006 federal court decision with respect to the Dene Tha and the federal government's failure to consult during the design of an environmental review process clarifies that First Nations are to have a significant role from the outset in review processes whose decisions may affect their Aboriginal rights or interests. The November 2006 decision in *Dene Tha First Nation v. Minister of Environment et al.* found that the federal government had breached - and were continuing to breach - their duty to consult the Dene Tha concerning the Mackenzie Gas Project (MGP). The decision provided a good illustration of the significant risk that resource developers may face if government fails in its consultation obligations to Aboriginal people.

The court found that the duty to consult began in the earliest stages of designing the review processes, rather than at the point when the Crown actually began to consult, which was 24 hours

before comments were required on the draft Joint Review Project Agreement. The court ordered a remedies hearing to address questions of how the problem could best be addressed, given that the review process was already underway. It also stayed the Joint Review Process from considering any aspect of the MGP which affects either the treaty lands of the Dene Tha or the aboriginal rights claimed by the Dene Tha, and from issuing any report of its proceedings to the National Energy Board.³⁸⁶

Both the UR-Energy decision by the Mackenzie Valley Environmental Impact Review Board and the and Kemess North Panel decision give cause for optimism that future review decisions will be an improvement over some of the weak decisions of the past, such as the case of Alberta's Cheviot Coal mine, described above.

In October 24, 2007 the federal cabinet upheld a recommendation by the Mackenzie Valley Environmental Impact Review Board to block Ur-Energy's uranium exploration program on the Upper Thelon area east of Great Slave Lake. Last May, the board shocked the mining industry when it denied Ur-Energy's plan to drill up to 20 holes near the Thelon River because it threatens the spiritual and cultural well-being of the Akaitcho Dene.

The Review Board agreed with intervenors - most notably the Akaitcho Dene - that the potential for industrial development of the area is not compatible with the aboriginal values of the cultural landscape of the Upper Thelon area. It concluded that the impacts of the proposed development - in combination with the cumulative impacts of all other past, present and reasonably foreseeable human

Consultation is not consultation absent the intent to consult. Consultation cannot be meaningful if it is inadvertent or de facto. Consultation must represent the good faith effort of the Crown (reciprocated by the First Nation) to attempt to reconcile its sovereignty as pre-existing claims of rights or title by the First Nation.

Justice Phelan, *Dene Tha First Nation v. Minister of Environment et al.*, 2006

activities in the area - are likely to have a significant adverse cultural impact on the aboriginal peoples who value the Upper Thelon. The Review Board concluded that, because "this impact is so significant" they would not recommend the proposed development.

The Review Board also identified other significant adverse environmental impacts that would require mitigation were the proposed development not rejected. These included the social impact of widespread distress which would significantly affect the mental well-being of the people of Lutsel K'e, socio-economic impacts on ecotourism operators and their clients using the area; and project-specific impacts on migrating caribou.³⁸⁷

The Kemess North Mine Joint Review Panel concluded in its September 2007 final report that the proposed mine "in its present form" would not be in the public interest. Northgate Minerals' proposal was to use Amazay Lake to contain tailings from its proposed Kemess North copper-gold mine expansion, located 425 kilometres northwest of Prince George, British Columbia.

The Panel found that any economic and social benefits from the project are outweighed by its long-term risks to the environment and by its social and cultural impacts on Aboriginal people. It has recommended to federal and provincial environment Ministers that the project not be permitted.

The Kemess North Mine Joint Review Panel's final report cited key adverse effects, including the loss of a natural lake with important spiritual values for Aboriginal people, and the creation of a long-term legacy of environmental management obligations at the mine-site to protect downstream water

quality and public safety. The Panel also noted that it may be difficult for Aboriginal people to increase their share of Project benefits, even though as the region's primary residents and users, they would experience first-hand any impacts on traditionally used resources.³⁸⁸

Over the last decade a number of environmental agreements have been negotiated in Canada, involving industry, government and Aboriginal peoples. Experience indicates that negotiated environmental agreements have considerable potential to address both the need to secure indigenous participation in environmental management of major projects that affect indigenous peoples, and the broader need to ensure effective follow-up of environmental impact assessments. However, greater effort must be made to develop structures and processes specifically designed to encourage Aboriginal participation, and the agreements must provide the financial and other resources required to support Environmental Impact Assessment follow-up and Aboriginal participation in that follow-up.³⁸⁹

5.6 Taking Action

Outside of the courts and environmental assessment reviews, many First Peoples are taking action to assert their Aboriginal title and inform and engage the mineral sector in mechanisms to protect Aboriginal rights, title and land uses.

Innu pressure on the Newfoundland & Labrador government resulted in amendments to the Mineral Exploration Regulation in 1996, which now requires companies to conduct archaeological assessments involving the Innu prior to any work which might result in ground disturbance, as well as more

rigorous environmental standards for exploration activities. The Innu guidelines have also been the basis for ongoing contractual agreements with several exploration companies, providing for continuing consultation and reporting between the company and the communities, monitoring of activities by Innu Nation staff, requirements for environmental and cultural protection, and employment and business opportunities. These agreements have provided Innu Nation with significant resources to employ professional staff and community monitors to engage with mining companies and governments, and formal opportunities to ensure that Innu are consulted prior to exploration or mining activities.

Also in 2001, Nishnawbe Aski Nation (NAN) issued a handbook on "consultation" in natural resource development, intended to inform and assist First Nations in planning for lands and resource development, but also to assist government and industry in understanding the positions of NAN communities. The handbook emphasized the duty of the Crown to consult with First Nations about any project, development, activity, legislation or amendment to legislation which may impact on Aboriginal and/or Treaty rights. It clearly set out NAN consultation policy, the duty of the Crown, and the role of resource development companies, and outlined the expected consultation process in a step-by-step fashion.³⁹⁰ The handbook was revised and re-issued in 2007.

Government and industry are more actively promoting the mining and minerals sector to Aboriginal peoples in an effort to relieve some stress caused when new mines are proposed or exploration activities are undertaken. The Ontario Ministry of Northern Development

In 1995, when 29 companies were operating approximately 120 drilling sites throughout Innu territory, the province (Newfoundland and Labrador) had refused to legislate interim protection of Innu lands, and refused to stop issuing exploration permits. The Innu decided it was time to act. Their first action was to issue an eviction order to Diamond Field Resources, and then they reclaimed the land with a 12 day protest when the company did not comply. Following the protest, the Innu made direct contact with over 50 mining companies, requesting that they recognize Innu rights and agree to certain conditions prior to working on Innu land. These conditions included: 1) establishing an environmental and cultural protection plan; 2) developing a plan to monitor impacts; 3) taking steps to mitigate any negative environmental effects; and 4) agreeing to be held liable to damages. The Innu have provided these and other directions to the mineral sector in their document "A Matter of Respect: Guidelines for the Mining Industry."³⁹¹

The Innu also requested involvement in the design of environmental impact studies in order to ensure that traditional knowledge would be used and respected. Later the same year, the Innu Nation decided to accept funding from Voisey's Bay Nickel Company to cover expenses related to the Innu oversight and participation in the project's review, including hiring technical experts, consulting with the communities, and ensuring that proper environmental procedures were being followed to minimize impacts on wildlife and the environment.³⁹²

and Mines along with Natural Resources Canada have produced an educational media disc describing the geological mapping activities and the mining sequence.³⁹³ The objective of this tool is to persuade Aboriginal communities of benefits of the mining process – from exploration to operation, to the eventual closure and rehabilitation of a mine.

In 2006, a partnership consisting of the Prospectors and Developers Association of Canada (PDAC), the Mining Association of Canada (MAC), the Canadian Aboriginal Minerals Association (CAMA) and the Government of Canada (Ministries of Natural Resources and of Indian and Northern Affairs) produced an information kit aimed at Aboriginal peoples. The package was described by its sponsors as an "educational tool" to help "Aboriginal people make more informed decisions and take advantage of opportunities offered by the mining industry in Canada."³⁹⁴ The kit's critics have called it "an insult to Aboriginal people," saying that it glosses over the serious environmental, social and cultural impacts of mining on Aboriginal governments and communities, and omits any discussion of the relationship of mineral staking and exploration to questions of Aboriginal Rights and Title.³⁹⁵

More recently, First Nations are taking proactive steps by preparing policy documents detailing how mining and mineral companies can operate on traditional lands.

In 2007, the Taku River Tlingit First Nation released their Taku River Tlingit Mining Policy. The document establishes how the First Nation will respond to mining-related activities in their traditional territory.³⁹⁶

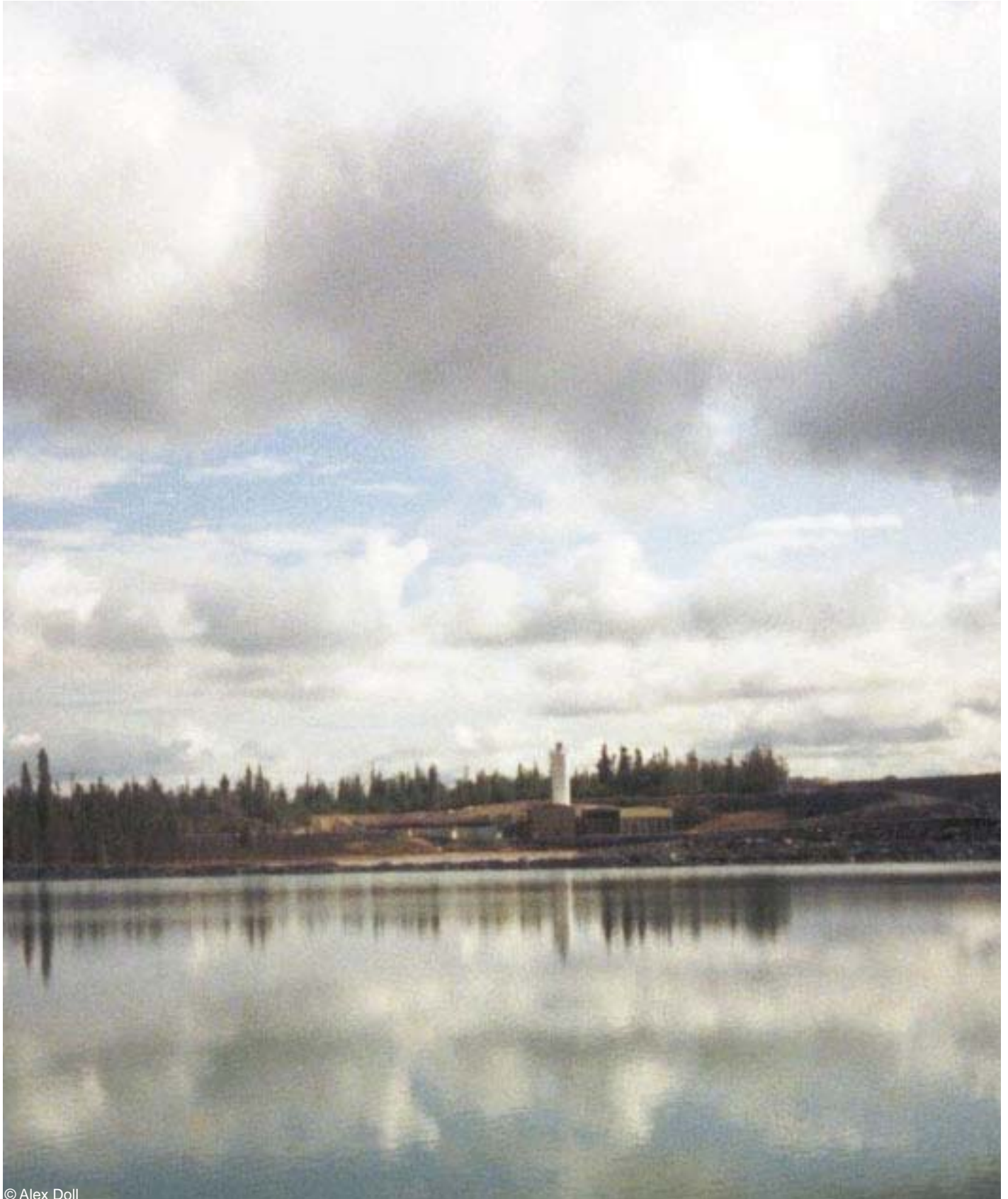
When negotiations fail, other measures may be taken to ensure that First Nation rights are met. For instance, in 2007, the Nishnawbe Aski Nation passed a resolution directing the Executive Council "to aggressively advocate a more positive shift in [the Ontario Ministry of Northern Development and Mines'] approach..." to mining issues. This is followed by a resolution "to explore more adversarial ways of forcing the Government of Ontario to honour its constitutional, court-directed, and fiduciary obligations..." should advocacy fail to achieve meaningful results.³⁹⁷

In effect, such resolutions place provincial governments on notice that current government practices are failing to meet First Nations' mining-related rights and needs, and that Aboriginal people expect greater efforts.

There is still a very long way to go. Contempt of court charges laid in two Ontario cases (Platinex and Frontenac Ventures) against First Nations people non-violently defending their lands from aggressive mineral exploration show what Aboriginal people and their allies are up against when their best efforts at negotiation are blocked and their only alternative is to defy unjust injunctions. As the struggles in KI and Sharbot Lake/Ardoch continue, the "honour of the Crown" - both the government and the justice system itself - is being put severely to the test.

If governments do not move forward on their own initiative, the courts must – inevitably – move them forward by force of law. With each decision, the courts can add to the growing body of case law that clarifies what is expected and required of governments in terms of honouring Aboriginal rights that are enshrined in the constitution.

And in the interim, as cases like that of the Dene Tha aptly demonstrate, the failure of government to act responsibly places both developers and potential developments at risk.



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6.0 Across Canada's Boreal

6.1 Newfoundland and Labrador

Of the four Atlantic provinces, three – Newfoundland, New Brunswick and Nova Scotia – have long and abundant histories of mining, but only Newfoundland and Labrador has mining areas in the Boreal forest region as delineated in Section 2.3.

The province includes the island of Newfoundland and the mainland of Labrador, on Canada's Atlantic coast. In 2005, the Labrador Inuit celebrated the beginning of the Nunatsiavut Government, a regional ethnic government in northern Labrador. The Nunatsiavut Government has many of the responsibilities and rights of other governments, including co-management responsibilities for renewable and non-renewable resources.³⁹⁸

Mining's History

Newfoundland's first mineral "rushes" came early. In the 1550s three different English explorers took both tales of mineral wealth and actual ore samples back to England. One set sail with a barge full of copper, iron, lead and silver ores from the Avalon Peninsula, only to disappear in a shipwreck off Sable Island.

It would take three more centuries before the first working mines would take root in the boreal forests that swath the rugged coasts of Newfoundland. But between 1855 and 1860, more than thirteen mineral deposits were being worked, producing copper, silver, galena and lead.

Some of the early mines were more notable in terms of struggle than ore production, with rapid openings and closings, and deal-making

galore. One of the first to register as a serious producing mine was the Tilt Cove Copper Mine, on the Baie Verte Peninsula that forms the northern coast of Notre Dame Bay. The copper was in irregular deposits, and first the miners removed ore from horizontal adits, but as surface ore became depleted they reached deeper into the heart of the hillside and worked by the light of candles stuck onto canvas hats with resin and pitch. The mines were worked from 1864 to 1917 and from 1957 to 1967. The small community grew from just three families in 1863 to become Newfoundland's first mining town by 1869 with 300 miners supporting the community's 768 inhabitants, on salaries ranging from \$10 to \$21 per month.³⁹⁹

After a roller coaster ride over the next three decades, new discoveries in the smelting process meant the Tilt Cove mines could add gold and silver to their list of products, and the American market opened up. This reduced shipping costs since the ore no longer had to make the long trip to Swansea, England for smelting. The mid 1890s was a prosperous period for the community of Tilt Cove, whose population had risen to 1,000. In 1887 Newfoundland issued a 5-cent postage stamp depicted miners at work underground in the Tilt Cove mine. The stamp was entitled "Mining: One of the Colony's Resources," and was the first mine-motif stamp issued in the world.⁴⁰⁰

By the time of confederation with Canada in 1949, there had been an estimated 64 mines in production on the island of Newfoundland. Still in operation were the iron mine at Bell Island in Conception Bay, lead-zinc at Buchans in the interior, and the fluorospar mine at St. Lawrence on the Burin Peninsula. Others were to reopen, including the Tilt Cove and nearby Little Bay copper mines,

and the Whalesback, Gull Pond and Rambler copper prospects on the northeast coast.

The period shortly after confederation saw a great deal of effort on the part of the Newfoundland government to encourage mineral development. The government went to some extraordinary measures, including numerous agreements that granted exclusive mineral rights. In the period between 1950 and 1970, 28 companies or individuals acquired mineral rights to almost all of Newfoundland and Labrador.⁴⁰¹

The Province of Newfoundland and Labrador has numerous mineral resources. Iron-ore deposits are found in western Labrador in Wabush and Labrador City and at Bell Island in Conception Bay; copper, lead, asbestos, gypsum, fluorite, and talc are found on the Island; and uranium is found in eastern Labrador. Nickel is now mined in northern Labrador, at the Voisey's Bay nickel deposit.

Mining Today

Until recently, despite its rich history of mining, Newfoundland and Labrador was a province dependent on fishing, with mining accounting for only about 4 percent of the annual gross domestic product. It is now a provincial economy dominated by the extraction industries – offshore oil in particular, and mineral shipments of nickel, copper, zinc, gold, iron ore.

The estimated 2006 value of mineral shipments (\$2.5 billion) was more than three times the level it was just five years ago (\$754 million). This is forecast to rise to \$3.3 billion in 2007, mainly due to increased nickel and copper production and higher commodity prices.⁴⁰² Direct employment in the Newfoundland and Labrador mining industry is

expected to increase from approximately 3,500 person years in 2006 to 3,550 in 2007.⁴⁰³

Both production and exploration have boomed over the last several years. On the exploration side, expenditures in 2006 reached a 10-year high of \$98 million and expenditures are projected to jump to an unprecedented \$116 million in 2007.⁴⁰⁴

Staking and Exploration

The mineral rush in northern Labrador following the Voisey's Bay discovery made mineral exploration loom large in the Province's ledgers, although the expenditures dropped to half of their 1998 levels by 2000. During the rush of 1995-1997 there were more than 245,000 active claims, covering more than two-thirds of Labrador.⁴⁰⁵

Between 2000 and 2004, activity maintained a relatively steady level, with a spike in 2002. Since 2004, exploration has boomed again, with claim staking and exploration spending up sharply in the province over the past three years, primarily as a result of increased interest in the province's uranium potential. Much of the new activity is concentrated in central and western Labrador and south-central Newfoundland. The more advanced uranium projects are at Michelin and Moran Lake in Labrador's Central Mineral Belt, with other major exploration projects at Pine Cove and Beaver Brook. Pine Cove received government approval in October 2007 and is anticipating going to production in early 2008,⁴⁰⁶ as is the Beaver Brook antimony mine. Major, ongoing drill projects include Boomerang, Rambler, Golden Promise and Jackson's Arm.⁴⁰⁷

The rising price of uranium is fueling unprecedented exploration levels for this commodity. The

search for uranium is expected to account for about \$46 million, or 40% of the total \$116 million predicted for exploration during 2007. The average yearly exploration expenditure for all mineral commodities over the past 10 years has been about \$45 million.

Currently, the most advanced uranium projects in the province are the Michelin and Jacques Lake deposits near Postville, Labrador, also known as the Central Mineral Belt. To date, Aurora Energy Resources Inc. has outlined approximately 58 million pounds of "indicated" and an additional 38 million pounds of "inferred" uranium oxide resource in these deposits. The company conducted 75,000 to 100,000 m of diamond drilling during 2007 through what it claims is the world's largest single uranium exploration project with a budget of \$21 million.⁴⁰⁸

Most of this uranium exploration is taking place in the Inuit territory of Nunatsiavut. There is strong opposition to uranium mining and exploration in the region, especially in the community of Makkovik. The Nunatsiavut Legislative Assembly is considering a motion to ban uranium mining and milling from Inuit lands (December 2007).

Newfoundland and Labrador is one of the few jurisdictions to have fully converted to a map staking system, although some ground-staked claims are still being worked. Ground-staked claims can be converted to map staked claims through a simple application process. Map-staked claims are 500 metres square, and can be recorded for \$10 each. Mineral exploration licenses can include up to 256 claims, and are issued for 20 year terms. To maintain the claims, a minimum amount of money must be spent on mineral assessment each year, ranging from \$200 per claim in the first year, to

\$1200 per claim for years 16 through 20. Any exploration work in the Province must have an Exploration Approval from the Department of Mines and Energy prior to beginning the activity, and in the case of exploration work on Inuit lands, a Permit to Access Inuit Lands from the Nunatsiavut Government. Mineral licenses can be converted to mineral leases after the equivalent of the first 3 years of assessment work has been done and reported on, for an annual rental fee of \$80 per hectare.

In addition to the projects described above, Anaconda Gold anticipates operating the Pine Cove Gold Mine on the Baie Verte Peninsula, and Beaver Brook Antimony Mines is expected to be in production by the end of 2007.⁴⁰⁹

Production

Voisey's Bay Nickel

The September 2005 opening of the Voisey's Bay nickel-copper mine and concentrator, owned by Voisey's Bay Nickel Company Ltd. (a subsidiary of what was once Inco and is now Vale Inco), brought on stream 6000-tonnes/day of ore production capacity and created 400 mine jobs. At the start of production, the mine hosted proven metal reserves of 880,000 tonnes of nickel, 508,800 tonnes of copper and 44,800 tonnes of cobalt. With a projected annual production of 49,880 tonnes of nickel, 34,000 tonnes of copper and 2,268 tonnes of cobalt, the mine life of the Ovoid open-pit is estimated at over 17 years. However, the other deposits in the Voisey's Bay group of deposits, namely, the Eastern Deep and related deposits, Reid Brook, and Discovery Hill, are in line for development, and could extend the mine life of the Voisey's Bay mine beyond 30 years.⁴¹⁰

Shipments by Voisey's Bay Nickel Company (VBNC) have been

projected to exceed \$1.5 billion, and the Voisey's Bay project is forecasted to generate 850 person years of work during 2007. The company estimates employment will increase to 1,700 person years in 2008, 2,500 in 2009, and 2,800 in 2010, before it decreases to 1,400 person years in 2011 due to the completion of construction of the commercial processing plant. These employment figures represent the number of individuals required as operations staff for the mine/mill in Voisey's Bay and the Demonstration Facility at Argentia, administrative and exploration staff employed in the province, and the construction workforce required for commercial processing plant at Long Harbour.

The Long Harbour facility is in Environmental Assessment as this report goes to press. The company plan is for an experimental hydro-metallurgical facility to process the ore. The Hydromet plant will discharge effluent into the sea and deposit its tailings in Sandy Lake. If this process is not permitted, then VBNC intends to create a traditional matte processing facility on the site. The terms of the Agreement with Newfoundland and Labrador permitting Voisey's Bay required that secondary processing take place in Newfoundland. The company anticipates a decision by the end of 2008 with plant construction to be completed by the end of 2011.⁴¹¹

While the Government of Newfoundland and Labrador is enthusiastic about the operations at Voisey's Bay, relationships with the VBNC workforce have been less than smooth since operations began in 2005. Two strikes have stalled or slowed production in the first two years of operation, and in both cases the company brought in replacement workers early on in the labour disruption.

In the summer of 2005, workers certified the United Steelworkers of America to represent about 115 employees at Voisey's Bay, which the Company elected to challenge in court a year later.⁴¹² United Steelworkers members handle heavy equipment and work in the mine's mill.

In 2006, workers on the mine site were on strike for 10 weeks before the company settled with a package of higher wages and benefits. Workers said that they had suffered reductions in their income compared to wages they had earned at other mines. The Union compared wages to those paid at Iron Ore Canada's operations in Labrador City, and found that the Voisey's Bay miners were getting \$3 less per hour.⁴¹³ The word was that mine workers employed by Inco in Sudbury earned 25% higher hourly wage than their counterparts at Voisey's Bay.

In 2007, support staff workers went on strike over disparities in hourly wages and quarterly bonuses paid to other Inco employees. When talks broke down and a walk-out shut down operations, the company immediately brought in replacement workers. As this is a fly-in operation, the company owns the site where miners live while they are at work. Striking workers were told to leave the camp, and the company brought in an extra flight to move them off site. 40 workers refused to leave the site, demanding that the company hand them a written statement saying it would not reopen the mine with replacement workers once they left.⁴¹⁴

Voisey's Bay did bring in replacement workers, but then had to shut down its mill after a dangerous incident between unionized and contract workers prompted some staff to walk off the job. A

replacement worker locked five unionized employees into a large container and parked a vehicle right up to the door so they could not open the door. VBNC fired the individual involved, but continued to use replacement workers.⁴¹⁵

Duck Pond

In 2007, Aur Resources started production at its copper-zinc metal mine at Duck Pond, in central Newfoundland, in the headwaters of the Exploits River system, approximately 100 km southwest of Grand Falls-Windsor. The official opening celebration on May 9th marked the reward of more than 20 years of exploration, discovery, development, and construction.

Falconbridge and Noranda initiated mineral exploration on the property in 1973. Aur Resources began development of the mine in December 2004, and completed construction in December 2006. Production of copper and zinc concentrates started in January 2007. The first shipment of concentrates left Turf Point, St. George's Bay in western Newfoundland, in April 2007.⁴¹⁶

The plan for the current reserves is to mine and mill 4.1 million tonnes of ore, at a rate of 1,800 tonnes per day, over a projected mine life of 6.2 years. Based on the existing reserves, the annual production is expected to be: 41 million pounds of copper; 76 million pounds of zinc; 574 thousand ounces of silver; and 5,000 ounces of gold. Approximately 1.1 million tonnes of inferred resources have been identified, which, if upgraded to reserves, could extend the mine life to about eight years. The Duck Pond operation employs 192 people full-time. About half of these employees live in the on-site camp accommodations, and half commute daily.⁴¹⁷

The feasibility study for Duck Pond anticipated a payback period of approximately 3.5 years, but with current higher metal prices a much faster payback is expected, along with a much higher rate of return on investment than the approximately 15% forecast by the study.⁴¹⁸

While the mine life is short, the new concentrator may have a longer-term impact. Industry observers note that if it were available as a custom mill, it would make other deposits in the area more economically attractive, such as Messina Minerals' Boomerang prospect in the Tulks Valley 70 km away, or Mountain Lake Resources' prospect at Bobby's Pond, 30 km away.⁴¹⁹

Other longer term impacts will be associated with the loss of Tally Pond, the small fish-bearing lake that is being transformed into a tailings pond, and the generation of relatively large volumes of acid-generating tailings and waste rock. Aur Resources worked out a compensation package with the Department of Fisheries and Oceans and other regulators that allows it to exchange one live lake for some work to improve spawning capacity on two nearby brooks, such as the removal of logs and debris left behind during forestry operations. After the mine is shut down, the company says that the small lake – by then partially filled with acid generating mine tailings is to become “a naturally self-sustaining marshland.”⁴²⁰

Nugget Pond Processing Facility
Crew Gold Corporation acquired the Nugget Pond processing facility on the Baie Verte Peninsula from New Island Resources in October 2006. Crew Gold saw this as a long-term solution to processing ore from their Nalunaq Gold Mine in south-western Greenland, which it operates through its subsidiary

company Nalunaq Gold Mines. Crew began processing Nalunaq ore at the mill in February 2007. Shipments currently arrive through the temporary port facility at Goodyear's Cove in South Brook. The reactivation of the Nugget Pond mill will create 30 new full-time positions over the projected 10-year life of the Nalunaq Mine.⁴²¹

Iron Ore Company of Canada and Wabush Mines

Labrador City has been host to two iron ore mines since the early 1960's. Canada's largest iron ore producer, Iron Ore of Canada, produces 35-38 million tonnes per year while the smaller operator, Wabush Mines, produces close to 5 million tonnes per year.

Since start-up, both mines have deposited their tailings directly into area lakes, despite the federal Fisheries Act prohibition against doing so. As Wabush Mines explains their history, the selection of Flora Lake as a depository for the mine wastes came through a process of elimination. Long Lake was closest but is a prime fishing, cottaging and recreational lake. The next closest lake is the water supply for the town. Third to be studied was Flora Lake, 3 miles east of the plant site. Flora was not a source for town water or a favourite fishing lake, and was obscured from the hamlet of Wabush as a result of low lying hills, and so, by some logic, was deemed appropriate. Thirty years later, 3 square miles of Flora's floor is now covered with ten million tonnes of Wabush Mine's tailings. IOC puts their tailings in Wabush Lake, at a rate of 23 million tonnes per year, and have been doing so since their operations began.

The unconfined deposit of tailings into lakes is not permitted under the federal Fisheries Act, and the "historic" practice of the Labrador

City operations dumping the iron ore tailings into Flora and Wabush Lake was a subject of debate during the mine effluent regulation's review in 1999. The notion of the Labrador City operations being brought into compliance was not one that was readily accepted by the companies or the provincial government of Newfoundland and Labrador. Most recent indications are that the companies may be listed in a "schedule" to the regulation which would allow them to continue placing their tailings in Flora and Wabush Lakes

The Iron Ore Company of Canada (IOCC), Canada's largest iron ore pellet producer, operates a mine, concentrator, and pellet plant in Labrador City (western Labrador), as well as port facilities in Sept-Îles, Québec and a 420-kilometre rail line that links the mine and the port. Annual mine production at the open-pit operation is in the 35-38 million tonne range at an average grade of approximately 40% total iron. Annual production capacity is 17 million tonnes of concentrate, of which 13.0 million tonnes are pelletized. With strong market demand for IOC's products, the shipment forecast for 2007 is estimated at 17.6 million tonnes. Total employment at the mine, mill and pellet plant will be about 1,300 people. A recent news release by IOCC provided details on a planned \$60 million expansion at the Labrador mine. These expenditures will increase production capacity to 18.4 million tonnes/year by mid 2008. The feasibility of a further increase to 21 million tonnes/year will also be studied.⁴²²

IOC's neighbour in Labrador City, Wabush Mines, began mining iron ore from the Scully Mine in Labrador in 1965. It currently operates the Wabush mine and concentrating plant, and a pellet

plant and shipping facilities in Point Noire, Québec. In June, 2007, Consolidated Thompson Mines Ltd announced an offer to take over 71.4% of Wabush Mines through an arrangement with Cleveland-Cliffs Ltd and Stelco Ltd. If the takeover is successful, the Wabush mill would also process feed from Consolidated Thompson's Bloom Lake iron ore deposit in Québec. In 2007, Wabush Mines is forecasting shipments of 4.95 million tonnes of product. The workforce at the Scully mine is about 450 people, an increase of approximately 39% from 324 people in 2004.⁴²³

Mining's Legacy

Newfoundland's boreal forest is host to many acid-generating abandoned mines, as well as the recently closed Rambler Mine and Roycefield Resources antimony mine, which is on care-and-maintenance, awaiting changes in market conditions.⁴²⁴ While reports indicate there were at least 64 mines on record at the time of Confederation, the Newfoundland government currently has only 39 abandoned mines on file, of which approximately 75% have been verified by field inspections. All 39 sites were assessed for groundwater contamination potential. Five were judged to have high potential, twenty-six moderate, and eight low potential.⁴²⁵ Several of the pre-confederation mines are now abandoned and are acid-generating, including the Tilt Cove, Whalesback and Little Bay mines.

As in so many other locations across the country, Royal Oak Mines gave the Government of Newfoundland a parting gift when it went into receivership in 1999. The Hope Brook Gold Mine operated from 1978 to 1997 on the south-west coast of the island of Newfoundland. Costs for closing it were estimated at \$2 million dollars

for work including removal of mine structures, construction of tailings dams, and movement of waste materials.⁴²⁶



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6.2 Québec

Introduction

In recent years, the Cree and Inuit of northern Québec have negotiated agreements for self-government in their traditional territories. Other First Nations in the province have not.

Québec recognizes self-government in the Cree lands defined by the James Bay and Northern Québec Agreement (JBNQA) of 1975 and the 2001 Paix Des Braves Agreement. *Eeyou Estchee*, the name the Crees give their territory, is approximately 400,000 square kilometers. In return for the damage caused on their lands by hydro dams, the Agreements give the Cree significant funding, jurisdiction over development on Category 1 lands and participation in decisions about administration and development activities on Category 2 and 3 lands, as well as resource revenues from development on their territory.

The Inuit of Northern Québec call their lands *Nunavik*. An agreement for self-government in Nunavik is in the stage of final negotiations (December 2007). The Agreement covers two areas: the Marine Region, which covers the offshore islands, intervening waters including the ice that separates them; the intertidal zones and the ocean bed along the northern Québec coastline, an area of more than 250,000 square kilometres, and the Nunavik Inuit Settlement Area, which covers an offshore area adjacent to Labrador from Killinik Island to just north of Hebron and an onshore portion in northern Labrador, consistent with the boundaries of the Torngat Mountains National Park Reserve of Canada. Like the Cree Agreements, the Nunavik Agreement provides for self-government, considerable funding and control over the lands

defined as “Inuit-owned lands,” as well as revenue sharing from resource developments on their traditional territory.

Both the Cree and the Inuit have representation on Environmental Assessment panels that review development in these territories.

In the rest of Québec, the Mining Act and environmental legislation is similar to other provinces. Only projects with more than 7500 tonnes-per-day of ore production trigger an environmental impact assessment in “southern” Quebec. Although there is no legal obligation to account for social impacts, the environmental assessments and reviews by the Bureau des Audiences Publiques en Environnement (BAPE) do provide a critical window for public participation. However, the current benchmark of 7500 tonnes-per-day means most projects are excluded. In addition, there is no mechanism for assessing cumulative impacts of mining exploration projects.

Mining’s History

Placer gold was discovered in Québec’s Eastern Townships in 1823. Placer mining in the Chaudière River yielded tens of thousands of ounces of gold through the 1800’s – not large volume by today’s standards, but a “boom” in its own time. Other mining firsts came in 1878, with the first mining of asbestos in Canada, and in 1888, with the first asbestos mill.

By the early part of the next century, mining had the Abitibi-Témiscamingue region in northwestern Québec well in its grip. In part, this was a spill-over from intense mining activities in northeastern Ontario, just across the provincial border.

The first evidence of an important gold-bearing vein in the Abitibi-

Témiscamingue district was discovered by James O'Sullivan and Hertel Hauthier in July, 1911. In 1915, in the Val d'Or area, prospector Stanislaw Szyszko discovered the deposit that was to become the Siscoe Mine. The next year Edmund Horne discovered an important copper-bearing deposit.

A decade later, the mineral processing industry in Abitibi was born around 4 o'clock in the morning of December 17, 1927 when the Noranda foundry produced its first copper casting. In the Val-d'Or area, the Siscoe Mine delivered its first two bricks of gold in 1929. Mining activity later spread north, with the beginning of operations at the Springer mine in Chapais in 1953, followed by the development of deposits in the Joutel-Matagami region in 1954.

In 1978, the Bureau for Studies on Toxic Substances (BEST) conducted an analysis of watercourses in the Rouyn-Noranda region. Around the same time, the Service for Water Quality of the Department of Environment and Fauna (MENF) also collected water samples in a dozen lakes and rivers near Rouyn-Noranda and Val d'Or.

These two studies revealed that lakes Dufault, Pelletier, Rouyn, Séguin and Trémoy were all displaying serious impairments of water quality, due to elevated levels of copper, cadmium and/or zinc. As well, the concentration of mercury and cyanide were very high in certain lakes. The majority of the rivers studied showed excess levels of copper and zinc on a quasi-continuous basis, while cadmium was a frequent minor problem.⁴²⁷

Mining activity in the Abitibi-Témiscamingue district peaked in the mid-1960's, when some 50 mines were in operation. However,

through the years, it has fluctuated considerably.

From the beginning of the first mine's operations until the year 2000, 195 mines operated in Abitibi-Témiscamingue. In total, they produced 2,000 tons of gold, 6,650 tons of silver, 16,000 tons of nickel, 28,000 tons of lead, 5.2 million tons of copper and 6.7 tons of zinc. Over a period of 73 years, 11 million tons of metal were extracted from the region. While those numbers may sound enormous, the volume of metals derived is relatively small in contrast to the total amount of ore mined – over 608 million tons.

Mining Today

Québec's mining industry typifies the Canadian mining experience: a cyclical industry with bust following boom following bust, and a government which is both enthusiastic and generous to mining interests, providing them with abundant access to the mineral resource and regular and substantial access to the public pocket-book.

Québec has traditionally been among the top three mining jurisdictions in Canada in terms of overall production, jockeying with British Columbia for the number two position behind Ontario. Nonetheless, the market crunch of the early part of this decade took its toll on the Québec mining sector, and by 2003 the industry was at a relatively low point, with a net loss that year of five mines, 12,700 tonnes of daily ore capacity, and 1,180 direct mining jobs. With world-wide poor market conditions, no new mine opening, and a significant number of mine closings, 2003 was the culmination of a decline that had begun in 1999.⁴²⁸

However, since 2003, with rising commodity prices, the Québec mineral sector has seen significant

growth.

In three years, the value of Québec mineral production has increased 33%, from \$3.6 billion to \$4.8 billion. Since 2003, some dozen mineral development projects have been completed or launched, for a total investment of over \$1.5 billion. They have helped create or maintain 4,300 permanent jobs. In addition, new projects currently underway could attract \$1.2 billion in additional investment in the coming years. This growth and vigour is a result of improving world market conditions and government policies that support and encourage mineral sector development.⁴²⁹

According to the results of the Fraser Institute's 2006 annual survey of the mining industry Québec ranked first in Canada and was in the top five in the world in terms of investment climate, as determined by mineral potential and government policy.⁴³⁰

Government "policy" includes a permissive regulatory regime, but could also be taken as a code word for a jurisdiction with a very generous sets of subsidies. For example:

- \$1.3 million changed hands as an "exploration rebate cheque" to Eastmain Resources Inc. for exploration activities in the James Bay region, July 2007⁴³¹
- \$2.7-billion was lost revenue for the Québec government as a result of subsidies to aluminium giant Alcan Inc. for the construction of a new smelter, June 2006⁴³²
- a \$253 million contribution to Noranda's now mothballed Magnolia magnesium plant was written off between 2000 and 2003⁴³³
- Québec is the only jurisdiction to purchase equity investments in mining ventures.

Staking and Exploration

In 2006, Québec mineral exploration turned out its best performance of the past 20 years, with more than \$260 million in investments. Between 2001 and 2005, the number of exploration businesses increased by 65% from 78 to 129. A majority are junior exploration businesses.⁴³⁴ In 2005, 88% of exploration expenditures were for off-mine-site work, with two-thirds of it managed by junior companies. Over half of the exploration and deposit appraisal expenditures were spent on gold, a quarter on base metals, and approximately 9% on diamonds.⁴³⁵

On November 1, 2006, there were more than 175,000 active mining titles in Québec, the highest number in a decade, and exploration expenditures have been above \$200 million in each of the past three years.⁴³⁶ Mining companies had great success in financing their exploration activities in 2006, due to a combination of high commodity prices, recent significant discoveries in Québec, and a supportive government that offers a suite of tax breaks, direct subsidies, and government funding of mining infrastructure. Forty-eight companies had budgets between \$1 million and \$5 million, six companies had budgets between \$5 and \$10 million, and 5 companies had budgets of over \$10 million (including 3 junior companies).⁴³⁷ Currently, there are more than 250,000 active mining titles occupying more than 11,500,000 ha (about 7 - 8% of the Province's territorial surface).⁴³⁸

Exploration activity has been intense in the Abitibi region (gold, copper-zinc), in the Otish Mountains, in the James Bay area (gold, diamonds), and in the Ungava area (nickel, copper), and there is growing interest in uranium throughout the province.⁴³⁹

In the Cree community of Wemendji, Goldcorp's Eleonore gold project may be the fore-runner for a new gold camp. The deposit is still being defined, but appears to be rich and deep. News of the deposit has brought significant pressures on Wemindji's traditional territory, which is probably now one of the most densely staked areas in the Province (if not the country).

In the Otish Mountains, Strateco is actively exploring a uranium deposit on the lands of the Mistissini Cree. Added to some excitement about possible diamonds in the area, this is creating pressures on the Mistissini Cree. This area is now also intensely staked.

The Mineral Tenure System

In the early part of this decade, Québec overhauled its tenure system so that mining claims are now the only form of exploration title granted. Previous to recent changes to the Mining Act, mineral tenure also came in the form of mining leases, mining concessions and exploration licences.

The changes to the Mining Act came into force in the fall of 2000, "simplifying" the claims system, and making map staking the main method for acquiring a claim. Ground staking is now limited to a few specific areas or "staking parks," on unsurveyed territory and on Iles-de-la-Madeleine. Based on Québec's principle of "Free Mining" which grants any interested party a "right" to the resource, the map staking system does not require a licence, and requires only that the applicant file a map designation notice with the appropriate identifying information. Exploration must then be done on the claims, at varied rates, depending on whether the property is north of south of the 52nd parallel, and reports filed on the work and expenditures.⁴⁴⁰

Under the Québec system mining title is awarded on a first-come/first-served basis, granting an exclusive right to search for minerals. This basically serves as a guarantee of receiving a mining title in the case of a discovery. Under the “modern” map-staking system, the average cost of acquiring a new designated claim of an average area of 50 hectares is \$80, compared to approximately \$500 in expenses formerly costs required for staking out and registering a similar area.⁴⁴¹

The maximum amount required to renew a 100 ha claim located south of the 52nd parallel after its 7th two-year renewal period would be \$3,600. Costs north of the 52nd parallel are even lower.⁴⁴²

The electronic registry of mining titles was replaced in 2006 with a new interactive, transactional, Web-based mining title management interface called GESTIM Plus. GESTIM Plus provides free, instant access 24 hours a day to the public register of real and immovable mining rights in Québec.⁴⁴³

Exploration Incentives

One of Québec’s “advantages” is a well-funded and very accessible set of geoscientific data. Over the last 100 years, more than 2.5 million pages of information has been collected, including 64,400 reports produced by mining companies and 12.5 million geochemical analysis results obtained from 636,000 mineral samples. Valued at over \$5.5 billion, the data set is maintained by the provincial government and is constantly being updated and improved. Ninety percent of the pages in the database are digitized and can be viewed free of charge on the Internet. In addition to picking up the tab for housing the data and making it available free of charge to the mining industry, the public also foots the bill for collecting much of

the geoscientific data.⁴⁴⁴

Géologie Québec, a branch of the Ministry of Natural Resources and Wildlife (MRNF) carries out numerous geological projects in various areas of Québec. To “open northern Québec up to mining exploration” Géologie Québec conducted, between 1995 and 2003, two of the most extensive geological mapping programs in Canada.⁴⁴⁵ Subsequent “discoveries” included Goldcorp’s Éléonore Project. In 2006, the branch conducted nine geoscientific inventories, ten geological studies and analyses, and several compilations and evaluations of mineral potential. In the 2006–2007 Budget Speech, the government announced \$3 million in funding over two years for the Copper Plan. The funds will be used to complete geological inventories as well as a variety of geological studies on new high-potential sectors in northwest Québec.⁴⁴⁶

Québec also offers several tax incentives which significantly reduce the net cost of exploration for mining companies in Québec and promote the financing of their activities. Under the *Taxation Act*, the Québec government introduced a tax credit for resources (CIRR) in 2001, which provides direct assistance to mining companies that incur eligible exploration expenses in Québec. In addition to the refundable portion, a non-refundable portion can be used, where applicable, to reduce the income tax and capital tax that a company must pay in Québec. An additional deduction of 50% of qualifying exploration expenses may also be granted under the *Mining Duties Act*, up to a limit of 50% of annual profit. Eligible expenses include surface exploration and underground drilling work performed on land that is not under a mining lease or mining concession, or where no extraction

work has been carried out in the previous five fiscal years.⁴⁴⁷

The Québec system also boasts of heightened access to public funding, venture capital, and exploration partners for mining companies operating in Québec.⁴⁴⁸

The Québec *Taxation Act* enables a Québec taxpayer (individual) to claim a substantial tax deduction for his or her investment in flow-through shares. The Québec regime allows for a base deduction equal to 100% of the cost of flow-through shares. For shares acquired since March 31, 2004, individuals may deduct an additional 25% when the exploration costs are incurred in Québec by a company not engaged in the mining of mineral resources. A further 25% may be deducted if the exploration is done from the surface, bringing the total deduction to 150% of the cost of the investment.

Another amendment with respect to flow-through shares came into effect on March 31, 2004: upon selling the shares, an investor may benefit from an exemption on the capital gain realized on the portion of the sale price that corresponds to the difference between the cost of acquiring the shares and their adjusted cost base, which is deemed to be zero. For the 2006 taxation year, taking Québec and federal tax benefits into account, the net cost of a \$1000 investment in flow-through shares totals some \$284 for a Québec individual at the highest marginal tax rate.⁴⁴⁹

Several venture capital funds are dedicated to companies involved in mineral exploration in Québec, including:

- Société d’investissement dans la diversification de l’exploration (SIDEX), whose mandate is to invest in the capital stock of companies with exploration

Québec town sues Noranda for closing smelter

Oct. 17 2002 – Canadian Press

Residents of a dying Gaspé mining town are suing Noranda Inc. for \$23.1 million after the company shut a copper smelter that was the lifeblood of the community.

People in Murdochville said Wednesday that the April closure of the Noranda (TSX:NRD) smelter killed hundreds of jobs and sank property values in the town of 1,200 residents.

Toronto-based Noranda created Murdochville in 1953 to develop a body of copper ore. It decided last year to pull up stakes because the ore deposits were exhausted and a smelter to process imported ore proved unprofitable. The closure left 313 people out of work.

In August, residents voted 65 per cent in favour of closing the town. But the province, aided by a breakaway group of Murdochville town councillors, is trying to keep the community alive.

Québec announced a \$14 million aid package last week, which will top off pensions and pour cash into municipal coffers. Residents who leave the town are not eligible for the benefits.

Murdochville Mayor Marc Minville, a plaintiff who vehemently opposes the package, said Wednesday that legal proceedings are the town's last hope. "It could take years in the courts," he said. "There are citizens who just want to leave the city and go somewhere else."

Murdochville is about 500 kilometres east of Québec City.

projects that will lead to the diversification of the Québec mining industry. In 2006, SIDEX made seven investments totaling \$2.2 million.

- The Solidarity Fund, which invests in mining exploration and production companies, primarily through regional funds. The northern Québec regional solidarity fund invested \$1 million in seven exploration companies, while the Abitibi-Témiscamingue fund invested of \$600,000 in one mining company.
- SODÉMEX (Société de développement des entreprises minières et d'exploration) and SODÉMEX II are limited partnerships held by Capital d'Amérique CDPQ and SGF Minéral Inc. They invest in junior exploration companies and small mining producers with activities in Québec whose market capitalization is below \$125 million.
- The Société de développement de la Baie-James (SDBJ) (James Bay Development Corporation) "invested" in four exploration projects in 2006 totaling \$700,000.
- The Québec Ministry of Natural Resources and Wildlife (MRNF) provides an annual budget of \$300,000 to each of the Cree Mineral Exploration Board, the Fonds d'exploration minière du Nunavik (Nunavik mining exploration fund), and the Fonds minier Innu Nitassinan (Nitassinan Innu mining fund) to encourage Aboriginal communities in the far north to participate in mineral development.⁴⁵⁰

James Bay Cree and Nunavik The free entry system in Québec, with its free-for-all access to the land and mineral rights, is tempered by the following factors:

- The James Bay and Northern Québec Agreement (JBNQA) gives subsurface rights on Category 1 lands to the Cree, and enable the Cree to participate in decisions regarding mineral development on Category 2 and 3 lands.⁴⁵¹ The mineral rights for Categories 2 and 3 still rest with Québec, and land is staked as it is in the rest of the province. The Cree do not have an explicit and legally defined option of saying 'no' to mine developments.
- The Nunavik Agreements will give the Inuit the mineral rights on Inuit-owned lands, but – as in the Cree Agreements – the mineral rights on other lands in the territory will still belong to Québec and will be staked in the same manner.
- Land in all of Québec may be withdrawn from staking for the protection of the environment. Protected areas are also part of the land use plans of the Cree and the Inuit.
- The MNRF website states that a prospector must seek "mutual agreement" with a property owner before entering upon their lands for exploration purposes. If consent is refused, the prospector can seek expropriation under the Québec Expropriation Act.⁴⁵²

While there are particular arrangements in place for the James Bay Cree and the Inuit of Nunavik, as noted above, there are many other First Nations in Québec who do not have similar agreements in place, and many of whom do not have any land claim settlements.⁴⁵³

Production

Québec ranks second in Canada in terms of mineral production value. Its mineral wealth is particularly diverse, with 30 mineral commodities being produced in the province.

Québec ranks as a significant producer of iron, nickel, gold, copper, zinc, niobium, ilmenite, and titanium dioxide.⁴⁵⁴

In 2006, the Québec mineral sector provided nearly 14,900 jobs. Three-quarters of these jobs were in exploration and one-quarter in primary processing. Over 40% of direct mining jobs in Québec are located in the Cote-Nord, Abitibi-Témiscamingue, and Nord-du-Québec regions. Québec's mining activity can be generally grouped into metallic or non-metallic minerals. Except for iron, which is found on the North Shore, the metals - copper, zinc, nickel, gold and silver - are concentrated mostly in the Abitibi region, while the non-metallic minerals - asbestos, graphite, mica, salt, silica, talk, peat - are mined in the Eastern Townships, the Beauce and the Laurentians.

There are currently 15 metal mines operating in Québec's boreal forest region, plus two industrial mineral operations and a titanium mine. Six of the mines produce primarily copper and zinc, nine are primarily gold producers, and two are iron mines.

In the last several years there has only been one new mine opening - the Croinor Gold Mine near Val d'Or in 2004 - but there have been several re-openings and two major expansions. The Beauford gold mine, the Sigma-Lamaque open-pit mine near Val-d'Or, and the Joe Mann underground mine near Chibougamau re-opened in 2002. The Mouska underground gold mine near Rouyn-Noranda re-opened in 2004, and Copper Rand copper-gold reopened in 2005. During this same period, there were 15 mine closures. The Troilus Mine has two years of mine life remaining.

In the case of the Sigma-Lamaque Mine, the mine opened, closed and promptly re-opened again following a restructuring and refinancing involving SOQUEM Inc., Investissement Québec, and Canada Economic Development, as well as substantial redevelopment and expansion of its mill from 3000 tonnes/day to 5000 tonnes/day. The capital costs for redeveloping and re-opening were estimated at \$34 million. The mine is owned by Century Mining - a company headed up by the notorious Margaret Kent (aka Peggy Witte). Kent was the CEO of Royal Oak Mines, which left behind a trail of mining messes at the Giant Mine and Colomac Mines in the NWT, the Hope Brook Mine in Newfoundland, the Pamour Mine in Timmins and the Kemess South Mine in BC.

Other major expansion programs have been underway over several years at Agnico-Eagle Limited's LaRonde Mine and at Xstrata's Raglan Mine.

The LaRonde Mine in Val d'Or is considered the largest mine in Canada in terms of reserves. LaRonde I is also one of the deepest, at 2,200 meters, making it the deepest gold mine in the world outside of South Africa. Plans are to go to a depth of 3,100 meters in the LaRonde II expansion project. The expansion project alone will add 9 years to the operating life of the mine, at an estimated capital cost of \$218 million. Since commissioning in 1988, the mine has produced more than 4 million ounces of gold. In addition to the over 245,000 ounces of gold produced in 2006, the mine also yielded 4.96 million ounces of silver, 82,200 tonnes of zinc and 7,300 tonnes of copper. Agnico-Eagle has two other projects under development in the area, the Lapa and the Goldex properties - part of the company's corporate strategy

to expand operations around the LaRonde Mine.

In late 2004, Xstrata launched a two-phase capital project to expand the Raglan copper-nickel mine in Nunavik. The company says it intends to make the Raglan Mine one of the biggest on the planet, nearly doubling its output. The plan calls for boosts in ore production now 1.1 million tonnes a year to 1.3 million tonnes by the end of 2008, and more than 2 million tonnes in later years.⁴⁵⁵

The Raglan property is located in the Nunavik territory of northern Québec. The mine is linked by all-weather roads to an airstrip at Donaldson and to the concentrate, storage and ship-loading facilities at Deception Bay. The mine is north of the 60th parallel, nearly 1,100 miles north of Montreal in the sub-arctic permafrost region, with an average annual temperature of -10C and an average ambient temperature underground of -15C.

The operation consists of one open pit, three underground mines, a concentrator, a power plant and accommodations. 90% of the ore at Raglan comes from underground and 10% from the open pit mine. The mine is a fly-in/fly-out operation with employees working for 28 days, followed by 14 days off. The Raglan operation employs approximately 500 people, 16% of them Inuit.

Smelters

Québec hosts four smelters/refineries for the primary processing of substances extracted in the province, and ten aluminium smelters. The non-aluminum smelters are Xstrata's copper-zinc Horne Smelter in Rouyn-Noranda, the Canadian Electric Zinc refinery in Salaberry-de-Valleyfield, the CCR refinery in east Montreal, and QIT-Fer et Titane

The Horne Smelter

In 1978, a study of the Bureau for Studies on Toxic Substances (BEST) revealed high concentrations of metals in the soil within a radius of several kilometres around Noranda's Horne Smelter in the Abitibi-Témiscamingue District. At that time, the Horne smelter was spewing 552,000 tons of SO₂ into the atmosphere.

In 1979, a first public health study on a small group of children revealed higher levels of lead in the blood of the children from the Notre-Dame neighbourhood located closest to the smelter than anywhere else in Rouyn-Noranda or in the town of Évain. In 1989, a screening was done to verify if some children in the neighbourhood had high levels of lead in their blood. At the time, regional health authorities determined that the level of lead in the blood of young children should not surpass 100 µg/L.⁴⁵⁶ The screening reached most of the children between age 2 and 4 in the Notre-Dame neighbourhood, and results showed 50% of them with plasma lead levels over 100 micrograms per litre (µg/L).

In response, the Department of Community Health (DSC) recommended that soils be decontaminated and that discharges be reduced. A task force was set up to find concrete solutions to the problem. The committee was made up of citizens from the neighbourhood, and representatives from the city of Rouyn-Noranda, the company, the Department of Environment and the DSC. The group proposed that, by 1995, no more than 10% of children between age 1 and 5 in the neighbourhood should display plasma lead levels exceeding 100 µg/L. Strategies to achieve this objective included soil decontamination, a reduction of the sources of lead emissions, and improved hygiene habits in the affected families.

After 80% of the residential properties in the Notre-Dame neighbourhood had been included in a soil decontamination program in 1990-91, only 25% of the children had plasma blood levels exceeding 100 µg/L. In 1993, a third screening of the same neighbourhood showed the proportion of children with plasma lead levels exceeding 100 µg/L had dropped by half, and none of the children showed a level over 150 µg/L. A last screening took place in 1999, with 95 of the 98 children identified participating. The geometric mean of plasma lead level was slightly below 50 µg/L, the upper limit of normality according to the Québec Toxicology Centre. This last screening also showed that only 6% of the participating population had plasma lead levels above 100 µg/L, confirming that the objectives of the five-year intervention plan (1990-95) had been met. Tests results also showed a systematic decrease between 1989 and 1999 in plasma lead levels exceeding 100 µg/L. It was the first time that this proportion had fallen below the 10% mark.⁴⁵⁷

In 2000, the DSC proceeded to analyse a small number of soil samples from the eastern part of the neighbourhood (the sector that had been almost completely decontaminated in 1990-91). The soil in the zones located immediately to the south of the smelter reached contamination levels in the area of 500 ppm, a figure 10 times higher than the levels found in the replacement fill used during the decontamination operations of 1990-91. This renewed contamination decreases progressively as the distance from the smelter increases.⁴⁵⁸ The testing in 2000 indicated that the average plasma lead level among the children had not gone down since 1993.

Preliminary reports from 2006 indicate that 66,779,300 kg of lead and lead compounds were released to the air.⁴⁵⁹

SO₂ emissions have also been reduced over the last several decades, with emissions reduced to 28,186 tonnes in 2006, according to preliminary reports. While this is excellent progress when measured against the 552,000 tonnes of 1978, it still presents a significant environmental stress, as do the releases of lead and lead compounds.

Inc. facility in Sorel-Tracy. In 2006, deliveries from primary processing totalled \$1.5 billion.

In 2001, Noranda Inc (now owned by Xstrata) announced that it would close its Gaspé copper smelter in Murdochville at the end of April 2002. This leaves the Horne Smelter in Rouyn-Noranda as the last base metals smelter in Québec's boreal region.

Québec is also host to ten of Canada's eleven aluminium smelters, which are heavily subsidized through reduced hydro rates. Production of primary aluminium in reached 2.89 million tonnes in 2005 with a value of \$6.6 billion, and ranking Canada third after China and Russia in terms of world primary production. Production of primary aluminium in Canada increased by 12% in 2005 due to an Alouette smelter expansion and the restarting of idled lines at Aluminerie Becancour. The Alouette expansion made that smelter the largest such operation in the Americas.⁴⁶⁰

Alcan – now owned by Rio Tinto – owns the Alma smelter in Alma, the Arvida smelter in Jonquiere, Québec, the Grande-Baie smelter in La Baie, the Laterrière smelter in Chicoutimi, Québec, the Shawinigan smelter in Shawinigan, and the Beauharnois smelter in Melocheville (plus the smelter in Kitimat, British Columbia). Alcan also has a 40% interest in the Alouette smelter in Sept-Iles.⁴⁶¹

Alcoa Inc. owns the Deschambault smelter (Lauralco) located near Québec City and a smelter located at Baie Comeau. Alcoa also has a 74.95% interest in the Aluminerie de Becancour Inc. (ABI) smelter.⁴⁶²

Mining's Legacy

The Québec government has undertaken a number of inventories

related to abandoned mines, including an inventory of sites needing reclamation work in 1994, an inventory of industrial sites which was started in 1998, and an inventory of tailings deposits in 1999. In total, there are 1000 mine sites on file.⁴⁶³

Since the early 1990s the Government of Québec has spent an estimated \$30 million on research, work, and financial assistance related to abandoned mines and the rehabilitation of mining sites.⁴⁶⁴

An estimated \$20 million of that \$30 million investment has been spent on the rehabilitation of 11 sites that were "returned" to the Province between 1967 and 1985. The 11 mine sites, covering a total area of more than 500 hectares, were located in Abitibi-Témiscamingue (East Sullivan, Sullivan, Terrains Aurifères A, Canadian Malartic, Wood Cadillac, Preissac, Stadacona and Lorraine), in Mauricie-Bois-Francs (Somex) and in Gaspésie (Candégo and Les Mines Madeleine).⁴⁶⁵

The Québec government has identified 140 additional abandoned mine sites with unremediated mine tailings areas, with a combined rehabilitation cost estimated at approximately \$100 million. The 140 abandoned stockpiles cover over 1,900 hectares. Characterization and rehabilitation work has been deemed necessary for 100 of these sites, which represent nearly 85% of the total area (1,600 hectares). These sites, which will require more or less \$100 million in financing, are mainly located in:

- Abitibi Témiscamingue (71%)
- Outaouais (13%)
- Chaudière-Appalaches (7%)
- Estrie (4%)
- Nord-du-Québec (2%)
- Laurentides (2%), and
- Mauricie Bois Francs (1%)⁴⁶⁶

Alcan Spill turns Saguenay River red

The Canadian Press, April 7, 2007.

Environment experts in Quebec on Saturday were monitoring a spill that turned several kilometres of the Saguenay River red. An unknown quantity of red aluminum production residue spilled into the Saguenay River on Friday after a pipe ruptured at an Alcan plant in Jonquiere, north of Quebec City, turning the water a deep red.

The Company says the substance will not endanger the environment. There is no danger to people and likely not to aquatic life either, said company spokeswoman Rene Larouche. Larouche said the mud is composed of 40 per cent inert solid material, and the rest is a "chemical liquid that is low-level caustic." She said the leak was sealed within four hours, and the strong flow of the river diluted the residue's presence in the water.

Nancy Bourgeois of the Chicoutimi Environment Committee, a local conservation group, said her office received dozens of calls Friday from alarmed residents. She said the affected section of the Saguenay is a winter feeding area for sea trout and a breeding ground for smelt. "What we want is answers," Bourgeois said. "It's just shocking that in 2007, this kind of thing could happen."

An additional 365 “mining residue stockpiles” are still active, 167 are inactive but still have a company attached to them which could be held responsible.⁴⁶⁷

While Québec is paying the lion’s share of the costs for rehabilitating historic and abandoned mining sites, the mining industry is making some contributions. Xstrata has promised \$250,000 in the form of money, transportation and accommodation to support the work of the Fonds Restor-Action Nunavik, which is undertaking the clean up 25 major abandoned mining exploration sites in Nunavik.⁴⁶⁸

More than 20 companies have set up the Fonds Restor-Action Nunavik foundation to raise money for the restoration of the 18 worst abandoned mining sites in the region. Fonds Restor-Action Nunavik has raised \$750,000 among 20 mining companies and Québec has pitched in \$4.1 million towards the clean-up effort, while the Kativik Regional Government and Makivik Corp. will provide assistance to make sure all “priority number one” sites get cleaned up. Work will include removal of hazardous materials, burning of non-toxic debris, recovery of scrap metal, and removal of remaining garbage to the nearest municipal disposal site.⁴⁶⁹

A 2003 inventory identified 595 abandoned mine sites in Nunavik. The inventory looked in detail at 193 of these sites, of which 18 were found to need extensive clean-ups.⁴⁷⁰ Most of the sites are south of Kuujuaq and around Kangiqsualujuaq, with some near the Hudson and Ungava bays. In 1997, more than 100 litres of highly toxic acid was found near Kattiniq, while, in 2000, a stock of abandoned dynamite was found near Tasiujaq. At the very least, leftover debris on the sites could pollute groundwater,

said the inventory’s authors, who suggested crews remove materials, burn debris and recover scrap metal. This year, the clean-up activities have been concentrated on three sites near Blue Lake and Aupaluk.⁴⁷¹

In the 2007–2008 *Budget Speech*, the Québec finance minister announced a ten-year plan to restore abandoned mine sites. A total estimated cost of \$203 million was posted as an “environmental liability” on the financial statements.⁴⁷² It is not clear how and when this commitment will translate into real dollars spent, beyond those specifics identified above.

Arsenic-laden Tailings at Duparquet

The gold deposit in the village of Duparquet was discovered in the 1920s and mined from 1933 to 1957. The ore contains arsenic, sulphur and antimony. In 1937 a roaster was installed to increase the recuperation of gold by eliminating arsenic from the concentrate. Twenty years later, the company ceased operating, leaving on the site with some 10,000 tons of arsenic stored in three cement reservoirs. In 1976, Eldorado Gold Mines bought the site in order to use the roaster for molybdenum concentrate.

In 1981, cracks were discovered in the cement reservoirs. In response, Eldorado emptied two of the reservoirs into sealed barrels and partially patched the third one. Between 1981 and 1987, Eldorado Gold Mines managed to sell half of the 2,500 forty-gallon barrels, and, in 1990, the remaining arsenic was transferred into plastic containers.

In 1981, the Department of Community Health carried out a study to measure the level of arsenic contained in the urine and the hair of three distinct groups from Duparquet: the workers who had handled the arsenic, children below age 15, and a certain number of adults. Workers registered very high levels of arsenic, and the studies also revealed that the levels of arsenic present in the urine of the children of Duparquet were higher than those of La Sarre, the reference town. The Department of Community Health made a number of recommendations, including the decontamination of play areas for the children. To date, much of the arsenic that has been transferred to plastic barrels has been re-transferred into a cement reservoir. Given that the reservoir is less than totally watertight, arsenic is still leaking from the tailings area. There are concerns that arsenic might contaminate the water table and that runoff from the tailings area may end up in Lake Duparquet, a popular recreational lake.

The Manitou-Goldex Project:

The Manitou site occupies an area of nearly 200 hectares and presents the most significant rehabilitation challenge among abandoned mines in Québec. Over the years, acid mine drainage from the mine tailings has had a major impact on the local environment, particularly the Bourlamaque River.

Under a partnership agreement between the Québec Ministry of Natural Resources and Agnico-Eagle Mines, the Manitou site will be rehabilitated by using waste from the Goldex mine to cover and neutralize the acid generating tailings of the Manitou mine. The tailings from the Goldex mine are cyanide- and sulphide-free. In addition, the neutralizing potential of the waste will make it possible to neutralize the acidity of interstitial water in the tailings from the Manitou site, leading to an increase in pH and the onsite precipitation of metals dissolved in the interstitial water.

The waste from the Goldex mine will be transported to the Manitou site in the form of thickened pulp, containing about 55% solids, by a 24-km pipeline. The work will be spread out over about 12 years, which is the anticipated mine life of the Goldex mine. In addition, site closure plans provide for revegetation of the site and stabilization of the banks of the Bourlamaque River. Finally, the development of a marsh and the restoration of wildlife habitats, especially fish habitats, will be integrated into the work to rehabilitate the site. The preparation of the Manitou site and construction of the infrastructure for transportation of the tailings will be finished by the end of 2007. The first ore processing tests are planned for early 2008. Therefore, by spring 2008, the first tailings from the Goldex mine could be transported to the Manitou site.⁴⁷³

6.3 Ontario

Mining's History

Ojibwe people in the Bruce Mines area, on the north shore of Lake Huron in northeastern Ontario told the Indian Agent of copper deposits they had mined for centuries. The first modern metal mine was opened in the area in 1850. Copper-nickel ore was discovered at Sudbury in 1883 and silver at Cobalt in 1903. Both discoveries were made accidentally by railway blacksmiths. Following the discovery of rich finds of silver at Cobalt, prospectors roamed even further afield in search of precious metals⁴⁷⁴ and mineral extraction in Ontario's boreal forest began.

A Mining Convention in 1905 followed on the heels of the Cobalt discovery, and the heightened level of mining activity showed the need to regulate the industry, and especially to have a means to resolve disputes between claimants. The result was the Mines Act of 1906, which was a comprehensive revision and update to mining laws which had been around since the mid 1880s.⁴⁷⁵

A Mining Commissioner was appointed under the new Mining Act. His principal task was to bring "law and order" to the Ontario mining community and remove such disputes from the realm of Mines Ministers who were having to deal with difficult and time-consuming cases. He was to offer an accessible and affordable means of quickly and effectively sorting out mineral disputes.⁴⁷⁶

In the late summer of 1906, a prospecting party a hundred miles north of Cobalt found gold. Press claims that the gold was "visible in quartz, and we could knock it off with our picks" sparked one of the largest gold rushes in Ontario history. In

the winter of 1906-07 there were 2000 men in the area, who staked 4000 claims. Mining Promoters reported outrageous gold finds and values and encouraged the unsuspecting public to invest money with them in get-rich-quick schemes. The Canadian Mining Journal observed "the gold mined by these promoters did not come from the pockets of the earth."⁴⁷⁷

Discoveries in the Timmins camp followed soon after, with the Dome Mines Company Limited forming in 1910 and producing its first 214 ounces of gold and 19 ounces of silver by the end of the same year. The Dome Mine, the foundation stone for what is now Placer Dome International, was in continual production for 95 years.

Mining Today

For almost a century, Ontario has consistently led mined metal production in Canada, with totals approximately equal to the combined production of British Columbia and Québec. Ontario is responsible for one-third of Canada's total production.⁴⁷⁸

In 2006, the five highest value metallic minerals were nickel (\$3,269 million), copper (\$1,453 million), gold (\$1,247 million), platinum group metals (\$404 million), and zinc (\$379 million). Combined, these represent 98% of the total value of Ontario's metallic mineral production in 2006, totalling \$7 billion dollars.⁴⁷⁹

The mineral industry in Ontario includes: mineral production, mineral exploration, and industries supporting the mining sector, including contract mining, custom equipment design and mine financing. Toronto is known as the mine-financing capital of the world. More mining companies are listed on the TSX and TSX Venture Exchange than on

any other exchange in the world, with over 1100 mining companies valued at \$143 billion.⁴⁸⁰

Although most Ontario mining takes place in the boreal region, comprising 80% of the province, there is also a significant mining camp in Sudbury, which is in the transitional zone between the Great Lakes St. Lawrence forest and the boreal region.

Outside the boreal, skirmishes between exploration companies and concerned land owners and First Nations have erupted in the southeastern corner of the province, where the junior exploration company Frontenac Ventures has been in an extended confrontation with two Algonquin First Nations and other local residents and surface-rights holders over uranium exploration activity.

Staking and Exploration

Mineral exploration in Ontario is heavily subsidized, through direct grants to mining industry associations, government-funded mineral reconnaissance and research, and flow-through shares which provide tax benefits to those who invest in mineral exploration, regardless of whether a mine is ever found.

In 2001 the provincial government announced \$4 million in direct funding to help restructure the Ontario Prospectors Association.

The mineral exploration sector benefits from government funding of research and development, including a \$29-million Operation Treasure Hunt investment announced in July 2001 to generate “new geoscientific data that promotes Ontario’s standing as one of the best jurisdictions in the world for mineral exploration.”⁴⁸¹ In 2000, the Province announced an \$8 million program to develop advanced technologies

for mineral exploration.⁴⁸²

The province has its own flow-through share program, in addition to the federal “Super Flow-through Shares.” The Provincial program provides a 5% tax credit to investors in Flow-through-Shares.⁴⁸³ Ontario also offers a ten year tax holiday for any company developing a “remote mine.”

Exploration in Ontario is approximately five times higher than it was five years ago.⁴⁸⁴ Exploration and deposit appraisal spending rose from \$108.9 million in 2001⁴⁸⁵ to \$342 million in 2006. Predictions for 2007 anticipate a further increase of 9% to \$371 million.⁴⁸⁶

Ontario has led all Canadian provinces and territories in exploration and deposit appraisal spending every year for the last decade, and projections are that expenditures in 2007 will account for 20% of Canada’s total expenditures.⁴⁸⁷

Spending was split in 2006 in a 3:1 ratio, with \$245 million (72%) spent on exploration and \$97 million (28%) for deposit appraisal. Spending intentions for 2007 suggest a relative increase in deposit appraisal (advanced exploration) with \$258 million (70%) to be spent on exploration and \$113 million (30%) to be spent on deposit appraisal. Spending on activity away from existing mine sites is expected to climb from \$249 million in 2006 to \$332 million in 2007.⁴⁸⁸ Approximately 40% of this spending is by junior companies and 60% by seniors.⁴⁸⁹

66,926 new claim units were recorded in Ontario in 2006, with only 494 of them located in the southern part of the province. The number of mining claims in “good standing” in Ontario climbed to a record high of 229,000 in 2006 – an

increase from 213,000 in 2005.⁴⁹⁰

Gold has continued to be the most sought-after commodity in Ontario for several years, but base metals could surpass gold in 2007. Exploration for platinum metal group has increased dramatically across Northern Ontario, with a rise in exploration spending from \$2 million in 1998 to \$24 million in 2006. Diamond exploration continues across the province, particularly around Wawa and Cobalt and in the James Bay lowlands.⁴⁹¹ A recent nickel rush in the McFaulds Lake area near James Bay has also caught miners’ attention.

Mineral Tenure in Ontario

Ontario’s mineral exploration and development operates under the “free entry” system: both public and private land are generally open for staking, exploration and potentially development of the mineral resource.

Who actually owns the mining rights, even on properties that are privately owned, will vary from one parcel of land to the next. Generally, for any title granted by the Crown before May 6, 1913 – the date the Public Lands Act was amended to reserve mineral rights to the crown – the owner of the surface rights will also own the mineral rights. For parcels of land granted by the Crown after May 6, 1913, ownership may or may not include the mining rights depending on how the title is worded. The Province’s current policy is to reserve mining rights to the Crown in the majority of land grants made under the Public Lands Act.

Ontario still operates under a system of ground-staking, where mining claims must be physically staked on the land, but it is considering changes to the Mining Act that would introduce map staking

for southern Ontario and the far north.

Mining claims are each 16 hectares in size, and are staked using a four-post system, which means that there is a claim post in each corner, with a claim tag identifying the prospector and the time of staking. After staking a claim, the prospector or exploration company must perform exploration or assessment work to maintain it in good standing.

The assessment work must be of a value of least \$400 per claim unit per year, with an exemption for the first year and the option of assigning assessment expenditures to contiguous claims (for example, a prospector can spend \$1600 on one claim and use it as a credit for four contiguous claims). The assessment work must be reported to the Mining Lands Section of the Ministry of Northern Development and Mines, and must contribute to the understanding of the geology of the site. For example, a base line study of natural values on the site would not be accepted as assessment work. The holder of the mining claim owns the exclusive right to explore for minerals, and is entitled to bring the property to a mining lease upon fulfilling the requirements of the Mining Act. Mining leases are issued for twenty-one year terms and may be renewed for further twenty-one-year periods. They can be issued for surface and mining rights, mining rights only or surface rights only.

In 1996, preliminary mineral exploration on public lands was deregulated under the Bill 26 amendments to the *Public Lands Act*. Work permits for preliminary exploration on public lands are now only required when roads or buildings are being constructed, while impacts on ground and surface water may require authorization provincially

and/or federally. Clearing, mechanical stripping, bulk sampling, drilling and blasting, moving heavy equipment and drilling rigs, and building trails are allowed on public land without need for permit.⁴⁹²

Mining Claims in Protected Areas
During the Lands for Life land use planning process in 1997 and 1998, the mining industry fiercely opposed establishing additional protected areas that were needed in order for the parks system to adequately represent Ontario's natural diversity and ecological regions. Prospectors Associations and major mining companies teamed up to agitate for the opening up of existing Ontario parks and conservation reserves to mineral exploration.⁴⁹³

The expanded system of parks and protected areas announced in March 1999 included overlaps with mining claims and interests in approximately one-third of the 378 new protected areas. The areas of overlap were designated as "Forest Reserves," which permitted mineral exploration and mining development. The Forest Reserve lands were to be added to the park or conservation reserve if a claim or lease was forfeited through "normal processes."

In 2002, the government initiated a process with mineral exploration interests and conservation groups to try to "disentangle" the locations where the protected areas overlapped with pre-existing mining lands. From mid-2002 to June 2004, recommendations were developed for a total of 66 sites. Public comment was invited through a posting on Ontario's Environmental Bill of Rights electronic registry.

Between March 2006 and April 2007 decisions were announced for 33 forest reserves and portions of 2 conservation reserves and 1

provincial park. For 31 of the 33 forest reserves the decision was made to re-designate the areas as either general use areas or enhanced management areas. And, as one of the notices stated, "for the areas being changed from forest reserve designation to GUA or EMA, this will remove all current intent to regulate these areas as per previous intent indicated for forest reserve designated lands via the approved Land Use Strategy."⁴⁹⁴ This means these areas are now lost from the system of parks and protected areas now and into the future.

Public Opposition

While the level of mineral exploration in Ontario has risen dramatically over the last several years, so has the level of opposition from the public and First Nations, literally from one end of the province to the other.

In southeastern Ontario – in the Rideau Lakes area, and North Frontenac in particular – there have been conflicts between prospectors and exploration companies intruding on private land for several years, and several cases have been brought before the Mining and Lands Commissioner. The Mining Commissioner has responded erratically. The uproar has resulted in a review by Government of sections of the Mining Act related to mineral staking and exploration on lands where the surface rights are held by private property owners.

The Mining Act currently requires the consent of the surface owner, in some circumstances, before a mining claim is staked and before prospecting occurs, but these protections are inconsistently recognized, and are not embedded in the regulations. They provide for compensation for damages but do not enable the surface rights holder to say "no."

Over the past few years, conflicts have arisen as a result of exploration companies or individuals entering private property to stake out mining claims or to undertake ground exploration work without consent or notification.

The Minister of Northern Development and Mines is proposing to introduce map staking in southern Ontario, and to add churches, cemeteries, burial grounds, natural gas/oil/water pipelines or airports to the list of lands that are not open for mineral staking.

The Ministry is also proposing to expand notification rules for exploration work. The proposed changes are:

- A mining claim holder would be required to provide a confirmation that a mining claim has been staked to the surface owner's address well in advance of entry on private surface rights (e.g. minimum of 30 days prior to entry); and
- A prospector would have to provide a notice of the intent to perform ground exploration work that would include details of the exploration work being proposed, including when, what, where, how and by whom the work will be carried out.

The proposed changes were outlined in Ontario's Mineral Development Strategy⁴⁹⁵ and a proposal outlining the potential changes was posted on Ontario's Environmental Bill of Rights electronic registry on July 18, 2007 for a 60 day comment period.⁴⁹⁶

The same circumstances exist across the north, including the vast stretches of the forest where there are a variety of land uses, including cottages, farms, forestry operations, hunting, trapping and

fishing by both native and non-native residents.

One First Nation after another is finding their traditional and treaty lands trespassed upon by an exploration companies who are either ignorant of Aboriginal land rights or indifferent to them.

In the spring of 2006, members of Muskrat Dam First Nation in northern Ontario were dismayed to find De Beers conducting drilling and helicopter exploration in the area where they carry out their annual spring goose hunt. The hunt usually provides about 200 geese for community use; an essential part of the diet, especially for elders. Chief Vernon Morris asked DeBeers to cease the exploration program immediately.⁴⁹⁷ Company officials asked for a meeting to discuss the disruption, then dictated who could attend. No meeting took place.⁴⁹⁸

In 2004, Platinex Inc. began exploring for platinum on the lands of the Kitchenuhmaykoosib Inninuwug (KI) First Nation, ignoring a moratorium on development that had been imposed by the First Nation in 2001, pending the resolution of the Treaty Land Entitlement claim. When the company entered on the winter road and began to undertake exploration work, KI asked them to leave. When the company persisted, the community blocked the road. Platinex responded by suing the First Nation for \$10 billion, and asking for an injunction. KI responded with a counter suit enjoining Ontario and asking the judge to declare that the Ontario Mining Act was unconstitutional, and asking the court to grant the community an injunction against the mining company. At the first injunction hearing, the Ontario Superior court judge rejected Platinex's request and granted the First Nation's application. He ruled

Goldcorp's Campbell Mine

The Campbell Mine is a gold mine owned by Goldcorp and located about 180 kilometres north of Vermillion Bay, in the small community of Balmertown, near Red Lake. Now "integrated" with the Goldcorp's Red Lake Mine next door, the Campbell Mine was owned and operated by Placer Dome until Goldcorp bought the property in 2006. A total of 666,000 tonnes were mined during 2004, producing 209,186 ounces of gold. The ratio of ore to total tonnes mined was 67%.

Arsenic could be the Campbell Mine's middle name. If there is a villain in the Campbell Mine cast of environmental contaminants, it is arsenic. Arsenic-laden tailings in the backyards of Balmerton, an arsenic plume steadily making its way to Red Lake, and 20,000 tons of arsenic trioxide stashed deep in the Campbell Mine.

From 1949 through to 1960, tailings were discharged into Detta Lake and what is now a residential part of Balmertown. The tailings were the waste products from the milling process during the first years of operation of the roaster. As a result, arsenic levels were high in the neighbourhood where the tailings had been deposited. A 1992 monitoring program found arsenic concentrations from 500 ppm to 1000 ppm at a depth of 0 m to 1 m below the yards. Studies in 1995 found that those living in the Balmertown neighbourhood built on the tailings had higher levels of arsenic in their urine than the other groups. There has been no remedial action taken.

Several years ago, groundwater sampling showed that arsenic from the tailings had penetrated the clay below the tailings impoundment and had reached the underlying aquifer, and that the groundwater was flowing toward both Balmer Lake and Red Lake, with most of it flowing toward Red Lake. Studies done in the early 1990's indicated that three groundwater plumes will report to Red Lake in three or more locations. There is an aquifer discharge directly into Red Lake, there is seepage into a stream entering McNeely Bay, and there is seepage into a marshy area adjacent to Red Lake. The aquifer may also discharge into the mouth of McNeely Bay. The earlier studies estimate that the dissolved sulphate plume has migrated approximately 200 metres from the tailings area towards Red Lake, and will reach Red Lake in 10 to 20 years. The arsenic plume was predicted to reach Red Lake in 30 to 55 years. More recent estimates are that the arsenic could reach Red Lake much sooner. Estimates of potential arsenic loadings range from 170 kilograms per year to 2500 kilograms per year.

Between 1975 and 1991, an estimated 20,000 tons of arsenic trioxide was air-blown into the underground workings at the Campbell Mine. Arsenic trioxide is a known carcinogen, with no safe level of exposure. The Mine's 1995 closure plan said that Placer Dome was relying on the Ontario Waste Management Corporation to review options for the treatment of the arsenic trioxide stored underground, but the OWMC had ceased to exist by late 1995. In 2000, five years after filing the closure plan, Placer Dome restarted their search for an environmental solution to the arsenic trioxide problem. They pinned their hopes on the work of a project team established by the federal government, which had been given a year's funding to examine options for managing the 270,000 tonnes of arsenic trioxide left behind at the Giant Mine in Yellowknife after Royal Oak's collapse. By 2001, Placer Dome officials were indicating that they expected to bring the materials to surface for treatment, but that the timeline and treatment methods had not yet established.

The newest closure plan, filed by Goldcorp in April 2007, describes a plan as having been developed from 1999 to 2002 and initiated in 2003, to remove the arsenic trioxide for "safe" disposal. The plan involves creating an arsenic trioxide slurry underground which is then pumped to surface for processing through an autoclave located in the mill (a Certificate of Approval for the autoclave dates back to 1991). Reportedly "literature reviews" indicated that the Campbell autoclave was the best available technology for stabilization and disposal of the arsenic. The autoclave fixes the arsenic with iron and the fixed arsenic is then deposited in the main tailings pond or returned as paste underground.⁴⁹⁹

The majority of pumping took place in 2005, emptying the 550 stope of 1100 tons. In 2005 pumping was stopped to allow the stope to be washed down and recorded for a visual review of progress.⁵⁰⁰ Once it is determined that the first phase of the project was successful, Goldcorp intends to proceed to Phase II, which will process the remaining arsenic trioxide over a period of 8-10 years.⁵⁰¹

that work must be stopped at the site, while the First Nation and the provincial government held talks.^{502/503}

Attawapiskat First Nation has demonstrated their openness to mineral development through their agreement to allow the DeBeers diamond mine in their territory, but they have continued to challenge other exploration companies which undertake work on Attawapiskat First Nation territory without the involvement or agreement of the First Nation. Metallex Ventures continued exploration work throughout 2006 and 2007 without the support of the First Nation, and were asked to leave the territory. Attawapiskat First Nation has clearly stated that it has no intention of supporting any project that does not show respect for First Nation Right.⁵⁰⁴

The Ontario Government's responses, delivered by the Ministry of Northern Development and Mines, have varied from hostile to weak. Ontario's 2006 Mineral Development Strategy devotes several paragraphs to describing how "effective consultation processes for the mining sector will continue to be developed and implemented with input from Aboriginal peoples, mineral sector and other stakeholders, consistent with government-wide guidelines."

Production

Currently, there are 17 metal mines operating in Ontario's boreal region with another 8 advanced exploration projects which are likely to come into production within the next year or two. There are an additional dozen mines operating in the Sudbury basin, which is the transitional zone between the Great Lakes St. Lawrence and boreal forests.

The greatest concentration of mining is in the Timmins area,

usually referred to as the "Timmins camp" or the "Porcupine camp" in the context of mineral production and exploration. The Timmins camp includes the Clavos, Dome, Hoyle Pond and Pamour gold mines, Xstrata's Kidd Creek zinc-copper mine and Montcalm nickel-copper mine, and Liberty Mine's Redstone nickel operation.

Two significant developments in the Timmins camp have been the formation of the Porcupine Joint Venture and a major expansion of the Kidd Creek operations.

The Porcupine Joint Venture was formed in July 2002 as a partnership between Kinross Gold Corporation and Placer Dome Inc (since purchased by Goldcorp). Operations and properties were combined, and a massive expansion of the Pamour Mine undertaken.⁵⁰⁵ The project, which was the subject of a comprehensive study under the Canadian Environmental Assessment Act, included expansion of the existing Pamour open pit mine, the construction of an isolation dam across Three Nations Lake, partial dewatering of the lake, alteration of the lake shoreline and extension of the lake, and the relocation of a portion of Three Nations Creek. The expansion involved relocating Highway 101 into Three Nations Lake and through a section of Three Nations Creek. The expansion represented a mine life extension of up to 11 years.⁵⁰⁶

The result of a \$640 million capital program to develop Mine D at the Kidd Creek operations has been to make the Kidd Creek the deepest base-metal mine in the world. Mine D is the deepest mine developed in Canada to date; the plan is to go deeper still.⁵⁰⁷ The mining rate at Kidd Creek is 5,651 tonnes per day. The Kidd Creek operations include the underground mine and

a metallurgical site, which is comprised of a concentrator, copper smelter and refinery, electrolytic zinc reduction plant, two sulphuric acid plants, cadmium plant, indium plant and a liquid sulphur dioxide plant.⁵⁰⁸

Goldcorp also operates two gold mines – now managed as a joint operation – in Balmerton, just outside of Red Lake, and the Musselwhite gold mine, 130 kilometres north of Pickle Lake.

Four mines are staggered throughout the Lake Superior watershed: the Lac des Illes palladium mine north of Thunder Bay, two remaining gold mines in the Hemlo camp just outside of Marathon, and a single gold mine just north of Wawa. On the other side of the province at roughly equivalent latitude is the last remaining gold mine in the historic Kirkland Lake camp. But while there may be just a few remaining mines in the Hemlo, Wawa and Kirkland camps, each area has an abundance of both abandoned mines, closed and suspended operations, and exploration activities.

Mining is heavily dependent on outside capital and external markets. Historically, mining in northern Ontario was difficult, given that the markets, labour, capital, technology and cheap transportation needed for the profitable operation were all found further south.⁵⁰⁹ Mining created a sparse and scattered population across the Shield in Ontario, where many communities were almost entirely dependent on the extraction and processing of ore – an unsustainable resource use, resulting in unsustainable communities.

Controlled by single industries which were often headquartered in distant urban centres, these

Acid Mine Drainage at Kam Kotia

The Kam Kotia Mine, located 15 km northwest of the city centre of Timmins, was originally operated as the “Wartime Metal Corporation” from 1942 until 1961. In 1961, the property was acquired by Kam Kotia Mines Ltd., principally owned by Robison Mines Ltd., and was operated until 1972, when it was abandoned, becoming a public liability. The site includes a partially filled open pit, old mill remnants, 200,000 tonnes of waste rock, and over 400 ha containing 6 million tonnes of impounded and unimpounded tailings.

The Kam Kotia mine tailings are reported to have the highest tailings sulphide concentration in Canada and are strongly acid-generating. Surface water runoff from the site is very acidic, and has been reported at pH 1.8 to 2.5, containing elevated levels of arsenic, zinc and copper. It has been estimated that 35,000 tonnes of tailings are currently clogging the Kamiskotia creek bed, much of which is flushed out and replenished on an annual cycle.

By 2006, approximately two-thirds of the rehabilitation required at the Kam Kotia site had been completed, at a cost of approximately \$38.5 million. Projects for the 2006-2007 fiscal year included the installation of a dry cover over the northwest section of tailings for a cost of \$12.3 million and the operation of a water treatment plant under a five-year contract for a cost of \$1.8 million.⁵¹⁰

communities have been, as one researcher described it “subject to crucial decisions made in distant corporate offices that were insulated from the devastating local impact of these decisions.”⁵¹¹ Perhaps at least in part because mining communities in northern Ontario are so often heavily dependent on a single resource industry, and because communities lack control in crucial decisions made in the industry, mining operations have generally not been widely subject to public scrutiny.

Water Regulation in Ontario

The Ontario Water Resources Act (OWRA) regulates water taking and mine effluents in Ontario. Both water taking permits – required to pump water for use in mining and milling processes and in order to keep mines free of water and thus open for operation – and permits for industrial sewage works are issued under the Act. In the mining context, industrial sewage works are the treatment ponds for mine effluent and the tailings management areas.⁵¹²

The OWRA includes prohibitions on water pollution, authority to issue approvals and orders regarding water pollution that constitute exceptions to the statutes prohibitions, as well as the authority to apply penalties for violating the Act or its regulations.

Levels of “acceptable” pollution vary by substance and by location, and the Ministry of the Environment has discretion to approve an operation which has releases of toxics to the environment that are higher than the levels in the Water Quality standards. The water pollution control regulations do not necessarily employ the total loading approach used in company-specific acid rain regulations. The acid rain regulations only apply to one or two

mining companies operating in the province.

The ministry can lay charges and order fines if an operation is out of compliance, but it rarely does.⁵¹³ For example, there were 50 exceedences of the water pollution limits by the mineral sector in northern Ontario in 2005, and there were no convictions.⁵¹⁴

The public has a limited opportunity to comment on proposals to issue approvals. There is limited notice and information for hearings, and short comment periods. Although the public has an opportunity to appeal approvals, few appeals are actually heard. Stringent tests must be met before the review tribunal will hear a case.

Ministry status reports on waste water discharges showed that in 1995 all nine mining companies operating in the northern administrative region of the ministry violated the mining effluent limits of their certificates of approval under the OWRA at certain times during the year. Environmental compliance reports a decade later show that non-compliance problems persist. As noted above, the 2005 Environmental Compliance Reports indicated that there were 50 exceedences of the water pollution limits by the mineral sector in northern Ontario in 2005.⁵¹⁵

Mining’s Legacy

Over 6,000 inactive or abandoned exploration or mining sites litter the province.⁵¹⁶ Ontario’s Ministry of Northern Development and Mines announced a \$27 million commitment to an abandoned mines rehabilitation program in 1999, with an emphasis on “eliminating risks to public safety” through the capping of abandoned mine shafts, removal of mine structures, and backfilling physical hazards, such as pits and

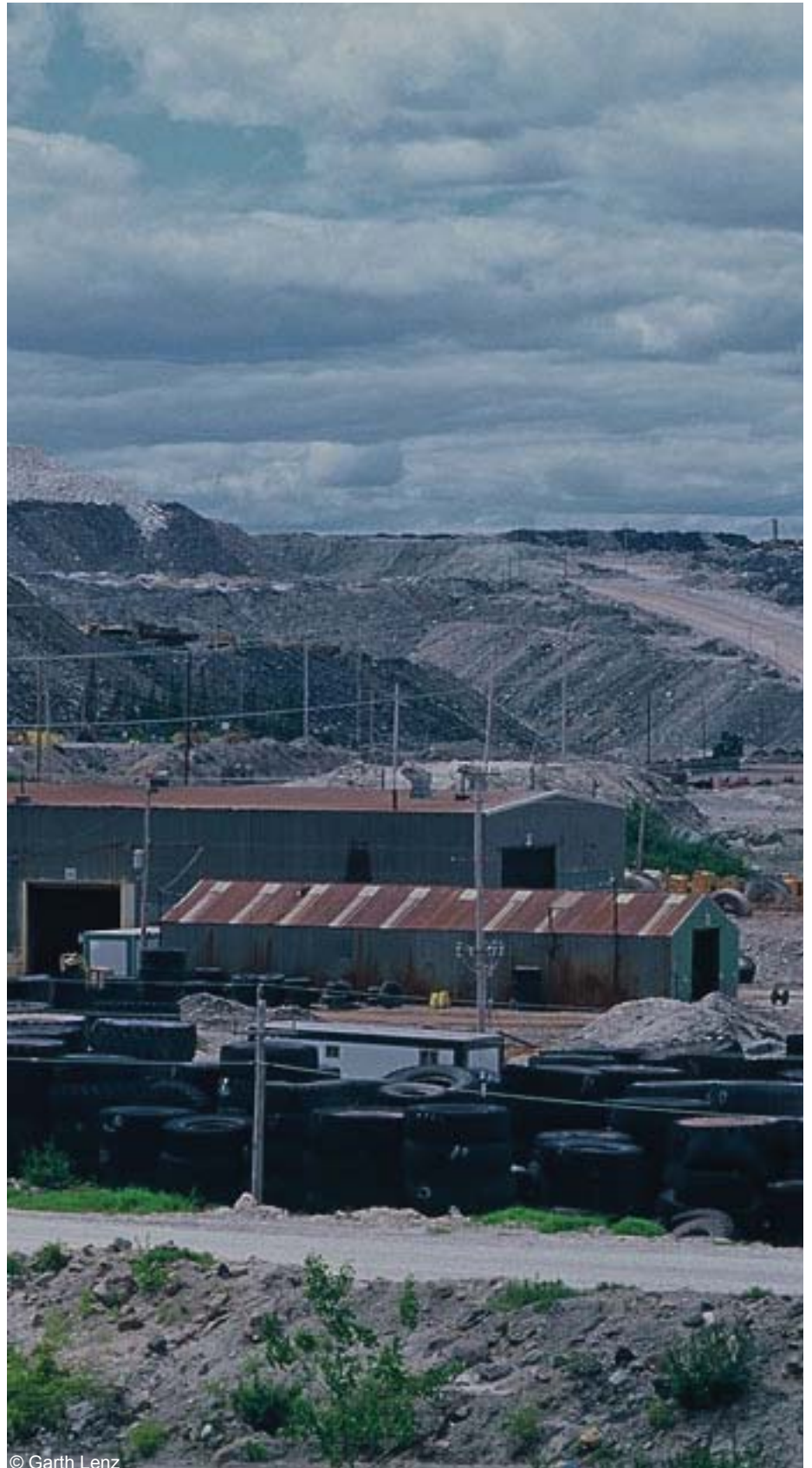
trenches.⁵¹⁷

In its first four years the Abandoned Mines Rehabilitation Fund and the program it supports completed more than 55 rehabilitation projects, including the rehabilitation of abandoned mine sites that had been posing either a public health and safety risk, or an environmental concern.⁵¹⁸ Extended funding allowed remediation at an additional 20 abandoned mine sites. In total, approximately 4,000 of Ontario's abandoned mine sites have been assessed under the abandoned mines program since in the first six years.⁵¹⁹

In late 2006 the Ministry of Northern Development and Mines announced that it was setting aside \$60 million over six years for its Abandoned Mines Rehabilitation Program.⁵²⁰ The province has promised to spend \$10 million annually for work such as capping, monitoring, filling in or fencing off surface hazards to ensure public safety.⁵²¹

While the abandoned mines program is a very positive development, its overall benefit has been offset by changes to mining legislation over the last decade which have weakened requirements around mine closure. In particular, changes have been instituted to replace the requirement for real financial assurances to cover closure and post-closure costs with financial means tests for some companies. There is no public or independent review of the amount of money that is to be set aside in closure bonds, companies are not required to disclose the amount of funds they have set aside for mine close-out, and the information is not available through the access to information law. Ministry staff no longer review and approve closure plans; they "accept" plans that have been prepared and approved by the

companies but companies can now request an "exit ticket" which allows them to hand mined-out properties back to the crown, after having met their closure plan requirements.



6.4 Manitoba

Mining's History

Over a century ago, when the workers building the transcontinental railway arrived in Winnipeg, they found a town with stone quarries and salt works already operating, and new discoveries of gypsum and coal ready to be exploited.⁵²²

Manitoba's first documented gold discovery occurred in 1911 at Rice Lake in southeastern Manitoba. In the early 1900's, mineral exploration moved north, with the construction of the railway up to The Pas and further.⁵²³

In 1914, a local Aboriginal man, David Collins, led Thomas Creighton to a copper-zinc outcrop at what is now Flin Flon. The Flin Flon mine was staked in 1915. In 1922, a copper-zinc deposit was discovered north of Flin Flon at Cold Lake that later became the Sherridon Mine. The railway was punched through and in 1930 the first copper and zinc were produced from the open pit. A large capital investment by HBM&S in the late 1920s for rail, mine, smelter, and refinery, as well as a hydro-electric plant on the Churchill River, laid the groundwork for opening up the prolific Flin Flon/Snow Lake Belt and later the Lynn Lake belt to the north.⁵²⁴ The Nor-Acme gold deposit was discovered in 1925 on the northeast shore of Snow Lake and produced gold and silver from 1949 to 1958.⁵²⁵

In 1946, Inco Ltd. began a 10 year exploration program in the Thompson area of Manitoba using newly developed geophysical and geological techniques. This culminated in the discovery in 1956 of the Thompson nickel-copper deposit along with at least 6 other smaller deposits. The mine began full production in 1961.

Over the last hundred years, Manitoba's mining industry has spawned over 70 mines.⁵²⁶ As the "Mining in Manitoba" website proudly claims "over the last century, our mining industry past and present has come a long way, leading railways, roads and airports into the great northern reaches of Manitoba and giving birth to the towns of Flin Flon, Snow Lake, Thompson, Leaf Rapids and Lynn Lake."⁵²⁷

Mining Today

Metal mining pumps about \$1 billion into the Manitoba economy each year, representing 3.5% of the provincial Gross Domestic Product and 12.5% of the province's total exports.⁵²⁸ Manitoba's mining industry employs approximately 3,500 people directly and another 14,000 in indirect spin-off businesses.⁵²⁹ Manitoba currently has 9 producing mines, 2 operating smelters and 2 refineries. The main metals produced are copper, nickel, zinc, gold and tantalum.⁵³⁰

The province's mining activity is primarily clustered around the copper-nickel-zinc mining camps in the Flin Flon/Snow Lake and Thompson regions. There is also significant gold mining activity at Snow Lake and tantalum-lithium-cesium at Bernic Lake.⁵³¹

The mining industry is subject to a variety of both profit and non-profit based taxes. Payments to municipal governments average approximately \$15 million per year in Manitoba, based on a variety of municipal assessment formulae, including a portion that is grant-in-lieu of tax. In addition, up to 3% of the provincial mining tax revenue is transferred each year to the Mining Community Reserve Fund. This fund was established in the early 1970s to provide assistance to communities impacted by mine

closure.⁵³² Concerns have been expressed that this fund has been used in the past for purposes outside its mandate, such as for general revenue expenses or for exploration subsidies. As of 2001 the fund was at \$20 million.⁵³³

Non-profit taxes, such as sales tax, corporate capital tax and payroll tax paid by the industry to the Provincial Government, average approximately \$20 million annually. Provincial mining taxes, which are profit-based and vary with commodity prices and operating costs, have averaged approximately \$19 million per year over the last decade.⁵³⁴

The basic provincial mining tax rate of 18% has been offset by a variety of tax credits and allowances that provide on average an effective mining tax rate in Manitoba of 9%. In addition, new mines are eligible for a tax holiday and the provincial corporate income tax rate was recently reduced from 17% to 15%.⁵³⁵

In May 25, 1999, a new regulation under the Mines and Minerals Act entitled the Mine Closure Regulation came into effect. The regulation requires that mining companies be held liable for the full cost of all rehabilitation measures at mine sites, and that they provide sufficient financial surety up front to pay for the cost of rehabilitation.⁵³⁶ Since 1999, new mining operations are required to file a closure plan prior to acquiring an operating permit. Mines that had been in operation prior to 1999 must also meet the regulation.⁵³⁷

Staking and Exploration

Mineral rights can be obtained by staking a mining claim, or applying for a large area disposition called a mineral exploration licence. In the surveyed area to the south, claims can be map-staked, while

in northern Manitoba claims must be ground-staked. Whether map-staked or ground-staked, claims are of a minimum size of 16 hectares and a maximum size of 256 hectares. A claim is good for two years after it has been recorded. After two years, the claim holder must perform and report exploration work of a minimum value of \$12.50 per hectare for each year from year 2 to year 10 and a minimum value of \$25 per hectare for year 11 and beyond.⁵³⁸

Individual prospectors must pay \$13 to obtain a Prospecting Licence which is good for life. For \$257 a company can obtain a Company Prospecting Licence. The Company Prospecting License is then valid for as long as the company is in existence. In order to produce minerals from a claim, the claim must be converted to a mineral lease. A claim can be converted to a mineral lease if, over the life of the claim, required work in the amount of \$625 per hectare has been reported. The term of a mineral lease is 21 years with an annual rental of \$10.50 per hectare.⁵³⁹

Like a map-staked claim, only larger, a Mineral Exploration Licence does not require boundaries to be marked on the ground. The province is divided into two zones, with different expenditure requirements, size restrictions and licence terms for each zone, and mineral exploration licences are not available in the main mining areas. In Zone A, the minimum size is 5,000 hectares and the maximum 50,000 hectares, and licenses are for a three-year term, renewable for an additional three years. Expenditure requirements range from \$1.25/ha in the first year to \$15.00/ha in the sixth year. In Zone B, the minimum size is also 5,000 hectares, but the maximum size is 100,000 hectares, with licenses for a five-year renewable term. Expenditure

requirements range from \$0.50/ha in the first year to \$6.00/ha in the tenth year. There is an application fee of \$359.00 and a cash security deposit of \$0.50 per hectare.⁵⁴⁰

Since 1995, over \$31.5 million has been offered through the Mineral Exploration Assistance Program (MEAP) and the Manitoba Prospectors Assistance Program (MPAP) in direct financial assistance for mineral exploration in the province.⁵⁴¹ In addition, recent legislative amendments provide new investment opportunities for advanced exploration and development projects through Manitoba's labour sponsored funds.⁵⁴²

Mineral exploration has boomed over the past few years in response to high metal prices and increased demand. Company spending intentions for 2006 were estimated at \$52.0 million, comparable to the \$52.9 million spent in 2005.⁵⁴³

The total area of mining claims and mineral exploration licences as of December 31, 2006 was 4,576,778 hectares while the total area of mineral dispositions and leases in good standing was 4,726,543 hectares.⁵⁴⁴

Manitoba's Mineral Resources' Division 2006 exploration activity map identifies 57 major exploration projects, including 16 gold projects, 16 nickel-copper projects, 12 copper-zinc projects, 4 diamond projects and 2 uranium projects.

Historic highs in nickel prices have generated new exploration activity and spurred new development, including expansions at Vale-Inco's operations at Thomson. Most likely to move to production are Crowflight's Bucko Project and Nuinsco Resources Limited's Minago nickel deposit located 225 km south of Thompson.⁵⁴⁵

The search for diamonds in Manitoba continues in the Hudson Bay Lowland and Seal River areas west of Churchill. De Beers Canada Inc. completed a high-resolution airborne magnetic survey on a 20,000-km land package at Seal River and reduced their exploration licenses to cover the anomalous areas. Land acquisition by a number of competitors has followed the De Beers activity.⁵⁴⁶

Production

Current mining operations in Manitoba include Cabot Corporation's Bernic Lake and Tantalum Mining Operations in Lac Du Bonnet, Vale-Inco's Birchtree and Thompson copper-nickel mines, San Gold Corporation's Rice Lake Mine and San Gold # 1 Mine both near Bissett, and Hudson Bay Minerals' 777 Mine, the adjacent Callinan Mine, and their Trout Lake Mine, all in Flin Flon, and Chisel North Mine in Snow Lake.

Mining in Manitoba is dominated by its two largest players: Hudson's Bay Minerals Inc and Vale-Inco. Both operate several mines and a smelter complex, and both have undergone major expansions in recent years. Most significantly, perhaps, both lead the pack of Canada's polluters.

Both companies have been the subject of historic corporate mergers. On December 21, 2004, Winnipeg-based HudBay Minerals Inc. acquired Hudson Bay Mining and Smelting Co., Limited (HBMS) by a take-over of Ontzinc, a junior that had picked up the company from Anglo-American at a cost of \$316 million when that South African company was looking to unload it. Anglo-American had assessed the company's holdings as uneconomic: the copper smelter was facing stiffer pollution regulations, and the rich ore bodies were

almost depleted. The acquisition terminated HBMS's dominance of the copper-zinc mining scene in Manitoba and Saskatchewan over the past 75 years.⁵⁴⁷

On October 24, 2006 Companhia Vale do Rio Doce (CVRD) of Brazil (now Vale-Inco) took control of Inco by acquiring a 76% interest.⁵⁴⁸

Smelters in Manitoba

The two Manitoba smelters (Inco-Thompson and HudBay) currently contribute about 50% of all the SO₂ emissions from smelters in Canada. Despite decades of operation, these facilities are the only two smelters operating in Canada without sulphur fixation or a similar method of avoiding such emissions. Nor have these companies expressed willingness to invest in such technology or alternative approaches to significantly reduce these emissions.

"Canada is alone among developed countries in permitting the operation of a smelter without sulphur fixation."⁵⁴⁹

The smelting and refining operations of these two accounted for 46% of the Canadian mining industry's releases of sulphur dioxide,⁵⁵⁰ and 95% of Manitoba's releases, according to Manitoba's 1997 "State of the Environment" Report. Recent numbers – almost a decade after that sobering Report – show little to no improvement. Vale-Inco's operations emitted 180,736 tonnes of sulphur dioxide in 2005, and preliminary numbers for 2006 report in at 190,898 tonnes. Hudson Bay Minerals' Flin Flon operations emitted 203,145 tonnes in 2005 and preliminary reports for 2006 come in at 195,381 tonnes.⁵⁵¹

Over 595 tonnes of heavy metals are released annually into the air at Flin

Flon, including zinc, lead, copper, cadmium arsenic and mercury. Approximately 83 tonnes of heavy metals were released to the air from Thompson operations.⁵⁵² Acid deposition due to the Manitoba smelters is a factor in the acidification of lakes in regions of Northwestern Ontario, Northern Saskatchewan and elsewhere.

Since 1994, the province of Manitoba has prescribed annual limits on emissions of SO₂ emissions of 220,000 tonnes for each smelter.⁵⁵³ These limits were set at levels that exceeded actual company emissions, and they have not changed since that time. Manitoba's 24-hour air quality guideline for SO₂ is weaker, by a factor of about three, than the guideline established by the World Health Organization (WHO).⁵⁵⁴

Operations in Flin Flon and Thompson hold the unenviable positions of being the top ranking and third-ranking air polluters in the country. Hudson's Bay released 203,247,210 kilograms of CEPA toxins to the air, while Vale-Inco in Thompson released 182,577,851 kilograms. The companies are required to report their release of these air pollutants because they are regulated as toxic substances under the Canadian Environmental Protection Act.⁵⁵⁵

These releases have both chronic and immediate effects on the health of both humans and the environment. There have been numerous studies over many years chronicling the impact of the releases.

The one hour air quality objective for sulphur dioxide is 0.34 ppm, the 24 hour objective is 0.11 ppm and the 1-year objective is 0.02 ppm.⁵⁵⁶ There are no legal limits. At Flin Flon, there is a lag time of approximately 14 hours with converters

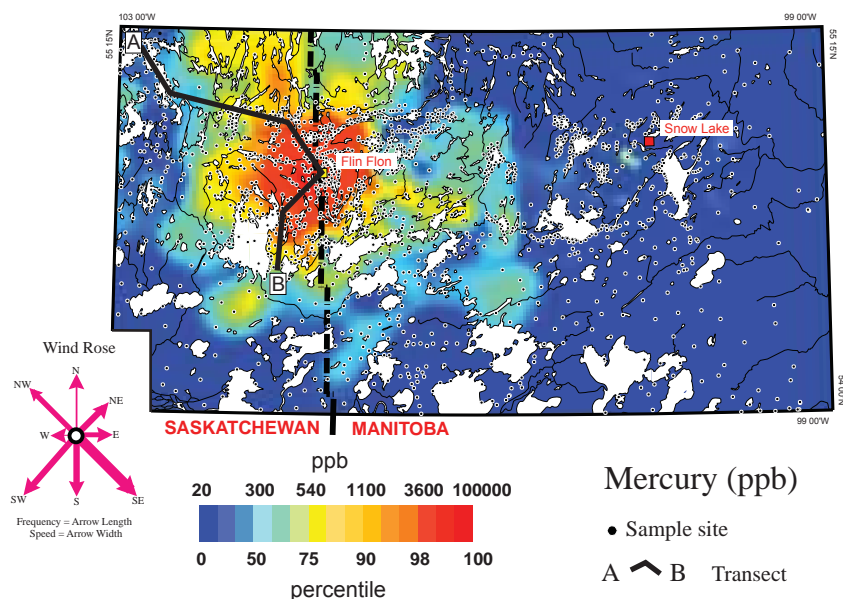
in the plant which means emissions cannot be immediately shut off. In contrast, Inco Ltd. operations in Thompson can cut back its air emissions if sulphur dioxide levels exceed 0.1 ppm in the city of Thompson.⁵⁵⁷

In Flin Flon, persistently high releases of SO₂ and other toxins to the air are exacerbated by the location of the smelter operations immediately next to the downtown. Prevailing winds carry emissions over the town, including the downtown, schools and residential areas. A public warning system is in place, and warnings are issued when average sulphur dioxide concentrations exceed 0.34 ppm. Suggestions for how the public should respond to the warnings include advice to stay inside with the windows closed.⁵⁵⁸

Health studies done in the early 1990's showed that hospitalization for respiratory diseases was 30% higher in Flin Flon than in other areas of the province.⁵⁵⁹ The difference was most remarkable for young people aged 5-29 years, and indicated a disproportionate amount of respiratory illness among this age group in Flin Flon.⁵⁶⁰

A government study quietly posted on Manitoba Conservation's web site in July 2007 reported that the level of toxic metals found in some of Flin Flon's soil exceeds guidelines and could pose a risk to human health. One hundred and eight sites were tested for soil contamination in August 2006 in Flin Flon and nearby Creighton, Saskatchewan, along with comparison areas in Cranberry Portage Bakers Narrows Provincial Park in Saskatchewan.

The study found that the levels of arsenic, cadmium, copper, lead and mercury exceeded the soil guidelines for human health in most of Flin Flon and parts of Creighton. Of the 93 Flin Flon sites that were tested for arsenic, 58 soil samples exceeded levels that were deemed safe for public health, including samples from 16 playgrounds and one schoolyard. Topsoil from selected boulevards, vacant lots, schoolyards, playgrounds and golf courses was tested for metal content, but the study did not include residential yards. Sixty-six per cent of test sites in Flin Flon and Creighton had high levels of arsenic, 41 per cent recorded high levels of lead, and half exceeded the normal levels of mercury.



Mercury contamination in Humus in the vicinity of the Flin Flon Smelter
From: <http://gsc.nrcan.gc.ca/geochem/envir/pdf/index3.pdf>

Airborne pollutants in the form of sulphur dioxide and heavy metals have been dispersed over the boreal forest in the Thompson area of northern Manitoba since 1961. Metal deposition in soils and plant material has been found to a distance of 35 km from the Inco nickel smelter, being very highly elevated around the smelter.⁵⁶¹ A significant inverse correlation was determined between seedling growth and copper/nickel concentrations in surface organic soils.⁵⁶² Forest decline surrounding the Thompson smelter has also been documented.

Areas in northern and eastern Manitoba that are downwind of the Flin Flon and Thompson smelters are particularly at risk from acid rain damage.⁵⁶³ Long-term monitoring has shown that precipitation at some stations has become slightly more acidic. Soil in the area east of Lake Winnipeg and in the northwest corner of the province (which represents approximately 30% of Manitoba) has been identified as being sensitive to acidic inputs. Lakes in the northwest corner of the province are highly sensitive, while lakes to the east of Lake Winnipeg are moderately sensitive.⁵⁶⁴

Sulphur dioxide can cause serious health problems including: premature death, worsening of respiratory conditions, impaired lung function, shortness of breath, eye irritation, and unnecessary hospitalizations. Multi-nation studies of SO₂ in Europe have demonstrated significant increases in hospital admissions and premature deaths at mean concentrations much lower than 0.25 ppm.⁵⁶⁵ The Manitoba government states that for longer exposures, sulphur dioxide levels above 0.15 ppm have been linked with increased hospital admissions for cardiac and respiratory illnesses.⁵⁶⁶ Sulphur dioxide may enhance the effects of respiratory problems caused by other air pollutants. Long term exposures to as little as 0.027 to 0.031 ppm with high levels of particulate matter in the air have been associated with an increase in respiratory illnesses in children.⁵⁶⁷

Lynn Lake, Manitoba

The town of Lynn Lake, Manitoba is still suffering the effects of mine shutdown. Both long-time operators such as Sherritt-Gordon Mines Ltd. and short-term miners like Blackhawk Mining Inc. have closed operations in the area, leaving behind a legacy of contaminated sites and environmental degradation including 11 contaminated sites and 25 million tonnes of acid-generating tailings.

Acid mine drainage is occurring throughout the 1200 ha of inactive mining properties adjacent to the town. Surrounding water bodies are contaminated, including the aquifer that supplies the town with water, and there are local concerns that contamination of waters downstream may have a negative effect on both tourism and commercial fishing and processing. Residents of Lynn Lake have reported elevated cancers and early deaths, which led to the Lynn Lake Adjustment Committee requesting an environmental health risk assessment for the region.⁵⁶⁸

Between 2001 to 2006 a number of studies and investigations were undertaken for use in developing a rehabilitation plan for the East Tailings Management Area (ETMA) under a 50/50 partnership between the Province and Viridian Mining Inc. A diversion has been constructed to divert clean rain and melt water around the ETMA, and a trial permeable reactive barrier has been installed to treat contaminated groundwater. Revegetation trials, a review of options for covering the tailings, and installation of an engineered wetland to remove contaminants from the ETMA runoff, have also been undertaken, as has relocation of the solid waste facility and implementation of the ETMA rehabilitation plan.

On other portions of the mine site, plans include demolition of the headframe and rail loadout, clean up of mill area contamination and relocation of the solid waste facility from the tailings area. Investigations of the mill site and rail loadout area have been completed and a rehabilitation plan has been developed. Rehabilitation work for 2007-2008 is to include demolition of the headframe and other buildings within the mine complex, ground cover trials and dyke stabilization.⁵⁶⁹

Arsenic, lead and mercury are all known carcinogens, and can cause numerous other health problems, including health problems and developmental delays in children. The report recommends that residents wear gloves when working outside and that children not put their hands in their mouth. The report also instructs local residents to wash all locally-grown produce to reduce their exposure to soil contaminants.⁵⁷⁰

While the study's findings are sobering, they should not be surprising, given the already known effects of the Flin Flon smelter on the surrounding environment from studies dating back several years. Emissions of heavy metals from the smelter are seen in increased soil concentrations above background levels to a distance of 70 – 104 km from the smelter.⁵⁷¹ Metals include zinc, lead, copper, cadmium, arsenic and mercury. A 1983 study found that lead levels in blueberries within 5 km of the Flin Flon smelter were 20 to 30 times higher than the average value for Canada. Lead is a metal that bio-accumulates and potentially biomagnifies in the food chain.⁵⁷² A 1981 study of fruiting shrubs downwind of the Flin Flon smelter concluded that it was difficult to determine the toxicological implications for wild herbivores consuming metal contaminated forage were difficult to determine because of the known nutritional interactions that the range of heavy metal contaminants have with each other.⁵⁷³ Acidity in soils also increases the bioavailability of many metals.

Hudbay Minerals announced in November 2007 that it will be closing the smelter in Flin Flon some time between 2008 and 2015 rather than meet federal regulations that may come into force some time after 2015.⁵⁷⁴

Mining's Legacy

In announcements in 2001 and 2002, the Province committed \$2 million in funding to begin the process of rehabilitating abandoned mine sites in Northern Manitoba. Five specific sites were identified for assessment over the first four years: the Lynn Lake Sherritt Gordon Mine, Sherridon Mine, Baker Paton Mine, Gods Lake Gold Mine and the Snow Lake Arsenopyrite Stockpile. The program included \$1 million to be spent by the Department of Industry, Trade and Mines over four years to cap and close off open mine shafts, and \$1 million from Manitoba Conservation's Environmental Health Risk Assessment Program to research and assess the environmental impact of abandoned mines. In addition, an Orphan Mine Site Advisory Committee, involving representatives from First Nations communities, industry, the mining sector, local communities, environmental groups and the public was to be established to provide on-going advice and direction for policy development related to the rehabilitation of abandoned mine sites.⁵⁷⁵

Between 2000 and 2006, more than \$1.5 million was spent to cap shafts and install fences to address safety concerns and old mine structures were demolished and cleaned up.

In March 2006, Manitoba established a \$70-million environmental liability account earmarked for the rehabilitation of orphaned and abandoned mine sites.⁵⁷⁶ This includes a new agreement between the province and Viridian Inc. to share the rehabilitation cost of the East Tailings Management Area near the town of Lynn Lake. The agreement required the parties to complete a plan for rehabilitation of the area by May 2007.

To date, the province has spent

approximately \$6 million on orphaned and abandoned mine site rehabilitation. This includes the \$1 million announced in each of 2001 and 2002, and an additional \$4 million spent in 2006 on projects at Lynn Lake, Ruttan, Sherridon and Snow Lake for environmental monitoring, dike repair, demolition and cleanup, site revegetation and preparation of long-term rehabilitation plans.

Under the program, 149 former mine sites have been identified as orphaned or abandoned, including the five which were identified as high priority in 2000 (Lynn Lake, Sherridon, Gods Lake, Snow Lake and Baker Patton). All 149 sites have now been inspected for safety and environmental hazards and scheduled for rehabilitation. Meetings have been held in communities affected by orphaned or abandoned mine sites to present rehabilitation plans, and work has been undertaken or is ongoing at the five high-priority sites. Long-term rehabilitation plans are being developed for all 149 sites.⁵⁷⁷

In August 2007, the Province announced that it was allocating \$6.8 million, including funding for rehabilitation projects at three of the high-priority sites identified in 2000 (Sherridon, Lynn Lake, and Gods Lake) and nine smaller sites in the Whiteshell and Bissett areas.⁵⁷⁸

6.5 Saskatchewan

Mining's History

The first gold discovery in Saskatchewan was in the North Saskatchewan River, near Prince Albert, in 1859. Gold was produced in small quantities in the early 1900s by panning and dredging operations, but it was not until after the transfer of lands from the federal crown to the province of Saskatchewan in 1930 that the first metal mine went into production.

By the late 1930s and in the early 1950s, gold was being produced in significant amounts in the vicinities of La Ronge, Flin Flon (on the Saskatchewan-Manitoba border), the Crackingstone Peninsula, and Prince Albert.

Uranium also came into production in the 1950's, with 16 ore bodies and 3 separate milling facilities developed in the Uranium City area, where production continued until 1982. In southern Saskatchewan, both coal and potash are mined extensively, producing one third of the world supply of potash and constituting approximately 14% of Canadian coal production.

Mining Today

In Saskatchewan's boreal region, there are currently 3 operating uranium mines, producing almost one third of the world's uranium supply.

Principal operators are Areva Resources (formerly Cogema) and Cameco Corporation with some joint ventures between Areva and Cameco. The uranium deposits in Saskatchewan are extensive, and of highest grade in world, some 5 to 20% ore grade, and in a few places even higher. They are also found relatively close to surface. This combination means the operations are both lucrative to operate and

dangerous to mine.

The Seabea Mine near La Ronge continues to be the sole operating gold mine, despite a rush of activity in the late '90's that saw the opening and then closing of gold operations in La Ronge Provincial Park, including the Cameco Corporation's joint venture Contact Lake Mine. Until its closure in 2005, the Konuto Lake Mine, near Denare Beach, fed copper-zinc to Hudson Bay Mining and Smelting operations in Flin Flon, Manitoba.

Saskatchewan ranks fourth in Canada (after Ontario, British Columbia and Québec) in terms of the total value of mineral production, accounting for 11.4% of the total value of Canadian mineral production in 2006.⁵⁷⁹

The total value of mineral sales in 2007 was \$4.6 billion, up nearly 45 percent from \$3.2 billion in 2006.⁵⁸⁰ Potash accounts for about three quarters of this total, and uranium a little under one fifth.⁵⁸¹ Potash and coal are both mined in Saskatchewan, but the mines are not located in the Boreal region, and are not discussed in this report.

The province was a "global leader" in the production of uranium, providing about 30% of the world's supply. In 2006 uranium production totalled 9,876 tonnes of uranium metal, valued at \$615 million, or \$745 million dollars when it is converted to yellowcake. In 2007, Saskatchewan produced 100% of Canada's uranium from three operating mines.⁵⁸²

Staking and Exploration

Exploration spending in Saskatchewan has increased almost seven-fold in a half decade, rising from a low of \$30.5 million in 2001 to over \$280 million in 2007.

Exploration activities were largely in the Athabasca basin - in vicinity of which most of the operating uranium mines are located - and the areas just to the north and south of it. Approximately 30 major uranium deposits have been identified, are under development or are the subject of feasibility studies.⁵⁸³

Diamond exploration has grown exponentially in the last fifteen years, with more than 6 million hectares of land under disposition for diamond exploration. While interest in diamond exploration has been concentrated in the area north of Prince Albert, particularly in the Fort à la Corne kimberlite province, the Saskatchewan government considers the entire province to be prospective ground for diamond exploration, and provides ongoing technical assistance to the exploration industry.⁵⁸⁴

Spending estimates for exploration activity for uranium, diamonds, base and precious metals, and industrial minerals in 2006 were \$208 million, an all-time record in terms of current year dollars.⁵⁸⁵ Almost half of the exploration spending - \$100.2 million - was spent on uranium exploration in the Athabaska region.

Record-setting exploration expenditures of near \$280 million are forecast for 2007, a tenfold increase over 2002. Uranium exploration leads the way at \$130 million, buoyed by a uranium spot price of \$US 120/lb for U₃₀₈ in the first half of 2007.⁵⁸⁶

As of December 31, 2006, there were 6,245 active mineral dispositions totaling just over 11 million hectares, or an increase of almost 4 million hectares during the 2006 calendar year. This rose to 18.3 million hectares by the end of 2007.

The major exploration programs

are being undertaken by three companies - producers Cameco Corporation, AREVA Resources Canada Inc. and junior UEX Corporation. But close to 100 other companies or individuals held over 2000 mineral dispositions covering 7.6 million hectares of the Athabasca Basin area at the end of December 2006.

In the surveyed Southern Mining District, 3,261 mineral dispositions were active covering 2.7 million hectares. The majority of these are related to diamond exploration in areas peripheral to the Fort à la Corne diamond region to the east of Prince Albert, and also in a second cluster to the northwest of Prince Albert, between Green Lake and Big River. Fort à la Corne is reputed to have the largest kimberlite deposit in the world. Expenditures for diamond exploration in 2006 were about \$85 million.

Two diamond exploration projects are in the advanced stage, both in the Fort à la Corne forest. Shore Gold Inc's (Shore) Star Kimberlite Project is undergoing a \$60 million pre-feasibility study, and Fort à la Corne Joint Venture exploration program is budgeted at \$43.2 million.

In 2006, gold exploration expenditures were estimated to rise slightly to \$16.2 million with most of the activity in the La Ronge and Glennie domains.

Mineral tenure in Saskatchewan
Saskatchewan's mineral tenure system is more protective of surface holders (both private land-holders and First Nations) than other jurisdictions. It allows surface and subsurface rights to be severed and reserved to the transferor on sale or disposition. Saskatchewan also separates prospecting permits from permits granting mineral rights.

Mineral Prospecting Permits, in both the Northern and Southern Mining District, are obtained by map staking rather than ground staking. Mineral disposition, or the granting of mineral rights, gives the holder the exclusive right to explore for minerals on the allocated lands. However, it does not give them right to enter upon or use the surface of those same lands to which they have been granted the mineral rights. A separate surface permit is also required for mineral exploration programs conducted on Crown mineral lands.

Saskatchewan Energy and Resources has an internet-based, online method of acquiring and maintaining mineral dispositions for all regions of the province. Mineral rights are acquired in Saskatchewan through a system that is a combination of ground staking and map staking methods.

Ground staking is used in the unsurveyed Precambrian Shield region in Saskatchewan (Northern Mining District) while map staking is the method used in the surveyed part of the province (Southern Mining District). Between 1997 and 2005, approximately 30.5% of the claims issued, covering 61% of the mineral lands applied for, were acquired by ground staking. During the same period, 70% of the claims issued, covering 39% of the mineral lands applied for were acquired by map staking.

Production

As with mineral exploration, mineral production in Saskatchewan's boreal forest region is dominated by uranium mining. Uranium is currently mined at Cameco's Eagle Point and McArthur River Mines, and at Areva's McLean Lake and Rabbit Lake. The Cigar Lake mine is now out of commission due to flooding and is not projected to be

operational until 2009.

Claude Resources' Seabee Mine is currently the only producing gold mine in Saskatchewan. The mine is located 120 km northeast of La Ronge. Seabee Mine produced 44,600 ounces of gold in 2005 and production for 2006 was expected to exceed 48,000 ounces.⁵⁸⁷

Major impacts of mine development in northern Saskatchewan come from the roads and power corridors needed to service mines. The three major highways into Saskatchewan's boreal forest north of the Churchill River have all been built to serve the mining industry, with public and community access only incidental. These highways – to Cluff Lake, Key Lake and Wollaston Lake – involve an estimated 1,000 kilometres of road.⁵⁸⁸

Uranium Mining

Mining uranium creates special hazards, due to the radioactive nature of the ore. Uranium is a radioactive element, which means that it is unstable. As it breaks down or decays, uranium gives off energy in the form of radiation. Each of the new elements or "progeny" radium, thorium, radon, bismuth, lead and polonium have specific characteristics that pose distinct problems in terms of health and environmental impacts due to their radioactive half-life (the time it takes for a radioactive substance to lose half of its radioactivity). Cancer, leukemia, birth defects, genetic damage and weakened immune systems are all associated with exposure to radiation.

Uranium ore is rock containing uranium mineralization in concentrations that can be mined economically, typically one to four pounds of U_3O_8 per tonne or 0.05% to 0.2% U_3O_8 . The uranium being mined in Saskatchewan is extremely high

grade, ranging from 4 to 9% pure uranium, or 90 times more radioactive than the uranium that was formerly mined at Elliot Lake in Ontario. The McArthur River and Cigar Lake deposits have an average grade of 20% uranium.

The Key Lake Mill is the largest uranium mill in the world, with a production capacity of 18 million pounds of milled uranium annually. The mill operates 24 hours a day, 365 days a year, with employees working on a seven-day-in/seven-day-out schedule. In 2006, production at McArthur River/Key Lake was 18.7 million pounds of milled uranium, also known as "yellowcake." Its chemical signature is U_3O_8 . As this is the licensed capacity of the Key Lake Mill, Cameco has applied for an increase in annual licensed capacity at Key Lake to 22 million pounds. McArthur River is the largest high-grade uranium deposit in the world. Grades within the ore-body reach 70% U_3O_8 and composite grades of 30% U_3O_8 over several metres are common.

The Eagle Point Mine completed its fourth full year of production in 2006, following a re-opening midway through 2002. Production in 2006 was 5.1 million pounds of U_3O_8 , down from 6.0 million pounds in 2005.

The Rabbit Lake Facility is now the longest running uranium mining-milling operation in Saskatchewan.

Areva's McLean Lake properties include the Sue A ore body,⁵⁸⁹ the Caribou and Sue B, D and E open pit operations, the McLean underground operations and the JEB mill, plus already depleted ore bodies.⁵⁹⁰

Cameco also operates Canada's only uranium refinery, located in Blind River, Ontario, and only uranium conversion facility, located in

Uranium Reserves (as of December 31, 2006)			
DEPOSIT	MINING METHOD	MILLIONS OF POUNDS U ₃ O ₈	AVERAGE GRADE (% U ₃ O ₈)
McArthur River	underground	367.0	20.6
Cigar Lake	underground	226.3	20.7
Rabbit Lake	underground	19.1	1.2
McCleam Lake - Sue A	stockpile	0.2	0.4
- Sue B, D, E	open pit	13.1	0.9
- Sue C	stockpile	0.6	0.4
- Sue E	stockpile	0.8	0.3
- McClean	underground	10.7	2.5
- Caribou	open pit	2.8	2.5
- JEB	depleted		
Midwest	open pit	33.0	4.8
Cluff Lake	decommissioned	nil	
TOTAL URANIUM RESERVES		673.6	

Numbers may not reflect total due to rounding

Source: Uranium in Saskatchewan" Fact Sheet, Areva, Cameco and Saskatchewan Mining Association

Port Hope, Ontario. The refinery at Blind River takes uranium oxide concentrate (U₃O₈) from mines in Canada and abroad and refines it to uranium tri-oxide (UO₃), an intermediate product. The UO₃ is trucked to Port Hope, which has about one quarter of the Western world's uranium hexafluoride (UF₆) conversion capacity and provides the only commercial supply of fuel-grade natural (unenriched) uranium dioxide (UO₂).

Mining's Legacy

There are an estimated 500 plus abandoned mines in the entire province of Saskatchewan, with a great number of them being coal mines in the southern part of the province. In 1976-77 an inventory was conducted of Abandoned Mines in the Uranium City Area, and another, in 1988-89, of abandoned coal mines in the south and metal mines in the northern part of the province. Only 37% of the more than 100 metal mines had site-assessments by early 2000. 23% of metal sites (60% with tailings) underwent remedial work.⁵⁹¹

In the 2000-01 fiscal year, the first year of the new Abandoned Mines

Uranium City

Uranium was discovered on the north shore of Lake Athabasca in 1936. Commercial production started in 1953 at the Beaverlodge mine on Beaverlodge Lake. The town of Uranium City was established in 1952 to service that mine and others that followed. By the late 1950s, ten mines were in production; the boom lasted almost three decades, ending in 1982.

Unlike the newer mines, the uranium ore was not of a very high grade. All of the mines in the vicinity fed into three processing facilities, at Beaverlodge, Lorado, and Gunnar. The smallest, Lorado, in operation from 1957 to 1960, left 0.6 million tonnes of tailings covering 14 hectares. Gunnar was in operation from 1955 to 1964, and left 4 million tonnes of tailings over 75 hectares, while the Beaverlodge operation left over 10.1 million tonnes - mostly in form of exposed solid tailings/dust - over 25 hectares in various areas of Beaverlodge.

Thorium, radium, polonium etc. are left behind when the uranium is extracted. The tailings still contain 85% of the radiation of the original ore as well as other metals. In the case of the Lorado and Gunnar sites, the tailings are also acid-generating.

At the Gunnar site, the tailings were simply bulldozed into a small lake, which eventually overflowed into Lake Athabasca. At the Beaverlodge mine, tailings were dumped into Beaverlodge Lake. Cameco Corporation, formed when Eldorado Nuclear was partially privatized, has stabilized the tailings at the Beaverlodge site, but the bulk of the wastes remain in the lake.⁵⁹²

The Saskatchewan and federal governments have been arguing for years about who will pay for the cleanup, with no resolution in sight. The province has estimated that cleaning up the Gunnar and Lorado sites would cost \$25 million.⁵⁹³

Assessment Program, 28 abandoned mines and associated waste disposal sites were inspected, and a draft assessment report was completed.⁵⁹⁴

In 2004, Saskatchewan Environment released the third and final component of its Abandoned Mines Assessment Program Report, examining environmental and public safety at abandoned mines in northern Saskatchewan. Altogether, 75 former mine sites were examined, representing all known abandoned mines in the north. The first report, released in 2001, covered 26 sites; the second, in 2002, examined 21, and the third the remaining 28 sites. The final report also provides a full listing of all the sites reviewed.⁵⁹⁵ Sites earlier identified as requiring clean-up include former uranium mines at Gunnar and Lorado near Uranium City, which have exposed tailings; the Gunnar site also has old mine structures that need to be addressed.⁵⁹⁶

The federal and provincial governments announced in April 2007 that they would be sharing the \$24.6 million cost of cleaning up some 40 mines near Uranium City, abandoned in the 1950s and 1960s. The clean-up program was to begin the summer of 2007. Most of the money is for remediation at the Gunnar Mine, with a smaller amount going to clean up 36 smaller abandoned mines. The old Gunnar mine site includes mine buildings which are in ruin, and four million tonnes of unconfined tailings which are leaking into nearby lakes.^{597/598}

The Eldorado Miners Cohort epidemiological study, done in 1995, considered a cohort of 20,000 workers between 1932 and 1967 from the Beaverlodge operations. In March 2006, epidemiologist Dr. Geoffrey Howe updated and revised that study. He found that among 17,660

early workers, some 5,372 cancer deaths were reported from 1955 to 1999, plus another 2,335 cancer cases. He also found another 618 recent cancer deaths, with three quarters of the miners still living. He found that the rate of lung cancer among the uranium miners was 30% higher than that of the general population.

6.6 Alberta

Introduction

Despite its enormous impacts, oil sands mining is outside the scope of this report.⁵⁹⁹ Since 1964, when Great Canadian Oil Sands (now Suncor) started mining oil sands to produce crude bitumen, and Fort McMurray was a small trading post, oil sands have dominated the Alberta economy.⁶⁰⁰ Syncrude Canada operates the largest mine in the world, and uses some of the largest mining trucks ever built, with capacities of 380 tonnes each. Between them, Syncrude and Suncor moved over 556 million tonnes of bituminous sands in 2000.⁶⁰¹

Within the scope of this report, coal dominates mining in Alberta. From the earliest discoveries of a century ago, through the decades of mining and dozens of ghost towns, mining in Alberta means mining coal. When the gold rush of the 1800's spilled over the B.C. border into Alberta, what they found was coal.⁶⁰²

Over 1800 mines are known to have operated in Alberta, and the majority of them mined coal. Alberta's coal first supplied domestic heating needs, but mining towns soon developed to supply coal to the Canadian Pacific Railway, at the Crowsnest Pass in the south and the Coal Branch in the northwest. South of Hinton, a number of mines and towns developed to supply coal to the Grand Trunk and Canadian National Railways.

Mining Today

There are 11 coal and oil sands mines, with the majority of them in the Boreal region. There is one metal refinery/smelter in Fort Saskatchewan, producing nickel and cobalt.⁶⁰³

Coal and oil sands mining contributes approximately 3.1%, or \$3.3

billion dollars, to the provincial economy

Staking and Exploration

While coal is significant in the past and present, diamond exploration is also important.

By 2001, approximately 45 kimberlites had been found in three separate clusters in northern Alberta, and government sources were estimating the potential there for finding a further 200 or more. More than half the kimberlites contain diamonds, although none of those found to date are of significant economic value. Areas of identified high potential include Buffalo Head Hills, Birch Mountains, Pelican Mountains-Calling Lake, and Cold Lake.⁶⁰⁴ Ashton Mining of Canada, their partners Pure Gold Minerals, and the Alberta Energy Company have an 11-million hectare block under permit in the Buffalo Head Hills, and New Claymore Resources has significant mineral holdings in the area surrounding the Ashton discovery.

In 1997, there were 4,135 permit applications filed with the Department of Energy for an area totalling over 37 million hectares. This brought the total lands under permit or application at that time to over 45 million hectares, or almost 90% of available crown land.⁶⁰⁵ Exploration peaked the following year, with a total investment in 1998 of \$27.5 million. However, it was in rapid freefall for the next three years, dropping by 50% in 1999 and sinking to under \$8 million per year for each of 2000 and 2001.⁶⁰⁶

There has been an upturn in the last few years. As of December 2006 there were 1,275 mineral permits in good standing, encompassing 9.6 million hectares of land. Exploration expenditures totalled \$6.5 million.⁶⁰⁷

During 2005 and 2006 more than 4.5 million hectares were newly staked for diamond exploration.

Several million hectares were staked for uranium, mainly in the northeast and southern parts of the province, making uranium exploration responsible for at least 30% of the mineral permits issued. By the end of 2006, almost the entire Athabasca Basin within Alberta had been staked for uranium, including much of what lies beneath Lake Athabasca itself. Main players included AREVA Resources, CanAlaska Ventures, Triex Mineral Corporation, Red Dragon Resources and Strathmore Minerals.

There was little activity in 2006 for precious metals, but there was a mini-staking rush in northwestern Alberta near Zama Lake for base metals. 10% of the permits issued were for other metals.

Mineral Tenure in Alberta

Alberta is unique in Canada in terms of rules for mineral tenure. The other provinces and territories operate on a free entry system wherein mineral properties are staked on a first-come/first-served basis, establishing tenure without any review of the application to stake by the Crown. In Alberta, the system requires approval from government before any tenure or claim to the property can be established or mineral exploration take place.

There are a number of steps in the Alberta process. First, an exploration license must be obtained in order to apply for or carry out any exploration program. An exploration permit is required in order to use any exploration equipment, such as a drilling rig. The exploration licenses and permits cost \$50 each, and are valid for as long as the company is operating in the province. If an exploration project

The Cheviot Coal Mine

In March 1996, Cardinal River Coals Ltd. (CRC) announced plans to develop a large open-pit mine coal mine in the foothills of the Rocky Mountains, south of Hinton, Alberta. The proposed mine area was located less than 3 kilometres from Jasper National Park, a United Nations World Heritage Site, covering an area 23 kilometres by 3.5 kilometres. The project required approval under both federal and provincial law prior to the construction, operation and decommissioning of the open-pit mine. A Joint Alberta Energy and Utilities Board and Canadian Environmental Assessment Agency Review Panel was established to conduct the review and hearing.

Despite serious shortcomings in the assessment process, the Panel recommended that the project be allowed to proceed. On October 2nd, 1997, the Federal Government approved the Joint Panel's report on the Cheviot Project, despite a number of serious deficiencies. Crucial baseline information had not been provided, and a cumulative effects assessment had not been done. The consideration of alternatives to the open pit mining had been inadequate, and there had been no analysis of the public need for the Cheviot project. The project failed to meet with Fisheries Act and National Parks Act obligations. The participation of the Smallboy Cree's participation in the hearing had been unfairly limited.

The Alberta Wilderness Society and others took government to court over the inadequacy of the Environmental Assessment. The court ordered that the hearing be reconvened to consider cumulative impacts and other information it had previously failed to consider.

Source: Canadian Environmental Network E.A. Case Studies, January 2000

is to involve environmental disturbance – drilling, trenching, bulk sampling or cutting of grids that involves more than limbing trees and removing underbrush – a project approval must be obtained from the Land and Forest Service of Alberta Environment. The licensee does not have to hold mineral rights for an area before an approval is sought or obtained. Approval usually takes about ten working days. Each application has a fee of \$100, and each project must have its own approval. The initial term of the permit is ten years, comprising five assessment periods of two years each.

To maintain the permit, assessment work must be done, at a value of \$5 per hectare for the first two-year period, \$10 per hectare for the second and third, and \$15 per hectare for the fourth and fifth two-year periods. At the end of each of those assessment periods, a report on the assessment work must be completed and filed with the Department. The report is kept confidential for one year, and then placed in an open file.

If a permit holder has met the terms and conditions of the permit (i.e. conducted the necessary assessment work and filed the required work reports), they may apply for a Metallic and Industrial Minerals Lease. For a \$500 initial fee and an annual rental fee of \$3.50 per hectare, the leaseholder is given exclusive right to exploit the minerals within the specified location. Leases are valid for 15 years, and can be renewed if the property is in production or has an approved development plan.⁶⁰⁸

Production

Currently, there are 7 coal mines operating in the boreal forest region of Alberta, using a variety of mining methods, including open

pit, drag line and strip mining. Five are operated by Edmonton-based Luscar Coal Ltd, Canada's largest coal producer. Luscar also owns the Gregg River Mine, now under closure after having produced 31 million tonnes of coal over 17 years. Luscar Ltd. is controlled by the Sherritt Coal Partnership, which is comprised of Sherritt International Corporation and a subsidiary of the Ontario Teacher's Pension Plan Board.⁶⁰⁹ Luscar is partnered with CONSOL Energy Canada Ltd, the Canadian face for Consol Energy Inc of Pittsburgh, in the development of the Cheviot project.⁶¹⁰

The Coal Valley Mine, 100 kilometres south of Edson in the heart of the historic Coal Branch mining district, is typical of the coal mining methods used in Alberta. The mine property includes a series of parallel, northwest trending ridges and narrow valleys. There are three separate and continuous coal seams, varying in thickness from 2 to 10 metres. A dragline is used to remove overburden, and a backhoe digs out and removes the coal, loading it onto a truck, which hauls it to a preparation plant for drying before being shipped out. The mine produces one million tonnes of coal per year. Coal mining has huge environmental impacts, particularly due to the very high level of surface disturbance on site.

Off-site impacts can include contamination of water, as most coal reserves are associated with high degrees of acid generation. Even after being "reclaimed," surface coal mines often create artificial, porous "geological recharge areas" where infiltrating water percolates through the fill and emerges as very acid seeps or springs that flow even during drought when natural waters dry up.⁶¹¹

The open pit mine at Cheviot Creek

began producing late in 2004, shortly after the Grande Cache Coal mines came on-stream (consisting of both an underground and an open pit mine).

In the case of major projects like the Cheviot Creek Coal Mine, all phases of the mine development are expected to have an effect on groundwater flows. Local springs will be lost due to groundwater drawdown, and surface water patterns will be altered.⁶¹² Nutrient loading and associated eutrophication may impact as far as 100 kilometres downstream.⁶¹³ Operating mines in the area north of the Cheviot project have already caused elevated levels of a number of metals, suspended solids, nitrates and sodium in water bodies downstream.⁶¹⁴ For example, elevated levels of selenium are a problem downstream from the Luscar Coal Mine,⁶¹⁵ and the mine exceeds its limits for sediment discharges and for selenium on a frequently basis.⁶¹⁶

Mining's Legacy

There are no definitions related to abandoned mines included in Alberta's mining or environmental legislation, and the term "abandoned mine" has never been formally defined in Alberta, though it has in most jurisdictions. Informally, the term "abandoned mine" is used in the Coal Mine Atlas, and the term "Permitted Mine" is used to refer to any mine site for which a current mine permit exists.⁶¹⁷

In any case, there have been more than 2000 large-scale coal mines in Alberta dating back to 1882. The Alberta Energy and Utilities Board (EUB) maintains a Coal Mine Atlas which provides a listing of all operating and abandoned coal mines in Alberta by operator, location, mine number, type of mine and mining method, with each entry in these listings is linked to the appropriate

PDF map. The maps are continually updated, and microfiches of the mine plans for many of the abandoned mines are available from the Board.⁶¹⁸

Provincially, 2,100 abandoned mines have been identified and are on file with the provincial government. Very few of the mines have been evaluated for physical or chemical stability, and fewer than 1% of all mines have undergone remedial work. Abandoned mines and mine reclamation in Alberta is regulated under the Coal Conservation Act, with some regulatory oversight under environment-related legislation.⁶¹⁹

6.7 British Columbia

Mining's History

British Columbia's mining history dates back to the mid-1800s, with early coal mines on Vancouver Island and placer gold camps of the Cariboo and Cassiar areas. The province encompasses the largest part of the Canadian Cordillera, a mountain belt rich in minerals and coal which has made British Columbia a major producer and exporter of copper, gold, silver, lead, zinc, molybdenum, coal and industrial minerals.⁶²⁰

The Hudson's Bay Company first started producing coal on Vancouver Island in the 1840s, and the discovery of gold along the Fraser River in the 1850s sparked a major gold rush.⁶²¹

In 1858, over 20,000 prospectors – many of them moving on from the California gold rush of 1849 – came into the region via the Hudson's Bay Company stockade of Fort Victoria and then up the Fraser River in search of gold. In response to the frenzied discovery and mining of gold and the instant towns that were springing up, the British Government created the mainland colony of British Columbia in 1858. Gold discoveries continued, with gold found in the Peace River in 1861. The Cariboo Wagon Road was constructed to the boomtown of Barkerville, which at its peak was the largest city west of Chicago and north of San Francisco. Completed in 1865, the Cariboo Wagon Road opened up the British Columbia Interior. Gold was discovered further north, placing Dawson Creek on the brink of the huge Klondike Gold Rush of 1898.⁶²²

A copper discovery on Howe Sound in 1888 took a decade and a half to develop, with the first ore from the Britannia Mine

shipped to the Crofton Smelter on Vancouver Island in 1904. By 1929, the Britannia mines were the largest copper producer in the British Commonwealth.⁶²³

An exceptionally rich lead-zinc orebody was discovered in 1893 in the East Kootenays, British Columbia. The Sullivan Mine was in production until 2001.⁶²⁴

Mining Today

Following a downturn of several years, British Columbia has seen a boom in its mining industry since 2004. The province produces 17% of Canada's minerals and now ranks second after Ontario for both mineral exploration expenditures and mineral production.

Although total shipments of ore in 2006 were down 4% from 2005 to 25 million tons, commodity prices soared, creating higher potential profit margins and a welcoming environment for exploration.

The province's mining industry earned a record-breaking \$8.1 billion in revenue and a net income of \$2.3 billion in 2006.⁶²⁵ Exploration expenditures have increased radically, from \$29 million in 2001 to \$319 million projected for 2007.⁶²⁶ The industry provided 7,345 direct jobs in 2006 with employees earning an average salary and benefits package worth \$99,900.⁶²⁷ There are approximately 28,000 jobs related to the minerals industry in the province. Copper prices rose 83% in 2006 and copper was the largest source of revenue for B.C. at \$2 billion. Coal was the second largest at \$1.98 billion.⁶²⁸ A considerable amount of this activity is in the boreal region of the province.

The provincial and federal governments have worked to make mining in BC an appealing investment, through tax breaks, streamlining

regulations and creating appealing avenues for engaging in the mining industry, as with its Mineral Tenure Online staking system.

Sixty per cent of Canadian exploration companies are based in B.C., raising \$3.2 billion in equity capital.⁶²⁹ Between 2003 and 2006, the government spent over \$75 million on mining exploration-related infrastructure.⁶³⁰ Flow-through shares and tax credits for exploration, which can reduce the cost of a \$1000 investment to \$383,⁶³¹ have been extended, as has the New Mines Allowance in order to encourage new mine development and expansion.

Much of the support for the industry is provided under the province's Mining Plan announced in January 2005, which has four cornerstones:

- Focus on Communities and First Nations,
- Protecting Workers, Protecting the Environment,
- Global Competitiveness, and
- Access to Land.

In the 2004 election year, mining companies donated \$1.3 million to the B.C. Liberals. Most of these donations came in just months before the BC government launched its Mining Plan in 2005.⁶³²

There are 57 actions in the Mining Plan including: investing in unserved areas to secure delivery of energy supply and transportation infrastructure, facilitating affordable industry access to ports and railways, focused marketing and investment programs, industry training programs for First Nations and rural communities, and the promotion of the industry in communities.⁶³³

The Mining Plan includes "protecting the environment" and contains action items including improving

compliance with environmental standards at mines and improving reclamation guidelines. There is no action in the Mining Plan to increase or improve reclamation bonding. There is, however, an intent to reduce bonding and permitting for small volume mechanized placer activities.

Tax returns from the BC mining industry to federal, provincial and local governments in 2006 totalled \$799 million, only about 10% of gross revenue. This total included federal and provincial income taxes (including those of employees), mineral taxes (royalties), provincial sales tax, gasoline and fuel taxes, and property taxes.⁶³⁴

It is impossible to compare the value of taxes paid versus government subsidies provided to mining companies, since the value of natural capital is overlooked. However, a question is being posed by some industry watchers as to whether government subsidies are greater than taxes paid. Along with subsidies such as the use of roads, ports and cheap electricity, mining companies receive a free supply of clean water and other environmental benefits.⁶³⁵ For example, in the case of Northgate Minerals' proposed development of the Kemess North Mine, the benefit to the company of using Duncan (Amazay) Lake for tailings disposal has been estimated at \$295 million.⁶³⁶

Staking and Exploration

More than 600 exploration projects were underway in B.C. in 2006, with 70 of these projects having budgets in excess of \$1 million.

According to the Mining Association of B.C., 25 major mining projects in the province are currently under review, amounting to nearly half of the proposed major mine projects in the environmental assessment

process nationwide.⁶³⁷

This activity has placed enormous pressure on communities and First Nations in BC. As an example in the Northwest mining district alone, 63 advanced exploration projects are underway in 2006.⁶³⁸ A listing of these 63 projects by the First Nations most affected is illustrative:

Taku River Tlingit First Nation
Adanac Molybdenum: Ruby Creek
Tulsequah Chief and Big Bull
Cash/Troymet: Golden Eagle
Property
Prize mining: Yellow Jacket and
LD gold property,
CZM Capital Corp: Tag property
Canarc: New Polaris
Saturn Minerals: Maple Leaf

Kaska Dene:
Western Keltic: Kutcho Creek
Hard Creek Nickel: Turnagain
property
Carmax Exploration: Eaglehead
property
Sutcliffe Resources: Beale Lake
Property
Arcus Development: Williams
Property,
Columbia-Yukon: Storie
Cusac: Taurus, Table Mountain
Fireside Barite quarry

Telegraph Creek Tahltan:
Copper Fox: Schaft Creek
Nova Gold: Galore Creek-
Bountiful and West Fork zones
Nova Gold: Copper Canyon
Nova Gold: More Creek
Pioneer Metals/Nova Gold: Grace
Paget Resources: Mess Creek
property, Schaft Creek North
Firesteel: Copper Creek,
St. Eugene Mining Corporation:
Poker property

Iskut First Nation
Fortune Minerals: Klappan
Imperial Metals: Red Chris
Canadian Gold Hunter : GJ
property

Tulsequah Chief Mine

The Tulsequah Chief mine is located in the Taku River watershed, which is an 18,000 square kilometre unroaded area in northwestern BC and the traditional territory of the Taku River Tlingit First Nation (TRTFN).⁶³⁹

The Mine was originally operated by Cominco Ltd. from 1937 until 1957, when it closed due to low metals prices. It produced gold, silver, copper, lead and zinc. Transportation to and from the mine was via barge down the Tulsequah and Taku Rivers to Juneau, Alaska.

In 1992, Redfern Resources Inc. (now Redcorp Ventures Ltd.) announced its intention to reopen the Tulsequah Chief Mine. Their proposal was extremely controversial for many reasons. The Mine was not remediated when it closed and is a source of AMD/ML. The lower Taku hosts commercial and recreational fisheries worth over \$8 million annually.⁶⁴⁰ Concern was raised about impacts on the Taku watershed, particularly impacts on fisheries. In addition, a part of the proposal included plans to build a 162 km access road to the Mine through the pristine unroaded wilderness of the Taku watershed and TRTFN territory.

Redcorp Ventures Ltd. currently has provincial and federal approval for the mine and for an access road. In January 2007, it announced a major change to its mine plan that would involve a transportation route by river through Alaska instead of by road through BC. The new mine plan proposes a 10 to 12 km haul road along the south side of the Tulsequah River from the minesite to a landing site at the confluence of the Tulsequah and Taku Rivers. Concentrate would then be transferred to a hover barge and transported to Juneau, and from there to a port facility at Skagway for smelting overseas. The company hopes to be in production by December 2008.⁶⁴¹

The new mine plan involves new risks to the environment. Amendments to provincial and federal approval are required, as is approval by the state of Alaska. This presents an opportunity for a bi-national environmental assessment of the project that has been advocated by Rivers without Borders, an alliance of 20 conservation organizations in BC, the Yukon and Alaska.⁶⁴²

Seabridge Gold: Kerr Sulpherets
Silver Standard Resources:
Snowfields
Kenrich Eskay: Corey Property
Paget Resources: Ball Creek
BC Gold and Kaminak: Voigtberg property
Equity Engineering: RDN
Skyline Gold: Bronson Slope
Newcastle Minerals: Snip North
Romios Gold: Newmont Lake and Porc
Spirit Bear Minerals: Iskut River

Iskut First Nation struggles to deal with the staking rush
By the end of 2006, Iskut First Nation (part of the Tahltan Territory) was struggling to deal with a number of mining and coal bed methane projects. A proposal for coal bed methane exploration by Royal Dutch Shell has been ferociously opposed by the First Nation and environmental groups. The elders have been resisting mine exploration in their traditional territory, which they call the Sacred Headwaters for over two years. In addition to the coal bed methane project, key mining projects in their territory include:

Fortune Minerals: Klappan Mine, a proposal for an anthracite coal mine with four separate deposits, a proposal for a coal-fired power plant, a road, and a possible railway connection. The proposal is in the preliminary stages for Environmental Assessment.

Imperial Metals: Red Chris copper-gold mine. This enormous (30,000 tonnes per day mine) will be acid generating in perpetuity and will take the headwaters of three creeks for its tailings disposal. The mine has received its BC Certificate of Environmental Compliance, and a positive screening level report from the CEAA process, but the federal EA has been challenged and overturned in court by MiningWatch

Canada.

There were, in addition, 13 major exploration projects on their territory, all of which had Notices of Work for 2007 which had to be reviewed by the First Nation. They are listed above.

Kaska Dene

Kaska Dene Territory straddles the Yukon/BC border on the eastern side, and is perched on top of the southern end of a geological structure known as the Selwyn and Kechika Basins. Mantle Resources is pursuing development of the Akie Deposit in the Basin. Teck-Cominco also has a mineral exploration property in the Basin, but are not moving it to production at this time. The Selwyn and Kechika Basins are part of a long stretch of zinc- and lead-rich shales stretching from northwest to southeast from the Yukon/NWT border north of the Mackenzie Mountains to the BC/Alberta border (at 54° north latitude). The Akie deposit lies on the eastern side of the Tintaya Fault line.

The origins of the deposit are believed to have been formed by the spewing out of hot, metal-bearing brines along fissures in an ancient seafloor, which then deposited minerals on the surface, primarily sphalerite and galena. The flow of these ancient brines and metals, and subsequent buckling of the earth's crust, means that the deposits are layered and often accumulated in small sub-basins, hemmed in by "bounding faults." The potential in the Basin is significant, with deposits typically contain 15-50 million tonnes of ore grading 6-15% zinc, 2-4% lead, 734 grams/tonne silver. Copper and gold are not present.⁶⁴³

The Selwyn and Kechika Basin has already been home to two enormous Yukon zinc mines: Sullivan

and Faro, which are now closed. In the Yukon and NWT portions, the Wolverine Mine has recently been permitted, and Howards Pass is in advanced exploration. The southernmost part of the Kechika Trough is called the *Gataga (geological) District*. The ores in the Gataga District are "sedimentary exhalative" deposits, called *sedex* deposits for short.⁶⁴⁴

In addition to these mines, the Kaska struggle to stay on top of Kutcho Creek, which is now entering the EA process, and a number of exploration projects of varying merit.

The Taku River Tlingit First Nation (TRTFN)

The TRTFN have been dealing with disturbing mining proposals for years, in an effort not only to protect their traditional lifestyles and territory, but to find a source of capital for development. Like other FNs in northwestern BC, they have had an onslaught of junior companies (listed above).

Historically, the TRTFN have been engaged for over ten years now, in a struggle to deal with Redcorp (or Redfern as its subsidiary is known), and its proposal for the *Tulsequah Chief Mine*. The mine would be a poly-metallic mine on the shores of the Taku River, with a very short life. The ore is acid-generating. For years, the major sticking point had been the company's perceived need for a 160 km road punched through the heart of TRTFN traditional territory. Now the company is proposing hovercraft to barge the ore out on the river.

The FN had to go to the Supreme Court to get a proper Environmental Assessment for the mine; they have had to be engaged in endless processes around EA, permitting and monitoring the old mine on the

area of Acid Mine Drainage. The lost opportunity costs involved in dealing with this mining proposal are probably inestimable.

To deal with this, the FN has developed a Mining Policy which sets out the terms on which the community will talk with companies. The policy took enormous energy, creativity and resources to develop, and it is now in place. They have only to get mining companies to respect it.

The mine the TRTFN have been most willing to entertain is the Ruby Creek Molybdenum Mine owned by Adanc Molybdenum Corporation. The mine is located in old placer workings, and the company has been respectful in its dealings with the First Nation. However, Ruby Creek has yet to find a buyer for its ore; the deposit is large, but the ore is low-grade; costs of credit, labour and equipment are going up, and the worldwide price for molybdenum is held up, not by a shortage of moly, but by a manufactured shortage of roaster capacity.

Mineral tenure in B.C.

A major change to the BC mining system since 2001 was the introduction of an online staking system in January 2005. The Mineral Tenures Online (MTO) or map-staking system, now only requires a Freeminer Certificate, an internet connection and a credit card in order to stake a mineral claim in BC. In one week the site received more than 2.56 million hits.⁶⁴⁵ As of September 30, 2005, 13,800 claims had been acquired online, a 160% increase over the previous year.⁶⁴⁶

The system is widely acclaimed by industry, but there is debate over the system's infringement upon Aboriginal rights and title interest and the government's requirement to consult with First Nations. Now it is incredibly easy to stake a claim

with a computer before any consultation or ground-truthing has occurred. This creates yet another party's interest on the land in areas where most treaties remain unsettled.

British Columbia is the province with the most unceded Aboriginal lands. As a result, Aboriginal governments and communities are more able to assert their rights than in provinces with older treaties.

Chief Leonard Thomas of the Nak'azdli Band expressed frustration about the area of traditional territory under claim following the launch of the system. The Band is in the throes of dealing with a proposal from Terrane Minerals for the Mt. Milligan open pit gold mine. One claim alone was 1200 square kilometres in size, located near the Nation Lakes, just north of the Band's village near Fort St. James. The Chief stated: "The government ought to know by now that they are creating an undue strain on our band's time and resources by constantly forcing us to monitor our territory against their infringements. This takes valuable energy away from our other priorities."⁶⁴⁷ Some First Nations have stated that the online system of mineral claims violates the principles set out in the Haida/Taku decision from the Supreme Court of Canada.

While the Mining Association of B.C. claims that the wealth generated from mining affects less than 0.05% of the B.C. land base,⁶⁴⁸ over 85% of the province is open to mineral exploration.⁶⁴⁹

In BC there a two-zone system for mineral access: protected areas, which are not open to mineral development, and the mineral zone, essentially the other 86% of the province. Changes made in 2002 to the *Mineral Tenure Act* in Bill 54, the

Miscellaneous Statutes Amendments Act, increased access.⁶⁵⁰ On private land, even the landowner's dwelling and buildings are now at risk. On public land, a land use designation or objective does not prevent a mineral claim holder from applying for permits for exploration/mining, with the only exceptions being parks, ecological reserves, protected heritage property or areas that specifically prohibit mining under the *Environment and Land Use Act*. In the first ten years after a recreation area is designated under the *Parks Act*, staked mineral claims may not be expropriated, and if a major deposit appears, park plans may be shelved.⁶⁵¹

With the apparent success of Mineral Tenure Online staking system, the province is now developing an online mine permitting process.⁶⁵² It continues to support the industry by providing exemptions from permits and pollution laws,⁶⁵³ and streamlining regulations. A news release by the Ministry of Energy and Mines in 2005 stated that it had eliminated more than 300 regulatory requirements.⁶⁵⁴ Another release in 2007 claimed the Ministry had "streamlined regulations, reducing duplication by over 30 percent."⁶⁵⁵

In February 2007 the provincial government introduced yet another subsidy for the mineral exploration industry. On February 20th the government introduced legislation to provide an "enhanced refundable provincial tax credit" of 30% for qualified mineral exploration undertaken in prescribed Pine Beetle affected areas.⁶⁵⁶

Production

British Columbia has 17 operating metal and coal mines, and seven of these mines are in or on the periphery of the Boreal ecozone.

There are three metal mines

Proposed Kemess North Mine

In September 2007, the Kemess North copper-gold mine, located 400 km northwest of Prince George and north of the Kemess South mine, was found by a Joint Panel Review Environmental Assessment to “not be in the public interest.” This was the first mine in Canadian history to be turned down by a federal/provincial EA.

The mine had an estimated mine life of less than 14 years.⁶⁵⁷

Northgate Minerals proposed building a 90 m high dam to flood an alpine valley and use Duncan Lake, known as Amazay Lake to First Nations, for a tailings impoundment. The lake is shared by four First Nations and is sacred to them.

First Nations have been frustrated that only one option that was seriously being reviewed – the use of Duncan Lake for a tailings impoundment. Moreover, the environmental assessment hearing began before they had received a funding agreement and separate consultation.⁶⁵⁸

Grand Chief Pierre of the Tse Keh Nay explained: “Our people don’t believe it is possible to keep all that poison contained in a dam at the top of the watershed. The company will make their millions and leave and we’ll be left wondering when the dam will fail and poison the rest of our water.”⁶⁵⁹

The Environmental Impact Assessment for the mine predicted loss of grizzly, caribou, moose and wolverine habitat, reducing moderate to high quality habitat in the region by 17.6%, loss of critical fisheries habitat with inadequate compensation for Duncan Lake productive capacity, and loss of plant communities.

Despite the area’s significance to First Nations and the project’s predicted environmental effects, there was no traditional ecological knowledge informing the Environmental Impact Assessment (EIA).⁶⁶⁰ First Nations also criticized the archaeology and fish studies conducted by the proponent.⁶⁶¹

The summary of the Joint Panel Report said:

“In order to weigh the Project development pros and cons in the context of public values and policy expectations, the Panel chose to adopt what it considered to be an appropriate sustainability assessment framework. In developing this framework, the Panel consulted recent mining sector sustainability initiatives, as well as the B.C. government’s 2005 Mining Plan. The framework was used to determine whether or not the Project is in the public interest.

“The Panel has considered the Project from five sustainability perspectives: Environmental Stewardship; Economic Benefits and Costs; Social and Cultural Benefits and Costs; Fairness in the Distribution of Benefits and Costs; and Present versus Future Generations.

The Panel notes that the Project’s benefits accrue for only a relatively short period (two years of construction and 11 years of mining production). This period could be reduced if the Project, which is not economically robust, were to close prematurely.

Key adverse effects include the loss of a natural lake with important spiritual values for Aboriginal people, and the creation of a long-term legacy of environmental management obligations at the minesite to protect downstream water quality and public safety. These obligations may continue for several thousand years, and include ongoing treatment of poor quality water from the open pit (the “North Pit”), and regular monitoring and maintenance of the waste disposal impoundment (the “Duncan Impoundment”) and its three dams, to preserve the desired water balance and water chemistry in the Impoundment and to ensure the health of its aquatic ecosystem.

The Panel also notes that it may be difficult for Aboriginal people to increase their share of Project benefits, although as the region’s primary residents and users, they would experience first-hand any impacts on traditionally used resources.”⁶⁶²

currently operating in or surrounding the Boreal ecozone: Eskay Creek (gold and silver), Kemess South (gold and copper) and Table Mountain (gold). In addition, as of 2006, there are eight proposed metal mines and 18 advanced metals exploration projects in this region.⁶⁶³

Kemess South will close by 2010. Cusac Gold Mines Ltd.'s Table Mountain Mine re-started in December 2006, when gold prices went up. The mine is an underground gold mining operation located on the Cassiar-Stewart Highway (Provincial Highway 37). In 1992, Cusac purchased the mill, mine infrastructure and a large land package from Energold. Cusac restarted gold production between 1993 and 1997, but the mine ceased producing when gold prices dropped. There are 3-4 potential ore bodies still to exploit.

Barrick Gold's Eskay Creek is scheduled to close in 2009. The mine has provided significant employment and contracts for the Tahltan people, and its closure has driven interest in other mining projects like the Galore Creek project. Eskay Creek is located in the headwaters of the Unuk River. The mine has been disposing of its tailings and waste rock into Tom McKay and Albino Lake, and there are serious concerns about leaching of antimony, arsenic and mercury into the Unuk ecosystem..

In July, 2007, the Galore Creek copper-gold mine was issued a *Mines Act* permit. It is the first new metal mine in B.C. in over a decade. Located in the northwest of B.C., 150 km northwest of Stewart in the lower Stikine watershed, the mine will cost \$2 billion to construct and will involve the construction of a 4.5 km tunnel to access the Galore Valley.⁶⁶⁴ The mine has the support

of the Tahltan Central Council, on whose territory it is located. However, in early December 2007, the project was shelved, when capital costs for construction ballooned from \$2 billion to \$5 billion.⁶⁶⁵

B.C. is the world's second largest metallurgical coal exporter and has one third of Canada's coal reserves. Four new coal mines have opened in the northeast since 2001 and are currently operating: Dillon, Trend, Willow Creek and Wolverine. There are also five proposed coal mines and five coal projects in the stages of advanced exploration in the boreal region.⁶⁶⁶ A Provincial Coal Coordinator was appointed in 2005 to work with First Nations and industry to facilitate the development of new coal projects.⁶⁶⁷

Several of the new coal projects are being developed under the mantle "Peace River Coal" - a 20:20:60 partnership between Hillsborough Resources Limited, NEMI Northern Energy and Mining Inc. and Anglo Coal Canada Inc., which is a wholly owned subsidiary of Anglo American plc.⁶⁶⁸

Peace River Coal has been issued a full mine permit for the Trend Mine, allowing it to increase Trend's rate of production to 2 million tonnes of product per annum.⁶⁶⁹ The plant is now fully operational, with throughput approaching the planned plant-feed capacity of 270 tonnes/hour.⁶⁷⁰

In future years the Trend Mine operations will be extended to encompass the Roman Project deposits and operations. The Roman Environmental Assessment will be submitted in 2008 and the company thinks that development of the mine will take place in 2009. The Roman Project will be a 5-km, linear open pit and it will be mined in stages. Backfill will be put into

the Trend mine, and its bulk explosives facility, mine office, dry and maintenance facility will be used. There will also be soil stockpiles, a process plant, water management structures, a permitted haul road to the load out and a 25-km power line extension from the Trend Mine.⁶⁷¹

Another Peace River Coal project, the Horizon Project, expects to submit an environmental assessment in late 2008 with development projected to begin in 2010.⁶⁷² The Horizon Project, which is 2/3 underground mining (with several open pits), will need upgraded road access and mine haul roads as well as a permitted (21km) haul road to the load out. There will be topsoil and waste storage areas, a wash plant, tailings impoundment, a coal-handling facility and water management structures.⁶⁷³

Outside the Peace River Coal partnership, there are plans for the development of not only a thermal coal mine but a coal-burning thermal generating plant as well. The thermal Wapiti deposit is being developed under a partnership between Hillsborough Resources Ltd. and US-based AES Corp, called AESWapiti Energy Corp.⁶⁷⁴

In September 2006 AESWapiti Energy Corporation signed a power purchase agreement with BC Hydro Corporation for the AESWapiti 184 MW power generation project. The agreement has a term of thirty years beginning in 2010. The project includes a coal- and biomass-powered plant and a 35-kilometre 230Kv power transmission line, and the development and operation of a thermal coal mine by Hillsborough Resources Limited. The power plant will be located at Hillsborough's Wapiti thermal coal property near Tumbler Ridge, where it will be fueled by thermal coal from the Wapiti property and

by up to 20% bio-mass from local forestry waste.⁶⁷⁵ As of March, 2007, the company was seeking regulatory and permit approvals for the power-generation facility and the Wapiti thermal coal mine, aiming for construction of the generation facility to begin in late 2007. Primary mine development would begin one year before the opening of the power-generation facility, scheduled for 2010.⁶⁷⁶

If approved, the operation would be British Columbia's first coal-burning electricity generation plant. However, the company views as "a significant setback" a recent announcement by the British Columbia government that the province is to become the first jurisdiction in the world to require 100% carbon sequestration for any coal-fired electricity project.⁶⁷⁷

Environmental regulation

Potentially the most forceful environmental statute in British Columbia is the Waste Management Act (WMA). It contains provisions for the issuance of permits and orders, as well as for managing special waste and controlling spills of polluting substances. It also enables the prosecution of offences committed under the statute or regulations. The WMA establishes a tribunal to hear appeals from ministry decisions on permits and approvals.

However, limitations in the WMA can lead to enforcement problems. The Act specifically designates categories of mining and metal smelting industries that are subject to the contaminated sites requirements, but the regulations exempt coal, metal and placer mines that produce less than 10,000 tonnes of ore annually, or any site that was remediated prior to April 1997.

Placer mining operations are exempt from the WMA, if discharges are

from hand panning for gold, testing for the presence of placer minerals in a manner specified in the regulations, or from mining production that does not use mercury or chemicals, or if the mine is located on certain listed creeks.⁶⁷⁸

Water is regulated by the BC Ministry of the Environment according to Water Quality Guidelines and Water Quality Objectives. Most mines in BC are granted site-specific water quality objectives, as they are usually unable to meet the guidelines for some chemicals. They also depend on mixing zones to dilute effluents before they are measured.

Mining's Legacy

Under the British Columbia *Environmental Management Act*, a Director (through his staff in the Department) may determine that a historic mine or contaminated site is an orphan site or a high risk orphan site. The minister can then declare that it is necessary "for the protection of human health or the environment" that the government undertake remediation of the site.

There are various means under the Act to attempt to recover remediation costs, including recovering costs from "responsible persons" and registering a lien against the property for the costs of the remediation. However, a previous owner or operator of a past producing mine site is not responsible for remediation if their transfer agreement excluded the owner or operator from liability or if they have obtained indemnification under the *Financial Administration Act*. Under Section 69 of the Act, a person is also exempted from liability if their exploration activities do not "exacerbate existing contamination" at the site.⁶⁷⁹

British Columbia has been developing their data base of closed and

abandoned mines – which they refer to as “historic mines” over many years. In 1992 there was a survey of closed and abandoned mines with acid mine drainage. In 2001 a database of historic mines was published. At that time, MINFILE data base identified 247 abandoned metal mines large enough to produce more than 10,000 tonnes each.⁶⁸⁰

In 2002, conservative estimates by the Ministry of Energy and Mines set unfunded liability at operating mines at \$85 million, and the cost of clean-up at abandoned mines at \$190 million.⁶⁸¹

A 125-page report released by the Ministry of Energy and Mines Mining Division in February 2003 confirms that there are 1,887 “historic” mines in BC. The report focuses on the 1171 mines that have environmental concerns and that present public health and safety issues. Approximately 3% of the sites were named as having the greatest potential environmental impact. These included the Midway, Lenoram Bralorne-Takla, Ymir, Second Relief and Sultana sites. The report recommended those sites be studied in greater detail, and that potential problems be addressed through a watershed-by-watershed approach to fully know the impact on a drainage system.⁶⁸²

Ten contaminated sites were identified in 2006 for immediate action because of the risk they posed to human health and the environment. All ten were mine sites. These sites included the Britannia mine and the mine tailings at the Yankee Girl mine in the West Kootenays.

6.8 Nunavut

Introduction

Approximately 5% of Nunavut is within the boreal region, and only one of the Territory's closed mines is found in the boreal. The Cullaton Lake/Shear Lake property included two close-by gold deposits which produced ferrous-based ore. Opened in 1981, these sites yielded 77,783 ounces of gold from 251,000 tonnes of ore extracted up to 1985. Nunavut has hosted many other mines over the past decades. The Nanisivik zinc-silver mine in north-western Baffin Island closed in 2002, as did the Polaris zinc-lead mine. Located on Little Cornwallis Island, Polaris was the world's most northern base-metal mine, operating from 1980-2002. Both the Nanisivik and the Polaris mines were important zinc producers for Canada and the only zinc mines north of the 60th parallel.⁶⁸³ North Rankin nickel mine at Rankin Inlet operated only briefly. The Bent Horn mine 325 km northwest of Resolute, produced oil.

The Lupin Mine, 275 km southwest of Bathurst Inlet, provided an ore rich in gold and uranium. This plant, which opened in October 1982 and provided work for over 500 employees at one time, shut down in January 1998. However, recent studies could indicate a profitable reuse of the mill for the bulk processing of samples from a kimberlite chimney (diamonds) found on the site.

The 1992 Northern Land Claims Agreement gave Inuit fee simple title to 356,000 km² of land. There are 150 parcels of land where Inuit hold fee simple title including mineral rights - "subsurface Inuit-Owned-Lands," or IOL - totalling 38,000 km² and representing approximately 2% of the territory. There are another 944 parcels representing

16% of Nunavut, where Inuit hold surface title only, termed "surface IOL," where the Crown (in right of Canada) retains the mineral rights.

Surface title to all IOL is held in each of the three Nunavut regions by the appropriate Regional Inuit Associations (RIAs). Inuit subsurface title is held and administered by Nunavut Tunngavik Incorporated (NTI). NTI issues rights to explore and mine through its own mineral tenure regime. Mineral rights (mineral claims or leases) that existed at the time of the signing of the Northern Land Claims Agreement - known as grandfathered rights - continue to be administered by Indian and Northern Affairs Canada until they terminate or the holder transfers its interests to the NTI regime.⁶⁸⁴

The Crown owns mineral rights to 98% of Nunavut. Indian and Northern Affairs Canada administers these rights through the Canada Mining Regulations (CMR), including lands where the surface rights are attached to Inuit Owned Land. In February 2006, 161 prospecting permits were issued, constituting over 6.4 million hectares of land. Altogether over 32.8 million hectares of Nunavut are covered by prospecting permits, mineral leases and mineral claims.

The *Nunavut Land Claims Agreement* created five land and resource management institutions to issue permits and oversee development:

- Nunavut Surface Rights Tribunal (NSRT)
- Nunavut Planning Commission (NPC)
- Nunavut Impact Review Board (NIRB)
- Nunavut Water Board (NWB)
- Nunavut Wildlife Management Board (NWMB)

Prospectors are required to get a

prospecting permit before they can enter on any lands in Nunavut to prospect. The claims are still staked under the Territorial Lands Act, Canadian Mining Regulations. This is a first-past-the-post free entry system, and unless lands have been specifically withdrawn from staking (such as surface IOL or dedicated national parks) they are open for staking.

This has created considerable tension, as Nunavut is still developing a territorial land-use plan to protect significant wildlife and marine habitat. Many of the areas being considered for protection have been recently staked by prospectors, who may only be interested in getting compensation if the area of the claim is needed for a park. On the large sections of IOL, Nunavut can set the rules and regulations regarding development, such as whether or not to allow uranium mining and exploration.

Mining Today

In 1999, the Government of Nunavut stated its commitment to preparing an economic strategy for the Territory. In June, 2003, The Nunavut Economic Development Strategy was released, identifying the need for economic growth to advance the quality of life for the Territory's people, and further identified mining as an important part of any growth strategy.

In March 2007, the Government of Nunavut released *Parnautit: the Nunavut Mineral Exploration and Mining Strategy*.

Nunavut is in the process of developing its own Mining Act and setting up the infrastructure to handle the devolution of the Territorial Lands Act.

Nunavut's mine reclamation policy applies only to new and

The *Parnautit Strategy* set out four pillars for action:

Pillar 1 – Jurisdictional Framework

We must put a solid foundation of sound legislation, regulations, and policies in place to facilitate the development of a mining industry that will achieve our vision.

Pillar 2 – Community Benefits

We need to find the strategies and initiatives that will build on our strengths and allow our people and communities to become full participants with a true sense of ownership in our minerals economy.

Pillar 3 – Infrastructure Development

We must take advantage of opportunities to improve and build our infrastructure so that developments in one sector of our economy provide broad benefits throughout other economic sectors.

Pillar 4 – Environmental Stewardship

At all times we must recognize the importance of protecting our environment and ensuring that the environmental effects of mining are always minimized and that the industry earns respect and acknowledgement as being a guardian of a clean and healthy environment.

existing mines with clearly identified owner/operators, and does not apply to prospecting, exploration or advanced exploration projects. All new mines must include a closure plan and reclamation plan, and financial securities must cover the estimated cost of having a third party carry out the reclamation activities at any time during the mine's operation.⁶⁸⁵

Staking and Exploration

Exploration and deposit appraisal expenditures throughout Nunavut totalled \$199.7 million in 2006,⁶⁸⁶ with an estimated 15% of the exploration activity taking place in the boreal region of Kivalliq. Almost half of the exploration and deposit appraisal expenditures were spent in the search for precious metals, and approximately 20% in the search for diamonds. Outside the Boreal, the Hope Bay deposit has seen enormous interest, with the Doris North project in the final stages of permitting.

There were eight exploration projects in the boreal area of the Kivalliq region under way in 2006:

- Uranium North's Kazan uranium project
- Ur-Energy Bugs uranium project
- Stornoway's Hyde Diamond project
- BHP's Keewatin zinc-copper-gold project
- Pacific Ridge's Matrix Gold project
- Cameco's Nueltin Lake uranium project
- Kaminak's Sy gold project, and
- BHP Billiton's Target 87 Nickel-Copper project

Exploration for uranium increased significantly in 2006. The majority of the new land acquisitions within Nunavut in 2006 targeted uranium mineralization in the Kivalliq region.

Production

The Jericho Diamond Mine is Nunavut's first diamond mine, and is the only operating mine in the territory. Commercial production was achieved effective July 1st, 2006, but the mine has been marginal financially. It is situated north of the Boreal region in Nunavut. However, after a year of financial struggles, the mine suspended operations at the end of January 2008, and is under bankruptcy protection.⁶⁸⁷

Mining's Legacy

A 2000 report summarizing abandoned mines in Canada identified Nunavut as having three abandoned mines, two of which had problems with either physical or chemical stability.⁶⁸⁸

NTI reverses itself on uranium mining of Inuit-owned lands

by Chris Windeyer, Nunatsiaq News, September 28, 2007

If the debate over mining uranium in the Kivalliq was ever dormant, it's not any more.

Nunavut Tunngavik Incorporated reversed this month its longstanding opposition to uranium mining on Inuit-owned lands. The decision thrills miners but worries opponents who say digging up the radioactive mineral, used as fuel for nuclear power plants, is bad for the environment.

But James Eetoolook, NTI's first vice president, says the new policy doesn't mean there's going to be a rush on the valuable radioactive mineral.

"A lot of people think the policy will automatically support uranium mining. It's not," Eetoolook said. "The policy will guide us [in] how we should tackle the people's concerns and tackle the idea of mining uranium in Nunavut."

The policy sets out what amount to five main conditions for uranium mining projects:

- Support environmentally responsible and peaceful use of nuclear energy;
- Require "significant economic benefits" for Inuit from uranium exploration and mining;
- Ensure uranium mining is done in a way that protects the health of workers and the public;
- Limits the effects of uranium exploration and mining on people, the environment and wildlife; and'
- Promotes Inuit participation in the environmental assessment and operation of uranium mines.
-

Projects that don't meet these guidelines won't go ahead, Eetoolook said.

But it also reverses a long-standing formal opposition to uranium mining within Nunavut, which has its roots in the 1990 uproar over the proposed Kiggavik mine near Baker Lake. That project died in 1997 thanks to low market prices for uranium.

But prices rebounded, then skyrocketed.

Since 2003, uranium prices have shot from around US\$10 per pound to more than US\$130 in May of this year. While prices have since settled back to around US\$85 per pound, they're still high enough to justify new exploration and mining projects.

Joan Scottie, a veteran activist with the Baker Lake Concerned Citizens Committee which has opposed the Kiggavik mine since 1990, said NTI's consultations on the policy, held last spring, glossed over her group's concern about the project.

"They have a lot of those one-night stands, three-hour consultation things and they write them down as a big consultation in their reports [but] many people don't get a chance to participate," she said.

Scottie is worried about the impact of millions of tonnes of radioactive tailings on water quality and the traditional food chain. She's also worried that Nunavut's elected officials have already made up their minds that uranium mining is going to go ahead.

The approval of one mine could lead to the "unstoppable opening of an entire region" to mining, she said. "It'll become politically impossible to prohibit others. We were concerned we would completely lose control of our future."

Kiggavik's owner, on the other hand, is pleased with the news.

(continued on next page)

“We’re happy that NTI has finalized its policy. We’ve been watching it for the past couple of years,” said Barry McCallum, Areva Resources’ director of Nunavut Affairs. “It was required before mining could take place on Inuit owned land, and part of our [Kiggavik] deposit is on Inuit- owned land.”

Areva, a subsidiary of a giant multinational company owned by the French government, is one of those who stand to benefit from renewed interest in nuclear power: the parent company owns not only mining projects, but nuclear plants and power transmission lines as well, the Report on Business says. Areva owns two active uranium mines, and one decommissioned mine in northern Saskatchewan.

McCallum is also quick to point out that the open-air disposal of radioactive tailings – the rock that’s left over once the uranium is taken out – is illegal in Canada. Tailings from the open pit mine would go back where they came from and never be exposed to the air, he said.

“A project that would harm the environment would not be proposed by our company, and if it was, it would not get through the environmental assessment process,” he said.

Further complicating matters is the need for well-paying jobs in communities like Baker Lake. William Noah, Areva’s community liaison officer, said the company hopes to double employment at Kiggavik next year to 50 jobs. For those 25 new jobs, Areva has 180 resumes to choose from, Noah said.



© Northwatch

6.9 Northwest Territories

Mining's History

At one time, the Northwest Territories included all of Alberta, Saskatchewan, the Yukon and most of Manitoba, Ontario and Québec. The Yukon was carved off in 1898; in 1905, both Alberta and Saskatchewan were created from the Territories; in 1912, the provinces of Manitoba, Ontario and Québec were enlarged; and in 1999, Nunavut was established, reducing the NWT by an additional two-thirds.

Still an extremely large and diverse territory, the NWT includes expanses of boreal forest in its south-central range, and much larger expanses of northern tundra in its eastern and more northern regions.⁶⁸⁹ Generally speaking, the Territories' metal mines are located in the boreal region, while diamond exploration and developments are more predominant in the Arctic tundra.

In the 1930's and 1940's, the Great Slave Lake region at Yellowknife and in the Great Bear Lake region exploded with mineral exploration and small mining and exploration camps. There was a sense that the "Golden Age" had dawned, with new mines opening in rapid succession, and Yellowknife a bustling cluster of tents, shacks and cabins hugging the north shore of Great Slave Lake. In the decades to come, the mining industry was to provide the Northwest Territories, and Canada, with many "firsts," and many mines would come and go such as the Camlaren (1937-39), the Discovery (1950-69), and the Tundra (1964-68). Major Yellowknife gold mines included the Con mine (1938-2005) and the infamous Giant mine (1948-99).

Leading up to and during the

Second World War, mineral exploration and the military were playing a major role in northern "development." Canada's first radium mine – later the first uranium mine in the world – came into production at Port Radium on Great Bear Lake, in 1933.⁶⁹⁰

Exploration for uranium increased in 1942, in response to a demand for "defence" purposes. The Port Radium mine of Eldorado Gold Mines Limited was reopened in 1942.⁶⁹¹ In 1944, the federal government took over the Eldorado company and formed a new Crown corporation which later became Eldorado Nuclear Ltd. Uranium exploration was restricted to the joint efforts of Eldorado and the Geological Survey of Canada.⁶⁹²

Port Radium produced the uranium that fed the Manhattan Project, and, eventually, material for the atomic bomb dropped on Hiroshima at the end of the Second World War.⁶⁹³ A smaller private uranium mine operated at Contact Lake, near Port Radium, in the early 1940's,⁶⁹⁴ and in 1957 the Rayrock uranium mine opened near Yellowknife. Unlike its predecessor at Port Radium, Rayrock was a private uranium enterprise.⁶⁹⁵

Mining Today

The total value of metal and diamond shipments from the Northwest Territories decreased to \$1.705 billion in 2005 from \$2.105 billion in 2004. The decrease is primarily due to lower diamond production and lower diamond value from the Ekati mine. Diamond shipments accounted for 98.7% of the total value of metal and non-metal production in the Northwest Territories in 2005. During the same year, the Northwest Territories accounted for 100% of Canadian diamond production, and for 8% of the world total diamond production

by weight and 11% by value.

The CanTung tungsten mine produced 700 tonnes of tungsten in 2005 for a total value of \$21.3 million.⁶⁹⁶

The Governments of Canada and of the Northwest Territories provide both direct and indirect financial support for the mining industry. In addition to ongoing technical support, public funding for training courses and "grubstake" funding for prospectors, the NWT funds a number of specific initiatives to support segments of the industry.

For example, the 1999 budget included \$1.4 million in "new funding" from the federal government to the NWT Department of Resources, Wildlife and Economic Development, to promote the establishment of a diamond value-added industry in the NWT. The budget also included \$265,000 for Aurora College to sponsor diamond industry pre-employment training, and \$133,000 in direct support to Sirius Diamonds to assist them in providing on-the-job training to northerners to work in their newly-established diamond cutting and processing facility in Yellowknife.⁶⁹⁷

"This signals Canada's commitment to sharing the cost of preparing the NWT for the oil, gas and mining development that is in our mutual best interest." Premier Stephen Kafkwi, November 14, 2000.

Infrastructure is one of the main areas of subsidy provided to the mineral industry in the NWT, and a cornerstone of the Territories' Non-Renewable Resource Strategy. Funding in recent years has included \$10 million in the 1999 budget for the upgrading of 17 kilometres of Highway 3 between

“The Act establishes public boards to regulate the use of land and water, to prepare regional land use plans to guide development, and to carry out environmental assessment and reviews of proposed projects in the Mackenzie Valley. The Act also makes provisions for monitoring cumulative impacts on the environment, and for periodic, independent environmental audits. As institutions of public government, the boards regulate all uses of land and water while considering the economic, social and cultural well-being of residents and communities in the Mackenzie Valley.”

Rae and Yellowknife to assist with the huge winter fuel resupply to the diamond mines.⁶⁹⁸

In November 2000, the federal government announced \$3.77 million, matched by \$2 million for the Territorial government, for the construction of permanent river crossings along the Mackenzie Highway winter extension, to prolong the shipping season from 5 to 8 weeks. The NWT views this as important encouragement to the resource extraction industries, largely the oil and gas sectors.⁶⁹⁹

Diamond exploration and new diamond mines have thoroughly captured the economic imagination of both business and government in the Northwest Territories. City administrators in Yellowknife estimate that half of the 550 people employed in BHP’s Ekati Diamond Mine – 300 kilometres northwest of Yellowknife – have chosen to live in Yellowknife.⁷⁰⁰ Diamond mining now accounts for about half of the Gross Domestic Product of the entire NWT.

Overall, the NWT economy relies heavily on resource industries, with mining reported to be by far the largest private industrial sector. Oil and gas exploration and development are also important.⁷⁰¹

Environmental Permitting and Assessment

In 1984, the federal government signed the Inuvialuit Final Agreement with the Inuit of the western Northwest Territories. Resource activities in the far northern area of the NWT (outside the Boreal) are subject to this agreement. Three other comprehensive land claims have been negotiated in the NWT: the Gwich’in Land Claims Agreement in 1992, the Sahtu Dene and Metis Land Claims Agreement in 1994, and the Tlicho Agreement

in 2003. Several other negotiations are taking place covering the territory of the Dehcho Dene and Metis, the NWT Metis Nation and some smaller specific claims and self-government arrangements.

In December 1998, the federal government passed the *Mackenzie Valley Resource Management Act* (MVRMA), which created an integrated co-management structure for public and private lands and waters throughout the Mackenzie Valley to fulfill constitutionally-entrenched commitments in the Dene and Metis land claims agreements mentioned above. The Act provides for land use planning, environmental assessment, land and water regulation, cumulative impacts monitoring and environmental audit. Part IV, proclaimed on March 31, 2000, covers land and water management, establishing the Mackenzie Valley Land and Water Board.

The Mackenzie Valley, as defined in the Act, includes all of the Northwest Territories, with the exception of the Inuvialuit Settlement Region, and the Wood Buffalo National Park.

Public boards under the MVRMA are formed through nominations. Under the land claims agreements, First Nations are entitled to nominate one half of the members of a board, reflecting its jurisdiction over all lands including First Nation settlement lands. The final authority for appointment of members to the public boards, with the exception of the Wek’eezhii Land and Water rests with the Minister of Indian Affairs and Northern Development.⁷⁰² “First Nations” in the Mackenzie Valley refers to the Gwich’in First Nation (represented by the Gwich’in Tribal Council), the Sahtu First Nation (represented by the Sahtu Secretariat Incorporated),

the Tlicho First Nation (represented by the Tlicho government) or bodies representing other Dene or Métis of the North Slave, South Slave or Dehcho regions.

Under the Act, the public boards are responsible for:

- regulating all uses of land and water in the Mackenzie Valley
- preparing regional land use plans to guide development where land use planning is to be carried out
- carrying out the environmental assessment and regulatory review process

The public boards perform regulatory functions, such as permitting, licensing, and conducting environmental reviews, previously undertaken by Indian and Northern Affairs Canada and the NWT Water Board (this body still retains authority in the Inuvialuit Settlement Region). This includes issuing land use permits and water licenses under the Mackenzie Valley Land Use Regulations and the *Northwest Territories Waters Act* and Regulations, within the Mackenzie Valley. Each board has its own specific jurisdiction.

There are also land use planning boards for the Gwich'in and Sahtu regions which are responsible for developing and implementing land use plans for their respective settlement areas in the Mackenzie Valley.

The Mackenzie Valley Environmental Impact Review Board (MVEIRB) is responsible for environmental impact review and assessment at a valley-wide level, including not only the Dehcho region but also the Sahtu, Gwich'in and Tlicho settlement areas.

Regulations under the Mackenzie Valley Resource Management Act

provide for environmental assessment and public participation in applications for advanced exploration permits (water and land).

While the regulatory regime created by the Mackenzie Valley Resource Management Act offers many improvements over earlier approaches in the NWT, and shows some strengths in contrast to other jurisdictions, it is not without its flaws.

The Mackenzie Valley Resource Management Act requires that an audit of the environment must take place in the Mackenzie Valley at least once every five years (similar requirements for environmental audits are described in the Sahtu, Gwich'in and Tlicho agreements).⁷⁰³ Conducted by an independent auditor, the first-ever NWT Environmental Audit was completed in December, 2005. Unique in Canada, this audit reviews the effectiveness of programs and processes related to the monitoring of cumulative impacts and the effectiveness of the regulation of land and water use in the Mackenzie Valley and the Inuvialuit Settlement Region.⁷⁰⁴

The Audit found several instances of unfavourable conditions and deteriorating trends. "While traditional economic indicators show that the NWT population and economy are growing, there is no commensurate progress in community wellness with numerous measures of social well-being being found to be less favourable than national comparisons. The social problems identified appear even more pronounced in the NWT smaller communities, and are more associated with the Aboriginal population."

The report emphasized the seriousness of recent large decreases recorded for the size of caribou

herds that Aboriginal people in the NWT rely on as a major source of subsistence. Studies undertaken by the NWT Government show that the Bathurst caribou herd, which lives between Yellowknife and the Arctic Ocean, has decreased by 74 per cent in the past 20 years, dropping from 472,000 to 128,000.⁷⁰⁵

The Audit also found the following:⁷⁰⁶

- Despite there having been land use planning requirements in place since the MVRMA was enacted in 1998, insufficient progress has been made in developing land use plans in the Mackenzie Valley. Less than 1/5th of the area covered by the MVRMA is covered by legally enforceable land use plans.
- Current consultation practices were found to overload the capacity of local communities to participate in a meaningful manner.
- There are no clear regulatory tools to assess and mitigate social, economic and cultural impacts from development.
- Regulatory and institutional gaps exist that are preventing the regulatory system from managing potentially adverse impacts to the environment in an integrated manner. Such gaps include the management of air quality and social and cultural impacts, as well as compliance and enforcement.
- With few exceptions, air quality impacts in the NWT remain largely unregulated because neither the federal or territorial government have assumed responsibility.
- Although in 1992, the Government of Canada committed that a method to monitor cumulative impacts would be provided, a Cumulative Impact Monitoring Program (CIMP) has not yet been implemented.

Moreover, limited regional/territorial environmental baseline and cumulative impact data are available to decision makers.

Staking and Exploration

Over a million hectares (1, 234,930) were staked in mineral claims the Northwest Territories in 2005, down from a record 2 million hectares in 2004. Exploration spending totalled \$96.3 million in 2005 and \$129.8 million in 2006, and is projected to be \$112.2 in 2007.⁷⁰⁷

The NWT led the country for dollars spent in diamond exploration and deposit appraisal in 2005. The increase resulted from diamond exploration activity reported by BHP Billiton Diamond Inc., by Diavik Diamond Mines Inc., at the Mackenzie project by Sanatana Diamonds Inc. and at the Tli Kwi Cho kimberlite by Peregrine Diamonds Inc., in the Lac de Gras region.⁷⁰⁸

Significant expenditure increases were also reported for uranium, base metals and precious metals. Among the gold projects with important expenditure increases expected in 2006 were Discovery and Nicholas Lake, by Tyhee Development Corp., and Courageous Lake, by Seabridge Gold Inc. Great Northern Mining and Exploration Inc. (base metals), Canadian Zinc Corporation (zinc), and Alberta Star Development Corporation (uranium) also contributed to the increase in exploration. The North American Tungsten Corporation (tungsten; other metals category) was more active at its Riffle Range property in 2006.⁷⁰⁹

Snap Lake is a kimberlite dyke with a mineable resource of 22.8 million tonnes, located approximately 220 kilometres northeast of Yellowknife, just south of the tree line. The public hearing into De Beers' application for a Class A water license and Type

A Land Use Permit for its Snap Lake Project concluded in January 2004, and on May 31st De Beers was granted the licenses required to proceed. Construction of the Snap Lake Mine began in 2005, and De Beers expects to take it to full production in 2008. Once production begins, it will be De Beers first mine outside of Africa and Canada's first fully underground diamond mine.⁷¹⁰

Production will be at a projected average rate of 3,000 tonnes per day, mining a grade of 1.45 carats per tonne at an estimated value of US\$76/carat. Mine life is estimated at approximately 20 years. The project is anticipated to employ about 500 people during construction and provide approximately 550 permanent jobs during operations.⁷¹¹

De Beers' Gahcho Kue project is a joint venture between De Beers Canada Mining Inc. (51%), Mountain Province Diamonds Inc. (44.1%) and Camphor Ventures Inc. (4.9%), and is located 300 km northeast of Yellowknife. It was referred to an environmental assessment by the Mackenzie Valley Environmental Impact Review Board, despite strong representation by the company. The Akaitcho Dene and others were deeply concerned that another mine would place too much stress on the already stressed Bathurst caribou herd that has shown a dramatic decline in population in the last 20 years of over 60%.⁷¹² De Beers appealed to the Northwest Territories Supreme Court, but lost. The Environmental Impact Review is proceeding, and is expected to take anywhere from 24 to 36 months, which would put the start-up in 2011, if the project is approved.⁷¹³

Canadian Zinc Corporation continued advanced exploration work at its Prairie Creek zinc-lead-silver mine, now completely enclosed

by the boundaries of the Nahanni Park expansion area. A mill, completed in 1982 just before the mine closed down, has been brought into service as a pilot plant, processing bulk samples. The underground program involved driving approximately 400 m of new decline tunnel and up to 10,000 m of underground exploration diamond drilling.⁷¹⁴ At its peak, the 2006 program involved up to 60 employees and contractors, constituting the most extensive work program since the mine was built.

Tamerlane Ventures Inc. has entered the permitting and feasibility stage on its Pine Point zinc-lead property east of Hay River. The project is undergoing an environmental assessment and a Final Terms of Reference has been issued. Tamerlane plans to use a freeze curtain around the perimeter of the project.⁷¹⁵ The CEO of Tamerlane is Margaret Kent, aka Peggy Witte, who was the CEO of Royal Oak Mines, and a petition about Tamerlane has been filed with the Auditor-General of Canada, expressing concerns about the lack of financial assurance for such a notorious mine operator.

In March 2005, Tyhee applied for a Water Licence to operate an underground mine, mill and camp 90 km east of Yellowknife at its Yellowknife Gold project. The application was referred to Environmental Assessment in May 2005 and a Terms of Reference was issued. Tyhee has now concluded that an open pit may be the most effective means of extraction. The application may be withdrawn and a new application submitted given the change in the scope of the project.⁷¹⁶

The Fortune Minerals NICO project is also going ahead. It contains an estimated 760,000 ounces of gold,

61 million pounds of cobalt, and 77 million pounds of bismuth. NICO has recently been assessed in a full bankable feasibility study, which contemplates a combination of underground and open pit mining and a process plant to produce gold doré, cobalt cathode and bismuth concentrate. The Company has completed a second \$10 million underground bulk sampling program and is in the first phase of moving the Golden Giant Mine mill and surface facilities at Hemlo, Ontario to the NICO site, the purchase of which will reduce projected capital costs for mine development. The proposed mine is located 160 km northwest of the City of Yellowknife, Northwest Territories, and 80 km north of the Tlicho community of Bechoko on the Highway between Yellowknife and Edmonton, Alberta. The study assumes installation of a power transmission line from Snare, to provide the 13 MVA electrical demand load required by the project. Fortune is working with the Tlicho Government and the governments of the Northwest Territories and Canada to engineer and construct an all-weather road to these communities and NICO, and also to connect with the roads already servicing the Snare hydro-electric facilities.

In 2007, a proposal by Ur-Energy to proceed to advanced uranium exploration in the Thelon River watershed ran into strong opposition from the Akaitcho Dene, for whom the area is of cultural and spiritual significance. As detailed earlier in Sections 3 and 5, the Review Board's landmark decision to reject the proposal was upheld by the Minister.⁷¹⁷

Production

The NWT boasts Canada's first two diamond mines: Ekati and Diavik (discussed below), and one other operating mine - CanTung. The

CanTung Mine is located on the NWT/Yukon border, in the NWT, about 310 kilometres northeast of Watson Lake, Yukon,⁷¹⁸ on the Flat River, 85 km upstream from the current boundary of the Nahanni National Park Reserve.⁷¹⁹

This tungsten mine re-opened in January 2002, after 16 years of suspended operations, and operated for less than a year before being closed again. A rebound in tungsten prices reactivated the mine in September 2005. Within a few days of opening, it had a major fuel spill. Can-Tung is a 1,200 tonne per day fly-in/fly-out operation, with a town-site and processing facility. North American Tungsten Corporation Ltd owns both the CanTung Mine as well as an enormous tungsten deposit called "MacTung," still in advanced exploration. The company says that these are the largest high-grade tungsten resources in the western world making up approximately 15% of the world's proven tungsten resource base.

Most of the infrastructure around Yellowknife has been developed to support the mining industry. For example, hydro dams were established at Bluefish and Snare Rapids, north of Yellowknife, to power the mines. The all-weather road to Yellowknife was intended primarily as a support to the mining industry. The winter road north of Yellowknife was first developed to support the Lupin gold mine, and now also services the diamond mines; the territorial government is now expressing interest in extending the road to the Arctic coast. All of these roads and infrastructure leave a footprint, dissect wildlife habitat, and open new areas for recreational hunting.⁷²⁰

The diamond mines

The Canada diamond industry is controlled by the biggest trans-

Prairie Creek Mine

The Prairie Creek Mine, located just outside the boundary of the Nahanni National Park Reserve and World Heritage Site, is an environmental and financial disaster waiting to happen. The issues are numerous and somewhat complex. They involve the mine's poor location, toxic substances, regulatory oversight, Aboriginal lands, and the expansion of one of Canada's most famous National Parks.

The mine includes complete mining infrastructure built in 1982 but never operated. It is located on the flood plain of Prairie Creek, a tributary of the South Nahanni River, upstream from world-renowned Nahanni National Park Reserve, and poses serious threats to the ecosystem and wildlife.

The mine is in the Deh Cho First Nations (DCFN) traditional territory, and poses a threat to traditional livelihoods and to future opportunities to develop their land in a sustainable fashion. The DCFN want the lands around the Park, known as the South Nahanni Watershed (SNW), to be protected. They are currently in court challenging the water licence.

Canadian Zinc Corporation (CZN), which owns the mine, has no history of operating a mine and is depending on a sustained rise in the price of zinc and silver to make it profitable.

Despite a history of fuel spills, heavy metals being discharged into Prairie Creek, and the presence of large amounts of toxic substances, there has not been an assessment of the overall impact of this 20 year old site, although there have been environmental assessments on small individual projects and activities at the mine. The assessments that have been completed have found the likelihood that proposed mining activities would cause significant adverse environmental impact, unless subjected to stringent conditions.

In its Ecological Integrity Statement of September 2001, Parks Canada identified mining activity as "the single greatest threat to the ecological integrity" of the South Nahanni River Watershed.

The ores that CZN hopes to mine have high levels of mercury, arsenic and antimony. This calls into question the mine's economic viability, as it would be difficult to sell such ore concentrates to smelters, especially given the poor markets for zinc and silver at this time.

Despite the Prairie Creek mine facility being 20 years old, it appears that no reclamation bond has ever been posted by the company. Independent analysis estimates the current cost of cleaning up the mine site at between \$3 million and \$5 million⁷²¹ (MiningWatch Canada, 2002).

national mining companies in the world: BHP-Billiton, Rio Tinto and De Beers. The wealth of these three companies has been built on the plunder of indigenous lands around the world.⁷²²

The NWT has two operating diamond mines: BHP-Billiton's Ekati, Rio-Tinto's Diavik. DeBeers' underground Snap Lake is in the permitting stage. DeBeers has also filed applications to operate another diamond mine at Gacho K'ue, about 90 km southeast of Snap Lake, but went to court to challenge the more rigorous environmental impact review that had been ordered.

The grade of diamonds varies from Ekati's 1.8 cts/tonne to Diavik's 3 carats per tonne. The revenue per tonne also varies: Ekati is about \$150/tonne, Snap Lake Cdn \$180/tonne and Diavik Cdn \$350/tonne.

The big money - the billions of dollars - goes out, much to the growing concern of former Premier Joe Handley and the government of the Northwest Territories. Mr. Handley has claimed that, since 2004, \$286-million in royalties have been paid by the diamond operations to Ottawa, as the mines are on federal Crown land. The Northwest Territories, says Mr. Handley, received "not one cent" in return. While this might provoke some sympathy, it must also be noted that the territorial government (GNWT) also makes some revenues from diamond mining through a payroll tax on out-of-NWT workers, and possible corporate taxes if the companies decide to file in the NWT rather than in another jurisdiction with a lower rate.

The greater problem is the very low economic rent the companies pay for their occupation and exploitation of public lands. And while the companies rake in the profits, the

GNWT has the tax authority to do something about it. However, it appears to lack the political will to take on the companies rather than simply complaining about the federal government.

Over the coming two decades, Mr. Handley says, Ottawa will collect \$23-billion in taxes and royalties. At the same time, the NWT government has failed to exercise its ability to raise taxes from the diamond mines. When BHP's Ekati mine was about to enter production, the NWT government pushed very hard for a guaranteed supply of rough diamonds to build a local secondary industry based on sorting, cutting and polishing of gem quality diamonds. The territorial government even provided loan guarantees to prospective secondary diamond companies to locate facilities in the NWT. Unfortunately, several of these ventures have failed, leaving taxpayers on the hook for millions of dollars.

There have been local impacts from the diamond mines in the capital city of Yellowknife. Housing prices have skyrocketed and drug-related crime is on the increase. Local service providers and retailers find it very difficult to retain staff and attract new employees given the attraction of the diamond mines and related services. Since none of the companies pay municipal taxes, the City of Yellowknife has to bear this burden without increased revenues.

Ekati

Canada's first diamond mine, Ekati, was "the largest construction project completed north of the tree line." It is 350 km north of Yellowknife, and is accessible by air or ice road. "During the construction phase, more than 40 million kilograms of building materials, trucks, diesel fuel and food were moved by truck

over the 475-kilometre ice road from Yellowknife to the mine."⁷²³

150 kimberlite bodies have been discovered within the mineral lease area held by the company, although most of these do not carry economic diamond concentrations. Ekati has open-pit mined from the Panda, Koala, Fox, Beartooth, and Misery pipes, and has underground production from Panda with future production from the underground at Koala. The project is expected to have a life of 25 years or beyond (dating from 1998). Koala is 900 meters in diameter and 230 meters deep, Panda is 800 meters in diameter and 300 meters deep.

Each open pit usually requires the draining of the lake that sits atop the kimberlite pipe and then some 35 - 40 million tonnes/year of waste rock is excavated from the pits. Any fish are removed. The ore feeds a central 18,000-tonne/day-capacity processing plant. The 3.4-km Panda Diversion Channel diverts water around the Panda and Koala pits into Kodiak Lake. Other lakes were taken for disposal of processed kimberlite and waste rock.

Ekati is one of the most closely monitored mines in Canada, as the Aboriginal governments involved negotiated for the company to fund an Independent Environmental Monitoring Agency (IEMA) as a public watchdog.⁷²⁴ In its report for 2004, the IEMA reported that total habitat loss to date was 19.7km² (twice the area of Yellowknife). It noted an increase in all monitored lakes of total dissolved solids, potassium and ammonia; and an increase in some lakes of nitrates and molybdenum. It has also been found that some of the polymers in the processed kimberlite are chronically toxic to water fleas (a crucial part of the aquatic food chain).

BHP-Billiton's last closure plan for Ekati was approved in 2002, although the company is now required to produce an updated plan that accurately reflects current operations. There is some question as to whether the financial security currently held is adequate to allow for a third party to carry out closure and reclamation.

The Bathurst caribou herd is the largest mainland herd in the NWT. The herd migrates through the area of the diamond mines. Dust from mining is a serious threat to caribou, as it can spread out and contaminate the lichen, on which they depend. The herd has declined in numbers from a high of about 400,000 animals in the 1980s to 128,000 in 2006. This reduction is apparently still within the range of natural variability, but caribou are much more sensitive to disturbance when a herd is in decline. There is some statistically significant data from limited satellite collaring that female caribou tend to avoid mine sites in the critical post-calving period.⁷²⁵

Ekati is also the only diamond mine in Canada with a union. The Public Service Alliance of Canada (PSAC) was certified in July 2004. In 2006, when they tried to negotiate their first contract with BHP-Billiton, they faced stiff opposition from the company, who brought in replacement workers. The strike lasted from May until June 30, 2006. The union was only able to achieve a one-year contract, and very modest concessions from the company.

The Diavik Diamond Mine

Diavik is located on Lac de Gras about 300 km (180 miles) north of Yellowknife, on a 20-km² island, informally called East Island. It is connected by an ice road and a 1,585-meter (5,200-ft) gravel

On Ekati:

“The clay slurries present serious, and as yet, unresolved closure challenges for the company. Despite questioning by the Agency at the workshop, it is apparently not yet known by the company how these, and the transition zones with beached tailings which are prone to liquefaction, can be effectively stabilized and reclaimed. For example, it is not known how to place a waste rock cover (as outlined in the currently approved tailings closure plan), or how to construct internal erosion control measures within the tailings facility.”⁷²⁶

“Community leaders were daunted and overwhelmed by trying to understand the proposed plans for the diamond mining, and what the implications could be for the people and the traditional territory in order to negotiate a good deal. “We’re trappers who live off the land. And people live in the bush and trap,” one community member said. “And all of a sudden this mining company comes in. We didn’t know anything about mines, or how to deal with it. That was our first experience. We didn’t know how to negotiate with them.”⁷²⁷

runway that regularly accommodates Boeing 737 jet aircraft.

The area was first staked in 1992 and construction began in 2001, with production commencing in January 2003. There are three ore bodies, named A154 South, A154 North, and A418. The mine is owned by a joint venture between the Aber Diamond Corporation and Diavik Diamond Mines Inc., a subsidiary of Rio Tinto Group. It employs 700, and produces 8 million karats (1,600 kg) of diamonds annually. The lifespan of the mine is expected to be from 16 to 22 years.

Aboriginal people named the lake Ekati for quartz veins found in local bedrock outcrops resembling caribou fat. Lac de Gras is 60 kilometres long, and averages 16 kilometres wide. Lac de Gras has a 4,000-km² drainage area, and, with Lac du Sauvage to the northeast, forms the headwaters of the Coppermine River flowing 520 kilometres to the Arctic Ocean. Lac de Gras has a maximum depth of 56 metres. Water temperature ranges from 0°C to 4°C in winter and 4°C to 18°C in summer. Before the mine, the Lake’s water quality resembled distilled water. Although aquatic productivity is low, lake trout, cisco, whitefish, arctic grayling, burbot, longnose sucker, and slimy sculpin are among the fish that live in the lake.

With Diavik mining the bottom of the lakebed and discharging its mine water back into the lake, there is increasing concern over water quality changes. Diavik is discharging more ammonia than permitted under its original licence, and there are serious concerns both about the aquatic baseline and about the ability of the current aquatic effects monitoring program to detect changes in water quality. These concerns recently came to a

head during the November 2006 Wek’ezhii Land and Water Board public hearings for Diavik’s water licence renewal. As with Ekati, there are also concerns about dust and contamination of the lichen.

Agreements with First Nations

Diavik has an environmental agreement with the affected First Nations, the NWT and the federal government.⁷²⁸ The Agreement establishes an Environmental Monitoring Advisory Board (EMAB).⁷²⁹ There is also a Socio-economic Agreement that covers tracking of economic benefits and some indicators of social dysfunction.

The First Nations whose lands are affected by the mine are: the Dogrib Treaty 11 Council (now known as the Tlicho Government), Yellowknives Dene First Nation, the North Slave Metis Alliance, the Kitikmeot Inuit Association and the Lutsel K’e First Nation. The Agreements cover everything from contracting out to training. The Diavik commitment is to have 66 per cent of the work force from the North, with 35 per cent aboriginal. Diavik says it now exceeds both commitments and has pumped \$233-million into the territorial economy since the mine was constructed, three quarters of that going to northern businesses. “Participation agreements” have been signed that apparently provide for annual cash payments in the order of about \$1 million per year. These agreements are confidential, but do not appear to be tied to profitability or involve revenue sharing.

The negotiation of these agreements continues to be incredibly time-consuming and disruptive for First Nations leadership. An excellent description of the process can be found in *Dealing Full Force*, published by the North-South Institute and Lutsel K’e Dene First Nation

in 2006, and in Ellen Bielawski's book, *Rogue Diamonds: the Rush for Northern Riches on Dene Land*, (Douglas and MacIntyre, 2003).

Mining's Legacy

The historic Giant gold mine closed in July 2004 after 30 years of production. Opened in 1948, the mine had a work force of over 300 during full production. Its closure meant there were no gold mines left operating in the Northwest Territories.

Production at the Con gold mine in Yellowknife had been suspended in 2003 due to high costs and reserves failures. At closing about 190 workers were laid off, with the remaining 250 workers – mostly mill workers – kept on site until 2005.

Since opening in 1938, the Con Mine produced more than 5.5 million ounces of gold. The Giant Mine commenced production about 10 years later, and has produced an estimated 7.1 million ounces of gold.⁷³⁰ However, the ore mined in the Yellowknife area is associated with arseno-pyrite, and therefore leaves behind a considerable amount of arsenic when it is processed.

Arsenic levels on the Giant mine site are as high as several thousand parts per million, and the soils in the community are all contaminated to some extent. Comparatively, soil samples set background range of arsenic in the greater Yellowknife area as being between 4 and 70 ppm. The roasting operations that extract the gold ended in 1999 when Royal Oak, then owner of the Giant Mine, went bankrupt.⁷³¹

Both historical and more recently deposited tailings have been found to contain extremely high levels of arsenic: up to 25,000 ppm in the Con Mine tailings, 4,800 ppm in the Giant Mine tailings, and 12,500 ppm in the historic Negus Mine

tailings.⁷³²

Surface water samples show arsenic concentrations that exceed Canadian drinking water standards, which set the limit at 25 ppm. For example, a popular recreational lake, the Kam Lake, showed arsenic levels of 1,570 ppm. Recent studies show that lake sediments have high concentrations of arsenic. Researchers presume that the arsenic is from historic and recent mining operations, and that it is remobilizing into local surface waters.⁷³³

But arsenic in the soil and water is not the only legacy of 70 years of gold mining. When it closed, Yellowknife's Giant Mine had 237,000 tonnes of arsenic trioxide, a highly toxic by-product of roasting ore, stashed underground in mined-out stopes. When Royal Oak went into receivership – not before making the mine infamous with a bitter strike in 1992 – the federal government became responsible for the property.

After many negotiations, an arrangement was reached that taxpayers will bear all of the environmental liabilities, including cost of cleanup of the site and the arsenic trioxide stockpiles. Miramar Mining Corporation bought the mine in 1999 but was exempted from liability for historic contamination.⁷³⁴ While it operated, Miramar was paid \$300,000 per month by the Department of Indian and Northern Affairs "towards environmental compliance and holding costs."⁷³⁵ Miramar stopped mining at the site in 2004, and the mine was declared bankrupt. Estimated cleanup costs for the underground arsenic trioxide range from \$400 million to over \$1.5 billion, depending on the method used.⁷³⁶

In October 2007 the governments of Canada and the Northwest

Territories announced that they were seeking approval – through a water license application to the Mackenzie Valley Land and Water Board – for the Giant Mine Remediation Plan.⁷³⁷

The Remediation Plan outlines a plan for the clean-up of the entire mine site, including the long-term containment and underground storage of the 237,000 tonnes of highly toxic arsenic trioxide dust using the "Frozen Block Method." It also addresses the demolition of more than 100 buildings on the surface, the backfilling and covering of several open pits, and the covering of 95 hectares of tailings. Funding will come from the Federal Contaminated Sites Action Plan and from the Government of the Northwest Territories under the auspices of a Cooperation Agreement signed between the Government of Canada and the GNWT in 2005.⁷³⁸

The 15 underground chambers and stopes containing the arsenic trioxide dust will be frozen using a system similar to ones used to freeze the ice in indoor rinks. A super-cooled liquid is circulated through a series of underground pipes to freeze the areas around and within each of the chambers and stopes. The theory is that this will create an impenetrable barrier, preventing water from entering the chambers and arsenic from leaving. The blocks will be kept frozen over the long term by using thermosyphons, which are tall, metal tubular devices that take heat out of the ground. Thermosyphons are self-sustaining, meaning they do not require an external source of power.⁷³⁹

At the Colomac Mine site, the most pressing environmental problem is the mine waste containment area. Precipitation and snowmelts

accumulate in this area, made up of three lakes with a total surface of about 76 hectares. Concentrations of contaminants (such as cyanide, metals, and ammonia) in the water require treatment before release into the environment. Without remediation, there was serious danger of the tailings dam overtopping and/or failing. This would have meant an uncontrolled discharge of contaminated water will enter the Indin River system, which is the water supply source for Tlicho First Nations communities located downstream. Indin Lake also has a spiritual significance to the community.

The cost of cleaning up the Colomac Mine is estimated at about \$70 million. Only \$1.5 million in security deposits was collected for this mine when it was in operation, and the mine has not generated any royalties to the government.⁷⁴⁰ A remediation program is now in place for Colomac, with a Tlicho company – Tlicho Logistics – managing the remediation.

As of February 2000, 37 abandoned mines were on Indian and Northern Affairs Canada (INAC) files. All of them had been visited by field staff personnel, and all of them matched the INAC criteria of “abandoned,” meaning that they had no legally responsible party in operation. Other sources identify 35 abandoned mines in the Yellowknife region alone, plus another nine more recently closed mines.⁷⁴¹

In her 2002 report to the Government of Canada, the Commissioner of the Environment and Sustainable Development, Johanne Gelin, concluded that the Government of Canada was not doing enough to solve the problems of abandoned mines in the North.

“Abandoned mines are a costly environmental mess left behind by bankrupt mining companies and Canadian taxpayers are left to foot the bill to fix this serious threat to the environment and human health”⁷⁴²

She characterized the sites as containing hundreds of thousands of tons of highly toxic chemicals such as arsenic and cyanide. The audit covered hard-rock mining only, and included a closer look at four mine sites: the Giant and Colomac mines in the Northwest Territories and the Faro and Mount Nansen mines in the Yukon.

The Commissioner’s report led to an allocation from the federal government of \$4 billion over ten years to clean up contaminated sites in the North. The worst of these are abandoned mines. Contaminated sites remediation at these enormous northern sites under federal care, is managed through the Federal Contaminated Sites Action Plan.⁷⁴³

Other mines in the NWT prioritized by the federal government for clean-up include Port Radium, the site on Great Bear Lake where radium and then uranium was mined during the Second World War.

6.10 The Yukon

Mining's History

The Yukon's mining history is long and colourful, with tales of the famous Yukon gold rush woven into the cultural fabric of the Canada's most north-western jurisdiction. Prior to European colonization, the First Peoples in the White River area are known to have mined native copper nuggets, which they used both for arrowheads and in trade. The first gold discovery was in 1850 at Fortymile, and prospecting for placer gold began soon after.

A discovery of gold on Rabbit Creek in the summer of 1896 sparked the Yukon gold rush, which brought tens of thousands of people flooding into the territory over a period of just a few months. Placer gold mining was the mainstay of the Yukon economy from the time of the Klondike rush through until the early 1920s, and then again from the 1940s to the 1960's. A new gold rush in the late 1970s – early 80s re-established the industry as a major contributor to the Yukon economy and it remains so. Placer mining continues in the Territory to this day.

Yukon's mining history has also been sporadic, with many of the mines opening and closing, only to reopen and close once more. The first high-grade silver/lead veins were discovered in the Keno Hill area in 1906, and a mill was built in 1925. The mines closed in 1941 and reopened in 1945, operating periodically through until 1989, and the property is now once again under exploration.

Massive zinc-lead-silver mineralization was found in the Anvil range in 1953, and the huge Faro ore body discovered in 1965, with mine production beginning in 1970. Production was suspended

in 1982, reactivated in 1985, suspended in 1993, reactivated in 1995 and suspended again in January 1998. Mount Nansen's on-again/off-again gold and silver operations are another example of a pattern of "mining-and-going" which has left the Yukon with a legacy of abandoned mines and confusion over title, ownership and liabilities.

Mining Today

As of 2003, the Federal government devolved its jurisdiction over mining to the Yukon Territorial Government. There is cautious optimism from some environmental groups regarding improved environmental protection in regulations that will be implemented in relation to new Yukon Placer Regime and the new Mine Site Reclamation and Closure Policy.⁷⁴⁴

Environmental Assessment and Permitting

Mineral activities are assessed under the Yukon Environmental and Socio-economic Assessment Act (YESAA). Assessments are conducted by the arms-length Yukon Environmental and Socio-economic Assessment Board (YESAB) or one of its six Designated Offices located throughout the Yukon. The Yukon government is the decision-maker and is responsible for regulating and enforcing permits and licenses.

For a major hard rock mining project in the Yukon to move to development and/or production requires a detailed environmental and socio-economic assessment and various regulatory approvals, including but not limited to a Type A or B Water License and a Quartz Mining License. An assessment of a 'Major Mining Project' is undertaken by the Executive Committee of the Yukon Environmental and Social Assessment Board, which undertakes a public consultation

on the project. The Committee then publishes a "draft screening report" which is again sent out for public comment.

After this, the YESAB recommends whether the project should proceed and recommends conditions that should be applied to any permits. Only after the determination of the YESAA process, may permits such as water license be issued.⁷⁴⁵ After the the YESAA assessment, the regulator (the Yukon Department of Energy Mines and Resources, EM&R) decides whether to accept, vary, or reject the various recommendations and then issues a quartz license or permit with conditions. The Yukon Territory Water Board is responsible for issuing the required water licenses and does so after its own review and taking into account the provisions of the EM&R decision document and the YESAA assessment.

The devolution of mining from the Federal government to the Territory has opened the door for changes to the free entry process for exploration, such as allowing political arrangements with First Nations in the territory. The Yukon government concluded an agreement with the Kaska Nation which included a pledge from the government to provide subsurface rights to the Kaska for certain lands on reasonable commercial terms. The agreement between the Federal government and the Kaska Nation includes revenue sharing with the Kaska from exploration and resource development.⁷⁴⁶

Agreements like this will allow First Nations more autonomy regarding land use decisions, although allocating subsurface rights through political processes may also be problematic. However, not all First Nations have these agreements, and the free entry system continues

to be a source of frustration for both First Nations and public interest organizations such as environmental groups.

Government Subsidies

The Yukon now provides an assistant to help major mining projects go through the assessment and permitting process. The YESAA process has streamlined environmental assessment for companies, although it is becoming a serious concern to the First Nations and citizens that have to live with the mines. The Yukon has the most permissive incorporation legislation in the country, requiring no Canadian directors and allowing meetings of directors to take place anywhere in the world.

The Yukon Government also provides a number of direct subsidies to the mining industry, such as tax exemptions, exploration funding and by footing the bill for mine infrastructure. The Yukon royalty regime is based on profits, not on production. An unusual feature of the Yukon royalty is that all income taxes paid or payable are deductible from net income. The government provides a fuel tax exemption for most mine-related vehicles. In 2007, the Yukon government plans to further explore tax incentives and improvement of infrastructure and the royalty regime to encourage mining development.⁷⁴⁷

There are also many subsidies for infrastructure. A key ingredient in the feasibility of the Minto Mine project was the power deal between the Yukon Energy Corp. and Minto Explorations Ltd. Under the deal, the mine pays only \$11 million of the total \$35 million required to build a power link between Minto Mine, Pelly Crossing, Stewart Crossing and the Whitehorse power grid. The amount paid by the Minto Explorations Ltd. includes the

\$4-million cost of a spur line from the new main line to the mine. However, the mining company will not have to make any payments until it has been in operation for 4 years.⁷⁴⁸

In June 2007, a feasibility study was published for a massive infrastructure project, the \$10.8 billion Alaska-Canada rail link. The study was commissioned by the Yukon and the State of Alaska. It is estimated by the rail link promoters that new mines opening as a result of the rail link would provide 7,800 permanent jobs in Canada, of which 4,000 would be in the Yukon, 2,000 in B.C. and the remainder spread across the rest of the country. The majority of tonnage for the rail link (63%) would be from the development of the Crest iron ore deposit in northeastern Yukon. Coal exports from B.C. and the Yukon would also provide significant tonnage under the proposal.⁷⁴⁹ However, waning interest on the part of the new Alaskan governor has reduced the likelihood of anything happening in the near future.⁷⁵⁰

Staking and Exploration

In 2006, the Yukon received a B+ in terms of attractiveness for mine development from a survey by the Fraser Institute. It had had a failing grade in 2003 and 2004, partly due to uncertainty regarding government regulations and environmental rules. (Manitoba and Alberta scored first and second in this survey out of 65 global jurisdictions.⁷⁵¹) The change in its position can be credited to a number of factors.

In the past five years, exploration expenditures have increased tenfold, from \$8 million in 2002 to \$80 million in 2006, well above the \$30-million average annual exploration expenditures over the last 20 years.⁷⁵²

Exploration for gold attracted the largest share of the exploration dollars, capturing 35%. Zinc followed at 22%, uranium at 15%, copper at 12% and silver at 7%, and tungsten and molybdenum at 6%. The remaining approximately 5% was divided between coal and gemstones.⁷⁵³

Spending on mineral exploration and deposit appraisal has risen significantly and consistently over the last three years, from \$54 million in 2004 to \$76.2 in 2005, with projections of \$103.7 for 2007.⁷⁵⁴

The Yukon has some 70 exploration projects, of which 10 are in advanced development stages.⁷⁵⁵

The largest exploration program in 2006 was Pacifica Resources Ltd's \$12 million dollar drilling program to confirm and expand a large zinc resource at Howard's Pass.⁷⁵⁶

The Wolverine project, located 130 km southeast of Ross River, is in the advanced stages of development. Located in Kaska Dene Territory, this proposed underground lead-zinc mine is owned by junior mining company Yukon Zinc, and expects to process 1,440 tonnes of ore per day. It is near the closed Kudz Ze Kayah Mine. The selenium content of the ore is such that it may be impossible to find a smelter to take it.⁷⁵⁷

The company constructed a 25 km access road in 2007 from the mine to the Robert Campbell Highway to mobilize equipment. The contract for road construction was awarded to Artic Construction Ltd. and the Ross River Dena Council under the Socio-economic Participation Agreement with the Ross River Development Council.⁷⁵⁸ Costs of closure for the mine at the end of its production are estimated by government at \$9 million.

Yukon Zinc Corporation has received a Mining Licence and was issued a Type A Water License in October 2007. A company spokesperson announced that the receipt of the permit completed the environmental permitting and "provides the framework for developing a low impact mine." The Licence extends to the end of 2027, covering the development, operation and closure of the Wolverine Project.⁷⁵⁹ Activity at the site has been considerably reduced as Yukon Zinc works to get its financing in order.

Other mine developments involved in mine licensing in the Yukon are: Carmacks Copper, Brewery Creek and Sa Dena Hes.

Carmacks Copper, owned by Western Copper Corp., is located 175 km north of Whitehorse. It will be an open pit, heap leach mine with a mine life of 8 years. It is only feasible at copper prices over \$80 US a pound and the ore grade is very low (1.01%). It is a "transition project" and is undergoing assessments through the *Environmental Assessment Act* and the YESAA.⁷⁶⁰ The YESAA Executive Committee assessment report and recommendations were released for public comment until Feb 6 2008. The report will then be finalized and sent to EM&R for a decision document and permitting. A water license application has not yet been submitted. Both the Little Salmon Carmacks First Nation and the Yukon Conservation Society have major concerns about the quality of the assessment and have expressed objections to it.⁷⁶¹

High gold prices have stimulated renewed interest in Brewery Creek. Ownership of the gold mine (which operated from 1997 to 2001) was taken over by Alexco Resources Inc. in 2005. Mine reclamation of the heap leach operation is continuing

and the liability is estimated at \$1.8 million.⁷⁶²

There is also new interest in re-opening Sa Dena Hes, a lead-zinc mine project approximately 45 km north of Watson Lake and owned by Teck Cominco and Korea Zinc. The mine produced 607,500 tonnes of zinc concentrate in 1991-92, but ceased operations due to low zinc prices. It is being maintained under temporary closure.⁷⁶³

Uranium exploration in Yukon peaked in the early 1980s, and for over 20 years there was no exploration. However, there has been renewed interest in uranium prospects in the Yukon, an interest based almost entirely on a high commodity price. Roughly \$12 million was spent on uranium targets in 2006.⁷⁶⁴

One of the more notorious uranium projects is Cash Minerals' project in the Wernecke Mountains. In October 2007 the company submitted plans to build a 289-km network of winter roads into and along the Wind River to access their multiple uranium claims in the Wind and Bonnet Plume watersheds. The Bonnet Plume is a designated Canadian Heritage River; the Wind River is one of the North's finest wilderness watersheds supporting existing tourism businesses. For the past several years the mining company has used airstrips for access. Now they want to bulldoze winter roads along the valley bottoms and build a new airstrip beside the Wind River.⁷⁶⁵ The decision document does not allow the airstrip, due in large part to the intervention of many Yukon interest groups and individuals who continue to insist that this access not be considered until a land use plan - scheduled for completion in about 18 months - has been issued.⁷⁶⁶

NDP Leader Todd Hardy tabled a

motion in the Yukon legislature in November 2007 calling for a moratorium on any uranium exploration or development activities in the Yukon.⁷⁶⁷

The Yukon Government is also encouraging the development of four known coal deposits, calling it a “local energy resource.” One notion is to use coal to generate electricity for anticipated new mines in the Yukon.⁷⁶⁸

Mineral Tenure in the Yukon

Until devolution, staking was governed by a federal statute. After devolution, the Yukon adapted the act for their own purposes, but without substantial changes (mirror legislation is the term). It is now called the *Yukon Quartz Mining Act* (QMA). Staking for Placer mines is governed by the *Yukon Placer Mining Act*.

Currently, the QMA encourages staking, and allows continued tenure for as long as prospecting and exploration activities are continued. No permit or approval is required for prospecting and low level exploration. A licensed prospector automatically has the right to acquire a mining lease once a claim is staked. The government must issue the lease.⁷⁶⁹

The QMA does not provide any holder of a mining claim, mining lease (Quartz mining lease) or mining license (QML) with exclusive right to use the surface of the land, and it does not convey any tenure in the surface of the land. However it provides very limited protection to private holders of those surface rights.

A mining claim, which must be renewed annually, provides exclusive rights to the holder of the claim for the mines and minerals located within the area of that claim. The

QMA also confirms that a claim holder has the following rights in relation to the minerals contained within the claim:

- the right to enter on and use and occupy the surface for the efficient and miner-like operation of mines and minerals; and
- the right to commercially produce a mineral and benefit from the sale of the mineral.

A Quartz mining lease provides to the holder of the lease the ability to hold claims for a longer period of time (21 years with renewal clause) than a claim.

All work undertaken on the surface of claims and leases is regulated through the *Quartz Mining Land Use Regulation* which has been made under the QMA.

A Quartz Mining License (QML) issued under the QMA gives the holder of the license the authority to undertake the activities listed in the license in relation to the development and production of minerals. Without this license, a person is not legally authorized to engage in development and production of a mine or minerals.

Production

The Minto Copper Project is the Yukon’s first producing hard rock mine in over five years. The mine began production in 2007. It is an open pit mine located on Selkirk First Nation Territory, 240 km northwest of Whitehorse on the west side of the Yukon River. The mine owner is Minto Explorations Ltd., a subsidiary of the Sherwood Copper Corporation.

The Department of Energy, Mines and Resources estimates the mine could contribute \$454 million to the Yukon economy. During the first five years of operation, the mine is projected to employ 170 people and

pay \$14 million in wages. Regular shipments of concentrates to the port of Skagway, Alaska began in July 2007 to Asian smelters. The mine is expected to produce 60,000 tonnes of concentrate per year.⁷⁷⁰ Security is presently set at \$3.7 million.⁷⁷¹ Under the terms of the Reclamation and Closure policy, the amount of security should be reviewed and adjusted every two years to reflect current closure liabilities.

Placer mining is still a key gold producer in the Yukon. In 2005, 128 placer mines produced 70,300 crude ounces of gold, valued at \$27.2 million, and approximately 450 people were directly employed at 128 placer mines.⁷⁷² Some placer operations are family-owned and some have been mining continuously since the gold rush, but they are increasingly corporate. The major placer mining centres in the Yukon are Dawson, Whitehorse and Mayo Mining Districts.

As discussed in more detail earlier, placer mining will now be regulated under the Yukon Placer Regime. The new regime is scheduled for implementation in the 2008 mining season. Specific standards will be set in each of 16 separate watersheds. Monitoring will be carried out on a regular basis, and the standards will be adjusted to reduce negative impacts if observed. In areas of high value fish habitat mining will only be allowed under a site-specific authorization under the Fisheries Act

Mining's Legacy

Yukon's mining history, with its many openings and closings, has left the Territory with a confusing legacy of abandoned mines and liabilities.

Approximately 120 abandoned mines have been identified and are on file with the federal Northern

Affairs Waste Management Program, but the list consists only of those sites for which no legally responsible party can be linked to the property or operation. In many more cases, mine sites are inactive, likely to remain so, and in need of environmental remediation, but they still have an identifiable owner, even if that owner may be taking no responsibility for the care or closure of the site.

As of 2001 there had never been a closure plan completed, approved and implemented in the Yukon, although closure plans were required under the *Yukon Waters Act*.⁷⁷³

In 2006, the Mine Site Reclamation and Closure Policy for hard rock mines was published. This policy should improve closure planning. It requires considerable security for closure and may be one of the better policies of this type in Canada.⁷⁷⁴ However, its recommendations are not enshrined in regulation, and is therefore at the discretion of the Minister of Energy, Mines and Resources. There is a regulation now but it only prescribes the forms of security to be accepted and provides for appeals by the mining company. In short, it fetters the Minister's discretion in favour of the industry.⁷⁷⁵ The policy will not apply to exploration sites or placer mines.

Reclamation costs are determined by the proponent and then checked by an independent consultant hired by the Yukon government. Following this, an amount for security is negotiated. The Policy allows for security to be assessed and re-evaluated throughout mine life, in order to encourage progressive reclamation. However, this strategy may cause greater environmental risks towards the end of the mine life, when closure costs may

be highest and the income to the company may be diminishing as lower value deposits are mined.⁷⁷⁶ Regulation to enable enforcement of the Policy is currently being considered.

Since the federal government has devolved its jurisdiction over mining to the Territory, it has also devolved its liability for the costs of clean-up of any future abandoned mines. The federal government has retained liability for "Type II sites" – those sites created under the watch of Indian and Northern Affairs Canada (INAC). The Yukon Territory must protect itself against major costs that it will be unable to bear with its small population and tax base.

Of those approximately 120 abandoned mines which have been identified, 45 have serious toxic or physical stability problems.⁷⁷⁷ There are four significant "Type II" abandoned mine sites under care of the Federal government in the Yukon: Mt. Nansen, Faro, United Keno Hill, and Clinton Creek. Clean-up will be paid for by the federal government under the Contaminated Sites Action Plan.

BYG's Mount Nansen Mine is an example of what can go wrong. Limited small scale mining and milling of high-grade gold and silver veins was conducted at several properties in the Mount Nansen area between 1945 and 1947, 1966 and 1969, 1975 and 1976, and 1996 and 1998. The mine closed in 1998 under the operation of BYG resources because it was unable to meet the terms of its water licence and was polluting Dome Creek with arsenic, cyanide, lead and other contaminants. The dam was leaky and unstable. A Territorial Court judge ruled that the actions of the company "demonstrate an attitude consistent with the raping and

Keeping Yukoners safe from fires at abandoned mine

October 16, 2007 – CBC News

The Yukon government says it's taking immediate steps to keep people away from a growing number of fires at an abandoned coal mine near Carmacks.

Two government inspectors were sent Tuesday to the former Tantalus Butte site to see what can be done to keep the public safe, mineral resources director Bob Holmes told CBC News.

"They're going to be looking at where we can better place signage, maybe some fencing, maybe block some of the road access," Holmes said.

"Once they've come up with a plan, then we'll be going to talk to the community about it and see if that plan is agreeable to the community."

Residents in Carmacks, a village of 425 people located 165 kilometres north of Whitehorse, have complained this year of seismic activity and increased smoke and smells from the Tantalus Butte site.

Coal seams have been burning deep underground since the mine was abandoned in the late 1970s, but residents say fires have been burning in more openings this summer compared to previous years.

pillaging of resources in the Yukon." The government spends \$2 million per year to maintain the site and must invest \$7 million in reclamation.⁷⁷⁸ Each summer, contaminated water is pumped from the tailings area to a treatment system before discharge. Additional management of water systems and physical hazards on site is also required.

Faro Mine

The abandoned Faro mine is being cleaned up under the Federal Contaminated Sites Action Plan, with a cost of between \$250 and \$850 million⁷⁷⁹ for closure and long term care.

The town of Faro and its mine are named after the gambling card game of the same name.⁷⁸⁰ Located in the Mount Mye area in south-central Yukon, the Faro mine produced lead, zinc, silver and gold. It opened in 1969 and its last shutdown was in 1997. In its heyday, it represented well over a third of the economy of the Yukon and it was the largest private sector employer in the Territory.⁷⁸¹ By the mid 1970's, it was the largest lead-zinc mine in Canada and for a brief period of time was the largest operating open-pit lead-zinc mine in the world.⁷⁸² At peak production it accounted for 15% of the world's lead and zinc output.⁷⁸³

The federal government collected a total of \$14 million from mining companies in security for the closure of Faro Mine. This compares with the annual budget for site care of the mine in 2007 of \$14.6 million, paid for by the federal government under the Federal Contaminated Sites Action Plan.⁷⁸⁴ The federal government will spend between \$250 million⁷⁸⁵ and \$1 billion⁷⁸⁶ in closure and long term care in today's dollars, depending on which closure scenario is negotiated.

The Faro Mine Yukon has had a history of problems with its tailings pond.⁷⁸⁷ Leaks and tailings spills from the tailings impoundment resulted in elevated levels of lead, zinc and arsenic being washed into Rose Creek. In March, 1975, two tailings dams failed and 54 million gallons of contaminated slurry flowed into Rose Creek, depositing tailings downstream for a distance of 15 km. Charges eventually led to a fine of only \$4,500. Over several months during the winter of 1976, highly toxic levels of cyanide were released to Rose Creek. Fisheries officials observed that this spill resulted in "the waters of Rose and lower Anvil Creek being toxic to [fish downstream to] the Pelly River." Charges led to a fine of \$49,000. The tailings impoundment is currently not stable and threatens to spill.⁷⁸⁸

The site contains approximately 70 million tonnes of tailings and 320 million tonnes of waste rock located across the mine complex, much of which is acid-generating or may become acid-generating.⁷⁸⁹ Water treatment plants using lime addition have been installed on the property, and part of the mill has been converted to this purpose. Despite water treatment, perpetual drainage from the mine may result in significant loadings to downstream water bodies over the long term. According to the Faro Project Management Team's technical manager Bill Slater, additional ground water contamination is just beginning to show up from the original waste rock pile started 40 years ago. Rainwater that leached through the site over many years and has not yet shown up as contaminated effluent, will show up.⁷⁹⁰

The Faro mine received more than \$1 billion in public investments in its 25 year life.⁷⁹¹ The federal government had previously agreed to

assume responsibility for present and future environmental liabilities at the mine in order to interest a company in re-mining the site.⁷⁹² Economic Development Minister for the Yukon Government, Trevor Harding stated in 1999 that “with three to five years of accessible ore and on-site infrastructure, the [Faro] mine can still contribute over one billion dollars in jobs and economic benefits for the economy.”⁷⁹³ In fact, reopening the mine would not have been feasible without very high metals prices, and in 2003, federal and territorial governments finally acknowledged that the mine would not reopen.

Closure planning in 2007 has evaluated the costs of remediation and long-term care for a variety of options. The least expensive option involves leaving tailings and waste rock in place, covering them with soil and revegetating. This option will cost between \$250 to \$430 million, creating an estimated 650 person-years of work. The most expensive option involves pumping tailings back into the Faro open pit, filling in the Vangorda pit with waste rock, and covering and resloping the other waste rock areas. The cost is estimated at \$590 million to \$850 million, creating an estimated 1,210 person-years of work.⁷⁹⁴ Costs for site care in 2007 are \$14.6 million.⁷⁹⁵

Major remediation work is scheduled to take place between 2012 and 2024. The cost of providing long-term care for several hundred years will run between \$2.7 and \$4.5 million annually. Life of the long-term care project is estimated at 500 years.

There is no walk-away option.⁷⁹⁶

United Keno Hill

The first high-grade silver/lead veins were discovered in the Keno

Hill area on Nacho Nyak Dun First Nation traditional territory. The property has over nine different mines, which operated between 1914 until 1989 when the price of silver fell. The last operator, United Keno Hill Mines attempted unsuccessfully to reopen the mine in 1996. The company became insolvent in 2000. The federal government severed the environmental liability of the site, although the new owners will manage it.⁷⁹⁷ The mine was sold to Alexco Resource Corp. in April 2006 and a closure plan is to be developed. The main environmental issue at site is metal-laden water, especially high in zinc flowing from old adits. Active water treatment using lime is presently carried out. The property has impacted Christal Lake, Christal Creek, Flat Creek and a portion of the South McQuesten River. Tailings dams may also be unstable.

Clinton Creek

Clinton Creek Mine was an asbestos mine operated by Cassiar Asbestos Corp. Ltd. from 1967-1978. It is located 100 km northwest of Dawson in the Tr’ondek Hwech’in First Nation traditional territory. Sixty million tonnes of waste rock have blocked Clinton Creek and formed Hudgeon Lake. Flooding downstream of the lake during heavy rains/snowmelt is of concern. The long term stability of the blockage is the major concern. Continued movement of the waste rock pile into the lake threatens to eventually cause a dam collapse. Temporary measures to prolong stability of the dam have been carried out on at least two occasions to date. A collapse of the dam would cause catastrophic damage downstream. The mine also discharged 10 million tonnes of tailings to the Wolverine Creek Valley, which have spread and blocked the flow of Wolverine Creek. Fish habitats of Wolverine Creek and upper Clinton Creek

have been destroyed. Reclamation includes the use of gabion beds (mesh cage) to stabilize waste and will cost \$17-35 million.⁷⁹⁸ These steps are still considered interim.

Collecting from the polluters

In January, 2007, the Yukon Supreme Court made a significant decision and set an important precedent in allowing the federal government to pursue the “Oppression Remedy” in recovering costs of cleanup for the abandoned Mt. Nansen and Ketzka mines operated by BYG Resources and a related company YGC Resources. The federal government had been involved in bankruptcy proceedings against “secured creditors” Ellake Services and Cosman that were in fact companies controlled by former principals of BYG Resources. This ruling enables the court to “pierce the corporate veil” between the companies YGC Resources, BYG Resources and their creditors Ellake Services and Cosman, in order to determine payment for clean-up at these two mines.⁷⁹⁹

The Yukon Water Board issued a Water Licence to Yukon-Nevada Gold Corp. in 2007 for site care and maintenance at the Ketzka River gold mine. The president of Yukon-Nevada Gold is Graham Dickson, also the former president of BYG Resources, which defaulted on a cleanup bond and failed to meet cleanup orders at the Mt. Nansen Mine. Dickson now wants to reopen the abandoned Ketzka mine. Interestingly, the environmental regulator for Yukon-Nevada Gold Corp. is a former Yukon government mine inspector who promises to do whatever is required in terms of environmental protection for new activities at the Ketzka mine. In granting the two-year Water Licence, the government required a \$3-million bond from the company to cover environmental problems, as

well as the submission of a closure plan by December, 2009.⁸⁰⁰ A study commissioned by the Department of Indian Affairs and Northern Development had estimated reclamation costs at Ketzia at more than \$1 million, plus an estimated \$7 million to construct and operate a water treatment plant needed to deal with a serious arsenic problem which would require treatment for more than 100 years.⁸⁰¹



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7.0 Conclusions and recommendations

7.1 Context

Political and Regulatory Trends

The past two decades have seen a variety of changes in the global mining industry, with significant environmental consequences for Canada. The influence of these global changes on the domestic political and regulatory climate cannot be underestimated.

The nature of the mining industry, particularly its high capital needs compared to other industries, and the increasing concentration of mining interests globally, creates a determination on the part of industry to lobby potential host governments for the conditions most favourable to their operations. Government policy can be influenced by mining interests, and the mining industry seeks to control the costs occasioned by policy.

Increased political notice of environmental issues in the mid-1980s to the mid-1990s encouraged federal and provincial legislators to begin developing a comprehensive legislative and regulatory framework to control the environmental impacts associated with the various stages of mining.

During the early 1990s, Ontario led the other provinces in introducing tighter controls over exploration and mining activities on Crown lands, and the setting of new standards for limiting toxic effluent through the Metal Mining regulations under the Municipal / Industrial Strategy for Abatement (MISA). Ontario set legal requirements for the reclamation of mine sites and other measures including the posting of security for reclamation costs. Amendments to the *Mining Act*⁸⁰² requiring progressive

rehabilitation, site closure plans and financial assurance requirements came into force in 1991.⁸⁰³

At the federal level, new environmental assessment legislation and the passage of the *Canadian Environmental Protection Act* both affected the mining industry and reflected the public's desire for increased environmental protection.

Historically, the mining industry had been a shrewd manipulator of the federal state, playing one level of government off against the other to achieve self-interested ends.⁸⁰⁴ Some within the mining industry view the tide of 1980s environmentalism as having caught companies "flat footed" and unprepared to resist the significant legislative and regulatory changes introduced by Canadian governments.⁸⁰⁵ The industry's historically sound client relations with governments and regulators were suddenly threatened by the rise of environmental stakeholders and demands for increased environmental protection, transparency, and accountability on the part of industry.

The green agenda was short-lived, and by the mid-1990s, in mining jurisdictions such as Ontario, most of the progressive elements were being deregulated or weakened. New significant gaps opened in the environmental regulatory framework governing mining. British Columbia was similarly afflicted a decade later.

Cuts to budgets of federal and provincial ministries made persistently over the last decade and a half have meant a decreased capacity to monitor environmental change caused by human activity, including mining. Particularly problematic were the significant cuts in the federal fisheries inspection and

monitoring capacity, one of the few areas of federal jurisdiction over the environment. Cuts have also reduced government capacity to provide baseline environmental information against which to track environmental changes, and to allow a comprehensive approach to enforcement. This pattern is well documented.⁸⁰⁶ The often remote location of boreal mines compounds this problem.

Several provinces have experienced dramatic deregulation. Mines require access to land, and easy access to public lands is facilitated through the relaxing of protective laws and regulations. Mineral exploration has by its very nature impacts over a large area in terms of water quality, wildlife habitat disturbance, etc. Governments have nevertheless deregulated obligations for exploration. The Government of Alberta, for example, had this to say about the environmental impacts of exploration:

Through its regulatory reform initiatives, Alberta implemented codes for activities that had low potential for adverse effects and where few or no statements of concern had been received under the approval process. Exploration met both criteria.⁸⁰⁷

In Ontario, in January 1996, Bill 26 (the omnibus *Savings and Restructuring Act*) made profound changes to the *Public Lands Act*, removing a statutory requirement for approval from the Minister of Natural Resources before any activities could be undertaken on public lands or affecting public waterways. The changes allowed Cabinet to define if and when regulatory approvals would be required.⁸⁰⁸ By November 1996, mineral exploration activities on public lands were completely de-regulated, including clearing, mechanical stripping,

bulk sampling, drilling and blasting, moving heavy equipment and drilling rigs and building trails.⁸⁰⁹ Another regulation made under bill 26 amended Ontario's *Environmental Protection Act* to grant mine developers immunity from liability for pre-existing mine hazards on brownfield sites.⁸¹⁰

Other mining reforms from the early 1990s in Ontario were also dismantled:

- The requirement to post “realizable financial securities” against the risk of bankruptcy and public liability for mine closure costs was eliminated, and replaced with an option for mining companies to “self assure,” meaning they could meet a financial means test instead for posting real securities;
- Information respecting financial assurances for mine closures and submitted to government was exempted from access to information legislation, making public access to such information less likely;
- Annual reporting requirements to the Ministry of Northern Development and Mines on mine closure plans were eliminated, which meant the loss of a key measure of accountability in implementation of plans;
- Holders of mining claims were exempted from statutory liability for “pre-existing mine hazards,” if they surrender their leases within twelve months of the Bill 26 amendments to the *Mining Act*.⁸¹¹

Similar changes took place in British Columbia, beginning in the late 1990's. The *Mining Rights Amendment Act, 1998*, suffered two fundamental changes:

- Holders of mineral claims allowed access to all areas outside of parks;
- The right to compensation for

holders of mineral tenure where their tenure is expropriated to establish a protected area.⁸¹²

When the Act was introduced, BC Premier Glen Clark said it was intended to make mining “an easier and more certain process in this province.”⁸¹³

In recent years, the devastating rollbacks in the mining rules in British Columbia have continued, including:

- In 2002 a section of BC's *Mineral Tenure Act* that prohibited mining companies from interfering with private landowner activities was repealed. The amendment also prevented the Mediation and Arbitration Board from denying exploration companies access to their mineral claims even in instances where the mining activity would affect other private business operations.⁸¹⁴
- In 2003 the *Mineral Exploration Code* was rewritten and restrictions on radioactive pollution were loosened, the rules about building environmentally friendly access roads were eliminated, and the distance that a mining operation must be set back from a wetland or stream was reduced from 50 to 10 meters.⁸¹⁵
- In 2004, a new cabinet position, the Minister of State for Mining, was created, effectively giving the mining and forestry industries two voices at the cabinet table; the abolished environment ministry has none.⁸¹⁶
- In 2005, BC replaced its traditional claim staking method with an Internet system which resulted in a massive increase in the number of claims staked in the province.⁸¹⁷
- Posting of security against clean-up costs became discretionary in British Columbia.⁸¹⁸

Rules for posting security against the risk of environmental damage vary among other Canadian jurisdictions. Many of these regimes are subject to discretion, which may compromise the public interest in consistency and certainty that sites are well maintained. Manitoba, for example, accepts several alternative forms of security.⁸¹⁹

Equally counter-productive changes are also being entertained at the federal level. After two years of study by the External Advisory Committee on Smart Regulation, a report was released by Treasury Board President Reg Alcock on March 24, 2005. The report included forty recommendations which, if implemented, would streamline the regulatory approval process to harmonize standards with the United States and speed up regulatory approval.⁸²⁰

The proposed changes have proceeded under the current Government, although without the "Smart Regulation" banner. At the heart of the plan is a triage system for all regulation which uses "risk assessment" to divide regulation into low, medium and high risk categories and effectively deregulate the low risk items. Most risk assessments are theoretical models that depend on thresholds set by political decisions. A 1997 study by Health Canada presented at a workshop of the National Orphaned/Abandoned Mines Initiative (NOAMI) in November 2005 found that risk assessment results were highly variable and unreliable. A comparison of results from four contractors looking at the risk of getting cancer from polyvinyl chloride exposure differed from one another by a factor of 100,000,000. Three times out of ten, the consultants underestimated risk by 60 to 146 times.⁸²¹

There were (and continue to be) a dizzying number of different policy initiatives under the Smart Regulation program. Several of them are discussed in Section 5, and will be significant in terms of the Canadian regulatory regime's ability – and reliability – in protecting the environment and public health from the adverse effects of mining and metal production. Changes include the Major Projects Management Office, amendments to the *Fisheries Act*, changes to the Department of Fisheries and Oceans Habitat Management Policy, and the politicization of the Canadian Nuclear Safety Commission.

Markets and Commodities

Times are very good for the mining industry in Canada. A seven-year slump ended in 2004, and by 2005 prices and profits were on their way up and they haven't stopped yet. In 2006, the value of mined metal production increased by a dramatic 45% to \$21.2 billion, while the value of non-metallic mine production in 2006 was \$10.2 billion.

The latest survey results (2006 preliminary estimates and 2007 spending intentions as of March 2007) include exploration and deposit appraisal expenditures at roughly 2500 properties across the country, reported by 732 project operators (including 13 prospectors/prospector groups).

The survey results confirm a continuing increase in activity since the last downturn, recorded in the 1999-2001 period in Canada. As already noted, total expenditures reached \$1.7 billion in 2006, up 32% from 2005, and a further increase of 9% to \$1.9 billion is indicated for 2007. Total expenditures have now surpassed \$1 billion for four straight years.⁸²²

The high levels of profit and activity are due to a combination of factors,

including increased demand and related increases in commodity prices. For example, the average price of copper rose from an average between 1994-2004 of about \$1 a pound to \$1.71 in 2005 and more than doubled the following year. For copper producers like Falconbridge (now owned by Xstrata) this translated into a windfall of about \$37 million for every 5-cent increase in the price.⁸²³

While mineral prices have risen and fallen in "boom and bust" cycles for generations, some analysts now calling the current boom period part of a prolonged "super-cycle." With the rise in demand for metals coming from across the so-called "BRIC" nations - Brazil, Russia, India and China - there is some thinking that prices could remain high for a considerable period of time in response to continued high demand.⁸²⁴

However, as discussed in more detail in Section 5.3, others are cautioning that the present boom may not be a long-term phenomenon, at least not in Canada, given that:

- Canadian mineral reserves are relatively limited, despite high levels of exploration funding in recent years;
- With 85% of Canadian exports destined for the United States, a weak American economy is a large factor for Canadian exports;
- China is emerging not only as the world's largest consumer of raw materials but may also become one of the world's largest mineral producers; and
- Costs of new mine development are outstripping metal prices, and - combined with less available credit - are inhibiting start-up of many marginal mines.

Public Expectations

One public opinion poll after

Mining losing the public relations battle

Apr. 17, 2007- Northern Life

The mining sector is ignoring the green light at the end of the tunnel that is attached to a 100-ton locomotive driven by the environmental movement. The collision is going to be messy. It will impact the industry at a time when the voracious metal demands of China and India could bring enormous prosperity to Canada's northern and aboriginal communities as well as impoverished countries around the world.

There is no doubt that environmental issues dominate society's cultural and political agendas.

On the political front, the new found commitment to environmentally green initiatives by the McGuinty and Harper governments spell enormous challenges for an industry that most urbanized Canadians still feel is a major source of habitat destruction and pollution.⁸²⁵

"Development of the Kemess North Copper/Gold Project in its present form would not be in the public interest. In the Panel's view, the economic and social benefits provided by the Project, on balance, are outweighed by the risks of significant adverse environmental, social and cultural effects, some of which may not emerge until many years after mining operations cease."⁸³¹

another over the last two years has shown increasing levels of public concern over the environment and growing dissatisfaction with the environment-related performance of government and industry. In 2006-2007, environmental issues overtook health care as the top concern of Canadians.⁸²⁶

When CBC News and Environics Research Group conducted a public opinion poll in early November 2006 on the issues of greatest public concern. When asked about the federal approach to the environment, 71% of respondents replied that the government's approach was not tough enough.⁸²⁷

One year later, a second study done by Environics – the Canadian Environmental Barometer – reported that it is not only government that Canadians view critically on questions of environmental performance. When asked to rate the efforts in addressing the environmental issues facing the country today, the public is largely critical of almost everyone, including the federal government, provincial governments and Canadian business and industry. The strongest criticism is levelled at business and industry, with more than four in ten giving them a poor rating for their environmental performance.⁸²⁸

A newly-released poll by the Environmental Monitor research program confirmed the findings of previous studies. The poll results, released in September 2007, indicated that seven in ten (70%) Canadians now call this country's pollution laws inadequate, up sharply from 11 years ago when fewer than half (41%) felt this way.⁸²⁹

7.2 A Call for Change

What emerges is a recipe for change: two decades of environmental rollbacks are now viewed with dissatisfaction by a public that identifies the environment as their top concern and expects to exercise their right to public participation. This same public has identified both government and industry as poor performers on the environmental front, and has better access to information and communication tools than ever before.

Combine these two potent factors with an industry that is more than prosperous, and it is easy to see why Canadians are fed up. They know the mining sector is cash-rich, and crowing publicly about its good fortune. The weak excuses of just a few years ago, when the industry cried "poor" in response to any and all suggestions of investing in better technologies that might improve environmental performance, just don't hold water today.

Good decisions can be and are being made – decisions that are based on the public interest and on long-term sustainability. One example is the independent Joint Review Panel established to conduct the Environmental Assessment of the Kemess North Project, a huge open pit copper and gold mine in northern British Columbia. In a landmark decision, the Panel said "no" to the project because it was not "in the public interest."

The Panel developed and applied five criteria for sustainability:

- Environmental Stewardship;
- Economic Benefits and Costs;
- Social and Cultural Benefits and Costs;
- Fairness in the Distribution of Benefits and Costs; and
- Present versus Future Generations.

The Panel noted that the Project's benefits would accrue for only a relatively short period (two years of construction and 11 years of mining production) while the adverse effects would be long-term. They would include the loss of a natural lake with important spiritual values for Aboriginal people, and the creation of a long-term environmental legacy of acid mine drainage which would continue for several thousand years.⁸³⁰

Change has, in fact, begun. Where do we go next?

We set out some fundamentals for a new approach to the treatment of public resources, including minerals. The changes suggested below provide a solid basis for further detailed steps that need to be worked out in specificity for each jurisdiction. They provide a framework that will protect the boreal forest for future generations and ensure that mineral exploration and production takes place within the context of sustainability.

Imagine the day when:

- **Regulations and pollution limits are based on protecting human health and the environment; monitoring for environmental effects and compliance ensures effective implementation.** Current standards are largely based on "Best Available Technology Economically Achievable." The limits were set in the 1990s based on studies of what technologies were then available and affordable for treating mine discharges before release. Monitoring is largely done through review of company test results, with very infrequent field monitoring and little evaluation to determine if the regulations are effectively protecting the environment.
- **Mineral rights are granted through a planning process that considers the variety of possible land uses and their compatibility.** Currently, mineral rights are disposed of through a "free entry" system where mineral rights for 90% of the land base are claimed on a first-come basis, with no regard for other land uses. The system assumes that mining is the best and highest form of land use, and tramples other natural, social, economic and cultural values, including Aboriginal land rights.
- **Revenues from mining activities are fairly shared with Aboriginal and other affected communities.** Currently the mining industry receives large subsidies from government and pays a small percentage of their profit back to the provincial/territorial and federal governments in taxes. An even smaller percentage goes to local communities, if any at all, despite the tremendous environmental and social burdens they bear.
- **Environmental Assessments are comprehensive and participatory, begin as early as the prospecting stage and effectively evaluate projects and policy from the perspective of long-term sustainability.** Currently, the greatest majority of environmental assessments done in Canada have little or no public participation and use a narrow definition of the project. Frequently, projects are spilt into different components to limit the scope of an environmental assessment or even avoid one, and there is often little or no public input in designing the review process.
- **Aboriginal peoples are consistently recognized as having rights to the land and natural resources and are engaged in decision-making early and equally.** Currently, governments frequently neglect their duty to consult and accommodate Aboriginal interests, or do so on a limited basis by identifying First peoples as "stakeholders" rather than "rights-holders." While the Canadian Constitution and a growing set of case law recognizes the rights of Aboriginal people, the "honour of the Crown" is often sacrificed to private interests, such as mine developers or exploration companies.
- **Public participation processes are early, accessible and supported, with transparency in decision-making and convenient access to information.** Currently the public has few opportunities to affect decisions being made about the mining process, and those limited opportunities are usually late in the decision-making process, just before permits are about to be issued. Few resources are available to support Aboriginal or other local communities' participation or their need for technical assistance and peer reviews.
- **Full-cost accounting, public disclosure, and the 'polluter pays' principle are implemented in the market place through tighter securities reporting and disclosure requirements.** Currently, financial regulations limit themselves to protecting the short-term interests of shareholders. Companies and shareholders that create liabilities should clearly be responsible for a proper clean-up. At the same time, government

must begin to act in the 'public interest', as long-term land stewards, by setting high reclamation standards that promote sustainability, and preventing those operations that do not make an adequate contribution from off-loading their costs.

These seven broad sets of changes would provide a fundamental re-orientation of environmental regulation for the mining sector. There has never been a better time than the present to begin.



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- 824 "Inside BC's Mining Boom: Why billions are pouring in for copper, coal, uranium", by Monte Paulsen Published the Tyee.ca, May 17, 2007, as found at Error! Bookmark not defined.Error! Bookmark not defined.
- 825 As found at <http://www.northernlife.ca/News/Columns/Archive/Sudol/04-18-07-mining.asp?NLStory=04-18-07-mining>
- 826 "Public Opinion Research in the Government of Canada: Highlights Of Key Public Opinion Research Projects", as found at <http://www.tpsgc-pwgsc.gc.ca/por/text/rpt06-07-06-e.html>
- 827 Results of the CBC/Enviroics poll November 2006, as found at <http://www.cbc.ca/news/background/public-opinion/>
- 828 http://erg.vironics.net/media_room/default.asp?aID=632
- 829 "Poll: Increasing Majority Call Canada's Pollution Laws Inadequate", McAllister Opinion Research, Vancouver, September 4, 2007, as found at <http://www.gvrd.bc.ca/smartsteps/pdfs/mcallistreglobescanpressreleasesep07.pdf>
- 830 Kemess North Copper-Gold Mine Project Joint Review Panel Report Summary, September 17, 2007
- 831 Kemess North Copper-Gold Mine Project Joint Review Panel Report Summary, September 17, 2007

Glossary of Selected Mining Terms

Acidic precipitation / Acid Rain - Snow and rain that have a low pH, caused by sulphur dioxide and nitric oxide gases from industrial activity released into the atmosphere.

Acid mine drainage - Acidic run-off water from mine waste dumps and mill tailings ponds containing sulphide minerals. Also refers to ground water pumped to surface from mines. Sometimes referred to as Acid Rock Drainage.

Adit - An opening driven horizontally into the side of a mountain or hill for providing access to a mineral deposit.

Aeromagnetic survey - A geophysical survey using a magnetometer aboard, or towed behind, an aircraft.

Airborne survey - A survey made from an aircraft to obtain photographs, or measure magnetic properties, radioactivity, etc.

ANFO - Acronym for ammonium nitrate and fuel oil, a mixture used as a blasting agent in many mines.

Annual report - The formal financial statements and report on operations issued by a corporation to its shareholders after its fiscal year-end.

Anode - A rectangular plate of metal cast in a shape suitable for refining by the electrolytic process.

Anomaly - Any departure from the norm which may indicate the presence of mineralization in the underlying bedrock.

Anthracite - A hard, black coal containing a high percentage of fixed carbon and a low percentage of volatile matter.

Assay - A chemical test performed on a sample of ores or minerals to determine the amount of valuable metals contained.

Assay map - Plan view of an area indicating assay values and locations of all samples taken on the property.

Assessment work - The amount of work, specified by mining law, that must be performed each year in order to retain legal control of mining claims.

Autogenous grinding - The process of grinding ore in a rotating cylinder using large pieces of the ore instead of conventional steel balls or rods.

Backfill - Waste material used to fill the void created by mining an orebody.

Background - Minor amounts of radioactivity due not to abnormal amounts of radioactive minerals nearby, but to cosmic rays and minor residual radioactivity in the vicinity.

Ball mill - A steel cylinder filled with steel balls into which crushed ore is fed. The ball mill is rotated, causing the balls to cascade and grind the ore.

Basal till - Unsorted glacial debris at the base of the soil column where it comes into contact with the bedrock below.

Base camp - Centre of operations from which exploration activity is conducted.

Base metal - Any non-precious metal (eg. copper, lead, zinc, nickel, etc.).

Batholith - A large mass of igneous rock extending to great depth with its upper portion dome-like in shape. Similar, smaller masses of igneous rocks are known as bosses or plugs.

Bauxite - A rock made up of hydrous aluminum oxides; the most common aluminum ore.

Bear market - Term used to describe market conditions when share prices are declining.

Bedding - The arrangement of sedimentary rocks in layers.

Beneficiate - To concentrate or enrich; often applied to the preparation of iron ore for smelting.

Bentonite - A clay with great ability to absorb water and which swells accordingly.

Bessemer - An iron ore with a very low phosphorus content.

Bio-leaching - A process for recovering metals from low-grade ores by dissolving them in solution, the dissolution being aided by bacterial action.

Blast furnace - A reaction vessel in which mixed charges of oxide ores, fluxes and fuels are blown with a continuous blast of hot air and oxygen-enriched air for the chemical reduction of metals to their metallic state.

Blasthole - A drill hole in a mine that is filled with explosives in order to blast loose a quantity of rock.

Blister copper - A crude form of copper (assaying about 99%) produced in a smelter, which requires further refining before being used for industrial purposes.

Bulk mining - Any large-scale, mechanized method of mining involving many thousands of tonnes of ore being brought to surface per day.

Bulk sample - A large sample of mineralized rock, frequently hundreds of tonnes, selected in such a manner as to be representative of the potential orebody being sampled. Used to determine metallurgical characteristics.

Bull market - Term used to describe financial market conditions when share prices are going up.

Byproduct - A secondary metal or mineral product recovered in the milling process.

Cable bolt - A steel cable, capable of withstanding tens of tonnes, cemented into a drillhole to lend support in blocky ground.

Cage - The conveyance used to transport miners and equipment between the surface and the mine levels.

Calcine - Name given to concentrate that is ready for smelting (i.e. the sulphur has been driven off by oxidation).

Carbon-in-pulp - A method of recovering gold and silver from pregnant cyanide solutions by adsorbing the precious metals to granules of activated carbon, which are typically ground up coconut shells.

Cathode - A rectangular plate of metal, produced by electrolytic refining, which is melted into commercial shapes such as wirebars, billets, ingots, etc.

Circulating load - Over-sized chunks of ore returned to the head of a closed grinding circuit before going on to the next stage of treatment.

Claim - A portion of land held either by a prospector or a mining company. In Canada, the common size is 1,320 ft. (about 400 m) square, or 40 acres (about 16 ha).

Clarification - Process of clearing dirty water by removing suspended material.

Classifier - A mineral-processing machine which separates minerals according to size and density.

Closed circuit - A loop in the milling process wherein a selected portion of the product of a machine is returned to the head of the machine for finishing to required specification.

Coal - A carbonaceous rock mined for use as a fuel.

Coalification - The metamorphic processes of forming coal.

Collar - The term applied to the timbering or concrete around the mouth of a shaft; also used to describe the top of a mill hole.

Column flotation - A milling process, carried out in a tall cylindrical column, whereby valuable minerals are separated from gangue minerals based on their wetability properties.

Common stock - Shares in a company which have full voting rights which the holders use to control the company in common with each other. There is no fixed or assured dividend as with preferred shares, which have first claim on the distribution of a company's earnings or assets.

Complex ore - An ore containing a number of minerals of economic value. The term often implies that there are metallurgical difficulties in liberating and separating the valuable metals.

Cone crusher - A machine which crushes ore between a gyrating cone or crushing head and an inverted, truncated cone known as a bowl.

Concentrate - A fine, powdery product of the milling process containing a high percentage of valuable metal.

Concentrator - A milling plant that produces a concentrate of the valuable minerals or metals. Further treatment is required to recover the pure metal.

Converter - In copper smelting, a furnace used to separate copper metal from matte.

Core - The long cylindrical piece of rock, about an inch in diameter, brought to surface by diamond drilling.

Cordillera - The continuous chain of mountain ranges on the western margin of North and South America.

Custom smelter - A smelter which processes concentrates from independent mines. Concentrates may be purchased or the smelter may be contracted to do the processing for the independent company.

Cut-and-fill - A method of stoping in which ore is removed in slices, or lifts, and then the excavation is filled with rock or other waste material (backfill), before the subsequent slice is extracted.

Cyanidation - A method of extracting exposed gold or silver grains from crushed or ground ore by dissolving it in a weak cyanide solution. May be carried out in tanks inside a mill or in heaps of ore out of doors.

Cyanide - A chemical species containing carbon and nitrogen used to dissolve gold and silver from ore.

Depletion - An accounting device, used primarily in tax computations. It recognizes the consumption of an ore deposit, a mine's principal asset.

Development - Underground work carried out for the purpose of opening up a mineral deposit. Includes shaft sinking, crosscutting, drifting and raising.

Development drilling - drilling to establish accurate estimates of mineral reserves.

Diamond - The hardest known mineral, composed of pure carbon; low-quality diamonds are used to make bits for diamond drilling in rock.

Diamond drill - A rotary type of rock drill that cuts a core of rock that is recovered in long cylindrical sections, two cm or more in diameter.

Dilution (mining) - Rock that is, by necessity, removed along with the ore in the mining process, subsequently lowering the grade of the ore.

Drill-indicated reserves - The size and quality of a potential orebody as suggested by widely spaced drillholes; more work is required before reserves can be classified as probable or proven.

Due diligence - The degree of care and caution required before making a decision; loosely, a financial and technical investigation to determine whether an investment is sound.

Dump - A pile of broken rock or ore on surface.

Electrolysis - An electric current is passed through a solution containing dissolved metals, causing the metals to be deposited onto a cathode.

Electrolytic refining - The process of purifying metal ingots that are suspended as anodes in an electrolytic bath, alternated with refined sheets of the same metal which act as starters or cathodes.

EM survey - A geophysical survey method which measures the electromagnetic properties of rocks.

Environmental impact study - A written report, compiled prior to a production decision, that examines the effects proposed mining activities will have on the natural surroundings.

Erosion - The breaking down and subsequent removal of either rock or surface material by wind, rain, wave action, freezing and thawing and other processes.

Exploration - Prospecting, sampling, mapping, diamond drilling and other work involved in searching for ore.

Ferrous - Containing iron.

Flotation - A milling process in which valuable mineral particles are induced to become attached to bubbles and float as others sink.

Flowsheet - An illustration showing the sequence of operations, step by step, by which ore is treated in a milling, concentration or smelting process.

Flow-through shares - Shares in an exploration company that allow the tax deduction of credits for mineral exploration to be passed to the investor.

Flux - A chemical substance that reacts with gangue minerals to form slags, which are liquid at furnace temperature and low enough in density to float on the molten bath of metal or matte.

Free milling - Ores of gold or silver from which the precious metals can be recovered by concentrating methods without resorting to pressure leaching or other chemical

Geochemistry - The study of the chemical properties of rocks.

Geology - The science concerned with the study of the rocks which compose the Earth.

Geophysics - The study of the physical properties of rocks and minerals.

Geophysical survey - A scientific method of prospecting that measures the physical properties of rock formations. Common properties investigated include magnetism, specific gravity, electrical conductivity and radioactivity.

Glory hole - An open pit from which ore is extracted, especially where broken ore is passed to underground workings before being hoisted.

Grab sample - A sample from a rock outcrop that is assayed to determine if valuable elements are contained in the rock. A grab sample is not intended to be representative of the deposit, and usually the best-looking material is selected.

Greenstone belt - An area underlain by metamorphosed volcanic and sedimentary rocks, usually in a continental shield.

Heap leaching - A process whereby valuable metals, usually gold and silver, are leached from a heap, or pad, of crushed ore by leaching solutions percolating down through the heap and collected from a sloping, impermeable liner below the pad.

Hedging - Taking a buy or sell position in a futures market opposite to a position held in the cash market to minimize the risk of financial loss from an adverse price change.

High grade - Rich ore. As a verb, it refers to selective mining of the best ore in a deposit.

High-grader - One who steals rich ore, especially gold, from a mine.

Host rock - The rock surrounding an ore deposit.

Hydrometallurgy - The treatment of ore by wet processes, such as leaching, resulting in the solution of a metal and its subsequent recovery.

Induced polarization - A method of ground geophysical surveying employing an electrical current to determine indications of mineralization.

Industrial minerals - Non-metallic, non-fuel minerals used in the chemical and manufacturing industries. Examples are asbestos, gypsum, salt, graphite, mica, gravel, building stone and talc.

Internet Staking - A form of claim-staking practised in some jurisdictions whereby claims are staked by selecting claim areas and filing the claim with the provincial mining department; usually done by selecting from an on-line map.

Ion exchange - An exchange of ions in a crystal with ions in a solution. Used as a method for recovering valuable metals, such as uranium, from solution.

Jig - A piece of milling equipment used to concentrate ore on a screen submerged in water, either by the reciprocating motion of the screen or by the pulsation of water through it.

Kimberlite - A variety of peridotite; the most common host rock of diamonds.

Laterite - A residual soil, usually found in tropical countries, out of which the silica has been leached. May form orebodies of iron, nickel, bauxite and manganese.

Leaching - A chemical process for the extraction of valuable minerals from ore; also, a natural process by which ground waters dissolve minerals, thus leaving the rock with a smaller proportion of some of the minerals than it contained originally.

Level - The horizontal openings on a working horizon in a mine; it is customary to work mines from a shaft, establishing levels at regular intervals, generally about 50 metres or more apart.

Limestone - A bedded, sedimentary deposit consisting chiefly of calcium carbonate.

Line cutting - Straight clearings through the bush to permit sightings for geophysical and other surveys.

Lode - A mineral deposit in solid rock.

Magnetic gradient survey - A geophysical survey using a pair of magnetometers a fixed distance apart, to measure the difference in the magnetic field with height above the ground.

Magnetic separation - A process in which a magnetically susceptible mineral is separated from gangue minerals by applying a strong magnetic field; ores of iron are commonly treated in this way.

Magnetic survey - A geophysical survey that measures the intensity of the Earth's magnetic field.

Map-staking - A form of claim-staking practised in some jurisdictions whereby claims are staked by drawing lines around the claim on claim maps which are then filed with the provincial mining department to stake a claim.

Marginal deposit - An orebody of minimal profitability.

Metallurgical coal - Coal used to make steel.

Metallurgy - The study of extracting metals from their ores.

Mill - A plant in which ore is treated and metals are recovered or prepared for smelting; also a revolving drum used for the grinding of ores in preparation for treatment.

Milling ore - Ore that contains sufficient valuable mineral to be treated by milling process.

Minable reserves - Ore reserves that are known to be extractable using a given mining plan.

Mineral - A naturally occurring homogeneous substance having definite physical properties and chemical composition and, if formed under favorable conditions, a definite crystal form.

Nugget - A small mass of precious metal, found free in nature.

Open pit - A mine that is entirely on surface. Also referred to as open-cut or open-cast mine.

Ore - A mixture of ore minerals and gangue from which at least one of the metals can be extracted at a profit.

Orebody - A natural concentration of valuable material that can be extracted and sold at a profit.

Ore Reserves - The calculated tonnage and grade of mineralization which can be extracted profitably; classified as possible, probable and proven according to the level of confidence that can be placed in the data.

Outcrop - An exposure of rock or mineral deposit that can be seen on surface, that is, not covered by soil or water.

Oxidation - A chemical reaction caused by exposure to oxygen that results in a change in the chemical composition of a mineral.

Pan - To wash gravel, sand or crushed rock samples in order to isolate gold or other valuable metals by their higher density.

Patent - The ultimate stage of holding a mineral claim, after which no more assessment work is necessary because all mineral rights have been earned.

Pellet - A marble-sized ball of iron ore fused with clay for transportation and use in steelmaking.

Pillar - A block of solid ore or other rock left in place to structurally support the shaft, walls or roof of a mine.

Pitchblende - An important uranium ore mineral. It is black in color, possesses a characteristic greasy lustre and is highly radioactive.

Placer - A deposit of sand and gravel containing valuable metals such as gold, tin or diamonds.

Plant - A building or group of buildings in which a process or function is carried out; at a mine site it will include warehouses, hoisting equipment, compressors, maintenance shops, offices and the mill or concentrator.

Polishing pond - The last in a series of settling ponds through which mill effluent flows before being discharged into the natural environment.

Possible reserves - Valuable mineralization not sampled enough to accurately estimate its tonnage and grade, or even verify its existence. Also called "inferred reserves."

Potash - Potassium compounds mined for fertilizer and for use in the chemical industry.

Precambrian Shield - The oldest, most stable regions of the earth's crust, the largest of which is the Canadian Shield.

Primary deposits - Valuable minerals deposited during the original period or periods of mineralization, as opposed to those deposited as a result of alteration or weathering.

Probable reserves - Valuable mineralization not sampled enough to accurately estimate the terms of tonnage and grade. Also called "indicated reserves."

Prospect - A mining property, the value of which has not been determined by exploration.

Proven reserves - Reserves that have been sampled extensively by closely spaced diamond drill holes and developed by underground workings in sufficient detail to render an accurate estimation of grade and tonnage. Also called "measured reserves."

Pyrrhotite - A bronze-colored, magnetic iron sulphide mineral.

Rare earth elements - Relatively scarce minerals such as niobium and yttrium.

Reclamation - The restoration of a site after mining or exploration activity is completed.

Reconnaissance - A preliminary survey of ground.

Recovery - The percentage of valuable metal in the ore that is recovered by metallurgical treatment.

Refractory ore - Ore that resists the action of chemical reagents in the normal treatment processes and which may require pressure leaching or other means to effect the full recovery of the valuable minerals.

Replacement ore - Ore formed by a process during which certain minerals have passed into solution and have been carried away, while valuable minerals from the solution have been deposited in the place of those removed.

Resource - The calculated amount of material in a mineral deposit, based on limited drill information.

Reverberatory furnace - A long, flat furnace used to slag gangue minerals and produce a matte.

Rockburst - A violent release of energy resulting in the sudden failure of walls or pillars in a mine, caused by the weight or pressure of the surrounding rocks.

Rock mechanics - The study of the mechanical properties of rocks, which includes stress conditions around mine openings and the ability of rocks and underground structures to withstand these stresses.

Rod mill - A rotating steel cylinder that uses steel rods as a means of grinding ore.

Room-and-pillar mining - A method of mining flat-lying ore deposits in which the mined-out area, or rooms, are separated by pillars of approximately the same size.

Salting - The act of introducing metals or minerals into a deposit or samples, resulting in false assays. Done either by accident or with the intent of defrauding the public.

Sample - A small portion of rock or a mineral deposit taken so that the metal content can be determined by assaying.

Seismic prospecting - A geophysical method of prospecting, utilizing knowledge of the speed of reflected sound waves in rock.

Shaft - A vertical or inclined excavation in rock for the purpose of providing access to an orebody. Usually equipped with a hoist at the top, which lowers and raises a conveyance for handling workers and materials.

Siderite - Iron carbonate, which when pure, contains 48.2% iron; must be roasted to drive off carbon dioxide before it can be used in a blast furnace. Roasted product is called sinter.

Sinter - Fine particles of iron ore that have been treated by heat to produce blast furnace feed.

Slag - The vitreous mass separated from the fused metals in the smelting process.

Sodium cyanide - A chemical used in the milling of gold ores to dissolve gold and silver.

Solvent extraction-electrowinning (SX-EW) - A metallurgical technique, so far applied only to copper ores, in which metal is dissolved from the rock by organic solvents and recovered from solution by electrolysis.

Stope - An excavation in a mine from which ore is, or has been, extracted.

Strike - The direction, or bearing from true north, of a vein or rock formation measure on a horizontal surface.

Strip - To remove the overburden or waste rock overlying an orebody in preparation for mining by open pit methods.

Stripping ratio - The ratio of tonnes removed as waste relative to the number of tonnes of ore removed from an open-pit mine.

Strip mine - An open-pit mine, usually a coal mine, operated by removing overburden, excavating the coal seam, then returning the overburden.

Sub-bituminous - A black coal, intermediate between lignite and bituminous.

Subsidiary company - A company in which the majority of shares (a controlling position) is held by another company.

Sulphide - A compound of sulphur and some other element.

Sulphide dust explosions - An underground mining hazard involving the spontaneous combustion of airborne dust containing sulphide minerals.

Sulphur dioxide - A gas liberated during the smelting of most sulphide ores; either converted into sulphuric acid or released into the atmosphere in the form of a gas.

Sump - An underground excavation where water accumulates before being pumped to surface.

Tailings - Material rejected from a mill after most of the recoverable valuable minerals have been extracted.

Tailings pond - A low-lying depression used to confine tailings, the prime function of which is to allow enough time for heavy metals to settle out or for cyanide to be destroyed before water is discharged into the local watershed.

Thermal coal - Coal burned to generate the steam that drives turbines to generate electricity.

Thickener - A large, round tank used in milling operations to separate solids from liquids; clear fluid overflows from the tank and rock particles sink to the bottom.

Trench - A long, narrow excavation dug through overburden, or blasted out of rock, to expose a vein or ore structure.

Trend - The direction, in the horizontal plane, of a linear geological feature, such as an ore zone, measured from true north.

Tube mill - An apparatus consisting of a revolving cylinder about half-filled with steel rods or balls and into which crushed ore is fed for fine grinding.

Witness post - A claim post placed on a claim line when it cannot be placed in the corner of a claim because of water or difficult terrain.

Zone - An area of distinct mineralization.

Zone of oxidation - The upper portion of an orebody that has been oxidized.

Suggested Readings and On-line Resources

Chapter 2 Mining the Boreal

Canadian Boreal Initiative, *The Boreal in the Balance: Securing the Future of Canada's Boreal Region*, 2005. Canada's Boreal region offers a tremendous opportunity for conservation on a large scale, but there is a diminishing window of time to plan for conservation solutions.

Available online at <http://www.borealbirds.org/resources/report-cbi-borealinthebalance.pdf>

Anielski, Mark and Sarah Wilson, *Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems*, Pembina Institute, November 2005.

The economic value of the non-market services provided by the Boreal region is over two times greater than the net market value of resource extraction activities. The value of the current total carbon stored in Canada's Boreal is estimated at \$3.7 trillion.

Available online at <http://www.borealbirds.org/resources/report-pembina-canadasnaturalcapital.pdf>

Boreal Futures: Governance, Conservation and Development in Canada's Boreal: State of the Debate, National Round Table on the Environment and the Economy.

This report examines the state of the boreal region today, and makes recommendations to achieve sustainability in this nationally and globally significant region.

Available online at <http://www.borealbirds.org/reports/bsi-borealfutures-nrtee.pdf>

Parfitt, Ben. *Undermining Biodiversity*. Environmental Mining Council of BC, 2001.

An examination of the environmental consequences of improperly located and poorly operated mines for biodiversity and ecological well-being. Discusses impacts of mining in terms of roads, watersheds, wildlife and water quality.

Available online at <http://www.eyedesign.com/publications/undermining.pdf>

Canadian Minerals Yearbook, Minerals and Metals Sector (MMS), Natural Resources Canada.

A comprehensive annual review of developments in the mineral industry. This publication forms a continuing historical record from year to year.

Available online at http://www.nrcan.gc.ca/mms/cmty/pref_e.htm

Overview of Trends in Canadian Mineral Exploration, Intergovernmental Working Group on the Mineral Industry (IGWG).

This report is prepared annually for presentation to federal, provincial and territorial mines ministers. It contains information on recent exploration and deposit appraisal spending levels in Canada, a review of exploration and deposit appraisal activities in the provinces and territories, and analyses of domestic and international trends affecting the Canadian mineral exploration sector.

Available online at: http://nrcan-rncan.gc.ca/mms/pubs/explor_e.htm

Key web sites

MiningWatch Canada www.miningwatch.ca

Canadian Boreal Initiative www.borealcanada.ca

Canadian Songbird Initiative web site www.borealbirds.org

Chapter 3 The Mining Sequence

Campbell, Karen *Undermining Our Future: How Minings Privileged Access to Land Harms People and the Environment*, West Coast Environmental Law Association, January 2004.

A discussion paper on the need to reform mineral tenure law in Canada by Karen Campbell, West Coast Environmental Law staff counsel, January 2004.

The full report is available as a PDF (45 pp; 420 KB) at http://www.miningwatch.ca/updir/WCEL_Free_Entry_paper.pdf

Association of Mineral Exploration in British Columbia. Mineral Exploration Primer. This series provides a general outline and “user friendly” translation of the technical materials found in news releases and analysts’ reports pertaining to mineral exploration and mining. Found on-line at www.amebc.ca/mineralexplorationprimer.htm

Sumi, L. Environmental Mining Primer: A Citizens Guide to Issues, Impacts, and Options in Mineral Development. Victoria: Environmental Mining Council of BC, 2001. The essential reader on environmental impacts of mining. Describes mining and milling processes, and details impacts on water and land. Primers on Labour, Mineral Efficiency, Water, Mineral Exploration, Environmental Impacts of Mining, Mining and Wildlife, Acid Mine Drainage, Mineral Financing, Roads, Modern Treaties, Negotiations, Environmental Impact Assessments, First Nations Guidelines and Consultation Process, Memorandum of Understanding, Impact and Benefit Agreements, Land Rights and Taking Action. Available on-line at <http://www.miningwatch.ca/index.php?/Publications/publications>

Sumi, Lisa and Sandra Thomsen. [Mining in Remote Areas: Issues and Impacts -- A Community Primer](#) To respond effectively to the challenges of mineral development, communities need the context and information necessary to understand and weigh the issues. This booklet profiles major impacts associated with mines developed in remote areas Available on-line at <http://www.miningwatch.ca/index.php?/Publications/publications>

BC Wild & Environmental Mining Council of BC. Acid Mine Drainage Mining & Water Pollution Issues in BC. BC Wild & Environmental Mining Council of BC, Undated. A primer on acid mine drainage and related environmental impacts. Available online at http://miningwatch.ca/index.php?/AMD/AMD_booklet

Kuipers, James R. and Ann S. Maest, Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements, Earthworks, 2006. The overall purpose of this study is to examine the reliability of pre-mining water quality predictions at hard rock mining operations in the United States. To our knowledge, no effort has previously been made to systematically compare predicted and actual water quality for mines in the U.S. or elsewhere. Available online at <http://www.earthworksaction.org/pubs/ComparisonsReportFinal.pdf>

Key Web sites

Links to the mining department for each province and territory can be found at http://www.nrcan.gc.ca/ms/busi-entre/ptar_e.htm. The provincial or territorial departments web sites will have links to mining acts and regulations, and many will have links to their claims fabric, or other maps and information identifying where there are active mines and active mining claims or exploration projects.

Natural Resources Canadas A-Z index will help you quickly locate information of interest on their very large web site. The index can be found at http://www.nrcan.gc.ca/ms/alphindex_e.htm and covers a large range of mining topics, from abandoned mines to zinc.

Public Interest Organizations dedicated to improving mining practices:
MiningWatch Canada (Canada) www.miningwatch.ca
Earthworks (United States) <http://www.earthworksaction.org>
Mineral Policy Institute (Australia) <http://www.mpi.org.au>
Centre for Science in Public Participation <http://www.csp2.org/>

Chapter 4 Mining and the Environment

WWF Canada, Map of ‘Prospecting Permits in Relation to Existing and Proposed Protected Areas’ in Canada’s North, February 2006. Available online at http://manitobawildlands.org/maps/WWF_MineralComm06_lg.jpg

Noss, Reed, PhD. *The Ecological Effects of Roads*. August 1996.
Still the definitive summary of the effects of roads on biological diversity.
Available online at <http://www.wildlandscpr.org/ecological-effects-roads>

Price, Bill, *Challenges Posed by Metal Leaching and Acid Rock Drainage at Closed Mines*, Canmet, Natural Resources Canada, 2003.

This paper discusses long term implications of acid mine drainage, including those related to environmental performances, challenges in predicting acid mine drainage, limited operating experience, and the need for proactive approaches to detection. A technical paper, but written in accessible language.

Available online at <http://www.trcr.bc.ca/docs/2003-price.pdf>

U.S. Environmental Protection Agency, *Human Health and Environmental Damages from Mining and Mineral Processing Wastes*. Technical Background Document. Based on an analysis of 66 case studies. 1995.

EPA developed this background document to illustrate the human health and environmental damages caused by management of wastes from mining (i.e., extraction and beneficiation) and mineral processing, particularly damages caused by placement of mining and mineral processing wastes in land-based units.

Available online at www.epa.gov/epaoswer/other/mining/minedock/damage/index.htm

Moodie, Sue, *Mine Monitoring Manual: A Resource for Community Members*. Yukon Conservation Society. 2001.

This manual is designed to help community members monitor the water quality impacts of a mine and determine the main sources of contamination and the level of pollution being generated by a mine.

Available online at <http://www.eprf.ca/eprf/mlf/documents/minemanual.pdf>

Diehl, Peter, "Uranium Mining and Milling Wastes: An Introduction", World Information Service on Energy, August 2004.

A very brief and easily read overview of uranium mining and milling and some of the related environmental and health issues. as found at <http://www.wise-uranium.org/uwai.html>

Winfield, Mark S., *Clearing the Air: Uranium Mining: Nuclear Power's Dirty Secret*, Pembina Institute for Sustainable Development, 2007.

This study examines the environmental impacts of the use of nuclear energy for electricity generation in Canada through each of the four major stages of nuclear energy production.

Available on-line at <http://www.pembina.org/pub/1503>

Key web sites

The Center for Science in Public Participation provides training and technical advice to grassroots groups on water pollution and natural resource issues, especially those related to mining. CSP2 seeks to focus the debate on factual issues, as brought to light by its technical analyses, and whenever possible to seek consensus and win-win solutions. CSP2 also performs policy related work with federal, state and tribal regulatory agencies on the implementation of water quality, waste disposal, and mining reclamation regulations. Reports and contact information available online at <http://www.csp2.org/organization.htm>

National Pollutants Release Inventory is Canada's legislated, publicly-accessible inventory of pollutants released, disposed of and sent for recycling by facilities across the country. Industrial, institutional and commercial facilities which meet NPRI reporting requirements are required to report under the Canadian Environmental Protection Act, 1999 (CEPA 1999). Available online at http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm

PollutionWatch provides information about pollutants that mining facilities release and transfer, including toxic pollutants (such as benzene, lead, dioxins and furans), Criteria Air Contaminants (pollutants that cause smog and acid rain) and greenhouse gases (air pollutants that lead to global climate change). PollutionWatch uses data from the National Pollutants Release Inventory, but classifies releases, disposals and transfers differently than Environment Canada's NPRI program. PollutionWatch is online at www.pollutionwatch.org

Chapter 5 Mining and Society

Kuyek, Joan and Coumans, Catherine. No Rock Unturned: Revitalizing the Economies of Mining Dependent Communities.

This document, which includes a literature review and bibliography, provides an overview of current research and information on problems faced by mining-dependent communities and the ways and means by which Canadian communities that are dependent on mining have been able to revitalize their economies in the face of industry down-sizing and closure.

Available on-line at <http://www.miningwatch.ca/index.php?/Publications/publications>

CCSG Associates. Overburdened: Understanding the Impacts of Mineral Extraction on Womens Health in Mining Communities, MiningWatch Canada, 2004

This is a comprehensive literature review prepared by CCSG Associates for MiningWatch Canada. The purpose of the review is to provide information to help heal and protect women, their families, and their communities from the adverse health impacts of mineral extraction by enhancing the level of knowledge and developing the capacity of women in mining communities to protect themselves and their families from the effects of mining. May 2004.

Available on-line at www.miningwatch.ca/index.php?/Publications/publications

NOAMI, Community Involvement in the Remediation of Orphaned/Abandoned Mines: Case Studies and Analysis. National Orphaned/Abandoned Mines Initiative, February, 2003.

Primary research and initial drafts of this document were provided by CCSG Associates. The final report has been revised and edited for publication by the National Orphaned/Abandoned Mines Advisory Committee.

http://www.abandoned-mines.org/ci_e.htm

Castrilli, Joseph F. Environmental Regulation of the Mining Industry in Canada: An Update of Legal and Regulatory Requirements. Walter and Duncan Gordon Foundation. 1999.

Available online at <http://www.gordonfn.org/resfiles/enviro-mining.PDF>

Grieg-Gran, Maryanne, Financial Incentives for Improved Sustainability Performance: The Business Case and the Sustainability Dividend. International Institute for Environment and Development, UK. 2002.

Prepared for a conference held in Washington entitled Mining, Finance and Sustainability, this report aims to provide an overview of the theory and practical evidence on the links between environmentally and socially sustainable performance and company financial performance.

Available online at http://www.iied.org/mmsd/mmsd_pdfs/047_grieg-gran.pdf

Kuyek, Joan. Understanding Mining Taxation in Canada.

MiningWatch has recently published new research on the bias of the tax system towards mining exploration. The astonishing environmental and social costs of the minerals we take for granted must be respected in government policy and industry practice. Many more jobs and more sustainable economies can be created in the minerals industry if the focus shifts from mining to the re-use of minerals already taken from the ground and to value-added production in Canada.

Available on-line at <http://www.miningwatch.ca/index.php?/Publications/publications>

Kuyek, Joan. "Mining Investors: Understanding the legal structure of a mining company and identifying its management, shareholders and relationship with the financial market".

Communities dealing with the impact from mining activities (whether at the claim-staking, exploration, development, operating, closure, or restoration/rehabilitation stage) find themselves confronted by a legal entity they may not understand, making demands that are contrary to the desires of the community, and giving reasons for its behaviour that they do not know how to counteract. This Resource is an attempt to understand the nature of this legal entity - what drives it and maintains it, where its strengths and vulnerabilities lie - and to provide some tools to persuade the entity to act in a manner that sees the best interests of the community as part of its self-interest. http://www.miningwatch.ca/updir/Mining_Investors.pdf

Winfield, Mark S., Amy Taylor, Catherine Coumans, Francois Meloche, Joan Newman Kuyek, Looking Beneath the Surface: An Assessment of the Value of Public Support for the Metal Mining Industry in Canada, MiningWatch Canada and Pembina Institute, October 2002.

This study examines the supports provided by Canadian governments to the metal mining industry over the period 1994 to 2001. The report finds that these supports have increased significantly over the study period and are continuing to expand, while the economic benefits generated by the industry have declined. It concludes that further subsidization of the metal mining sector cannot be justified on economic and environmental grounds, and recommends that the tax benefits and other special supports for the mining sector be removed. Available on-line at <http://www.pembina.org/pub/145>

NOAMI, Barriers To Collaboration: Orphaned/Abandoned Mines In Canada, Final Report Prepared for the: National Orphaned/Abandoned Mines Initiative by Joseph F. Castrilli, B.A., LL.B., LL.M., July 2002.

This report examines existing legislative requirements in Canada, selected other North American jurisdictions and other countries, regarding voluntary abatement, remediation, and reclamation of orphaned/abandoned mine lands, noting regulatory or institutional barriers, liability disincentives, and collaborative opportunities. Available online at <http://www.abandoned-mines.org/Castrilli%20Final%20Report.pdf>

Key Web Sites

The Mining Association of Canada (MAC) is a national organization of the Canadian mining industry. It comprises companies engaged in mineral exploration, mining, smelting, refining and semi-fabrication. Online at www.mining.ca

The Prospectors and Developers Association of Canada (PDAC) is a national association representing the interests of the mineral exploration and development industry. Online at <http://www.pdac.ca>

The International Institute for Environment and Development is a UK based international policy research institute and non governmental body working for more sustainable and equitable global development. Online at www.iied.org

Chapter 6 Aboriginal Peoples and the Mineral Sector

Qureshy, Shauna, Landlords and Political Traps: How Mineral Exploration Companies Seek Access to First Nation Territory, Norman Paterson School of International Affairs, Carleton University, 2006.

Many exploration companies seek either formal negotiated agreements or non-negotiated acquiescence from First Nation communities before they begin their exploration programs, while some proceed without acquiescence or agreement. This revised research essay summarizes the findings of 33 interviews with junior and major companies and consultants.

Available online at http://www.miningwatch.ca/index.php?/Free_Entry/qureshypaper

O'Faircheallaigh, C. Environmental Agreements in Canada: Aboriginal Participation, EIA Follow-Up and Environmental Management of Major Projects, Canadian Institute of Resources Law, University of Calgary, 2006.

This book examines the potential of a novel policy instrument, Environmental Agreements involving industry, government and Aboriginal peoples, to promote the goals referred to in the title.

Between a Rock and a Hard Place: Aboriginal Communities and Mining.

The relationship between mining operations and communities is a difficult one around the world. Mining and mineral exploration can bring opportunities for economic development, jobs and training, but it can also bring environmental destruction, abrupt cultural change, and fundamental changes in the way people use the land. This document is the product of a 1999 conference organized by the Innu Nation and MiningWatch Canada, which brought together seventy-three representatives from thirty-two Aboriginal groups and communities, along with representatives of the United Steelworkers of America and MiningWatch Canada to address these issues.

Available on-line at <http://www.miningwatch.ca/index.php?/Publications/publications>

Hipwell, Bill, Katy Mamen, Viviane Weitzner and Gail Whiteman, *Aboriginal Peoples and Mining in Canada: Consultation, Participation and Prospects for Change Working Discussion Paper*, prepared for The North-South Institute, 2002.

A literature review on Aboriginal perspectives on consultation with respect to mining projects. Available online at <http://www.nsi-ins.ca/english/pdf/syncanadareport.pdf>

Sosa, Irene and Karyn Keenan, *Impact Benefit Agreements Between Aboriginal Communities and Mining Companies: Their Use in Canada*, Canadian Environmental Law Association, 2001.

The report presents an overview of impact and benefit agreements. Available online at <http://www.cela.ca/publications/cardfile.shtml?x=1021>

Innu Nation Task Force on Mining Activities. *Ntesinan Nteshiniminan Nteniunan Between a Rock and a Hard Place*. Utashimassits: Innu Nation, 1996.

Final report of the Innu Nation Task Force on Mining Activities provides an overview of the social and environmental issues confronting the Innu people in the form of Inco's Voisey's Bay Nickel Project. The report conveys what the Task Force learned and heard in their conversations, community meetings and research with the Innu people.

Online at <http://www.ryakuga.ca/best/ntesinan.html>

Key web sites

Impact and Benefits Agreement Research Network aims to connect IBA-focused researchers, IBA signatories, and Northern governmental organizations. Online at <http://impactandbenefit.com/>

A comprehensive index of Aboriginal Law and Legislation is as found online at: <http://www.bloorstreet.com/300block/ablawleg.htm>

The Indigenous Environmental Network is an alliance of Indigenous Nations and communities towards sustainable livelihoods, environmental protection of indigenous peoples lands, water and air, and maintaining the sacred Fire of indigenous peoples traditions. Online at http://www.ienearth.org/mining_campaign.html

The Aboriginal Canada Portal is a single window to Canadian Aboriginal on-line resources, contacts, information, and government programs and services. Online at <http://www.aboriginalcanada.gc.ca/acp/site.nsf/en-frames/index.html>

Chapter 7 Across Canada's Boreal

Martin, Wendy. *Once Upon a Mine: The Story of Pre-Confederation Mines on the Island of Newfoundland*. www.heritage.nf.ca/environment/mine/appendix1.html

Government of Quebec, *Preparing for the Future of Quebec's Mineral Sector*, 2007.

Consultation paper on Quebec's mineral strategy. Some NGO submissions are also available on the site. Available online at www.mrnf.gouv.qc.ca/english/publications/mines/strategy/consultation-document.pdf

Daniel, C. and B. Lloyd, *UnderMining Superior: A Report on Mining in the Lake Superior Basin*. Northwatch, 2001.

Available online at http://www.web.ca/~nwatch/mines/UnderMining_Superior.pdf

McGuire, Lara and Jonquille Pak, *Understanding Mining Rights in Ontario*, MiningWatch Canada, August, 2005.

Provides information for land owners on legislation and regulations related to prospecting, staking a mining claim, and undertaking assessment work on private property as set out in the Ontario Mining Act and enabling regulations. Also outlines the process for disputing a mining claim, following provisions in the Mining Act.

Available as a [PDF file](#) (208 KB) (18 pages).

Online at <http://www.canaryinstitute.ca>

Mining Closure Plans: Your Right to Know! August 2005.

Information on how to review and comment on a Mine Closure Plan based on Part VII of the Ontario Mining Act and enabling Regulations.

Online at <http://www.canaryinstitute.ca>

Concentrations of Metals and Other Elements in Surface Soils in Flin Flon, Manitoba and Creighton, Saskatchewan, 2006, July 2007, as found at http://www.gov.mb.ca/conservation/wildlife/managing/pdf/flinflon_metalcon2.pdf

Green, Tom, Mining and Sustainability: The Case of the Tulsequah Chief Mine, Environmental Mining Council of British Columbia, 2002.

This report develops a model for assessing the compatibility of proposed mines with the requirements of sustainability. The model is then applied to the Tulsequah Chief Mine reopening project proposed by Redcorp Ventures Ltd.

Online at http://web.archive.org/web/20020214020541/miningwatch.org/emcbc/publications/tulsequah_sustainability_main.htm

NWT Environmental Audit Summary and Conclusions, 2005. Found at http://nwt-tno.inac-ainc.gc.ca/nwt-a_e.htm

Yukon Conservation Society. YCS Examines Mining. A current overview of mining issues in the Yukon.

Online at www.yukonconservation.org/issues/issuem.html

Canadian Minerals Yearbook, published by Natural Resources Canada, includes sections on each province and territory.

Available online at http://www.nrcan.gc.ca/mms/cmty/pref_e.htm

Overview of Trends in Canadian Mineral Exploration, prepared annually on behalf of the Intergovernmental Working Group on the Mineral Industry (IGWG), includes a detailed review of exploration and deposit appraisal activities in the provinces and territories.

Available online at: http://nrcan-rncan.gc.ca/mms/pubs/explor_e.htm

Key web sites

The Canadian Environmental Network (CEN) coordinates the work of national caucuses made up of participants drawn from its affiliated member groups across Canada. A link to the CEN Mining Caucus is online at <http://www.cen-rce.org/eng/caucuses/mining/index.html>

MiningWatch Canada links organized by province and territory are online at http://www.miningwatch.ca/index.php?/Canada_en

Links to the mining department for each province and territory can be found at http://www.nrcan.gc.ca/ms/busi-entre/ptar_e.htm The provincial or territorial departments web sites will have links to mining acts and regulations, and many will have links to their claims fabric, or other maps and information that identifies where there are active mines and active mining claims or exploration projects.

Additional On-line Links and Resources

The Boreal Songbird Initiative (BSI) is dedicated to outreach and education about the importance of the Boreal Forest region to North America's birds.

<http://www.borealbirds.org/index.shtml>

The Canadian Boreal Initiative (CBI) works with a wide range of conservation organizations, First Nations, industry and other interested parties to link science, policy and conservation activities in Canada's boreal forest. It is the key organization in Canada with the sole purpose of protecting the Boreal. CBI's long term vision is to safeguard the balance of nature for all time in Canada's Boreal Forest through establishing an interconnected network of large-scale protected areas and conservation lands, applying state-of-the-art sustainable development practices on the remainder of the landscape, and engaging and empowering local communities and First Nations on land management decisions.

<http://www.borealcanada.ca/>

Mines and Communities provides information and analysis to support communities affected by mining around the world. Much of the material is in Spanish. An excellent resource.

www.minesandcommunities.org

The World Information Service on Energy (WISE) Uranium Project is an excellent resource a comprehensive and detailed site about the mining and use of uranium.

<http://www.wise-uranium.org/>

Friends of the Earth International has a mining campaign: "less mining for a better world" <http://www.foei.org/mining/index.html>

Canadian Environmental Law Association (CELA) a non-profit, public interest organization established in 1970 to use existing laws to protect the environment and to advocate environmental law reforms.

<http://www.cela.ca/>

Nature Canada (formerly the Canadian Nature Federation) has a mandate "To conserve and protect Canada's natural diversity of plant and animal species and their environment."

<http://www.cnf.ca/>

Canadian Parks and Wilderness Society (CPAWS) is a non-profit membership-based conservation organization - the only national non-profit organization devoted exclusively to protecting Canada's wilderness heritage.

<http://www.cpaws.org/>

Friends of the Earth Canada (FOE) is a voice for the environment, nationally and internationally, working with others to inspire the renewal of our communities and the earth, through research, education and advocacy.

<http://www.foecanada.org/>

Innu Nation has provided leadership and research in the struggle for responsible mining and respect for indigenous land rights.

<http://www.innu.ca/>

Transboundary Watershed Alliance (TWA) was formed to assist its 22 member organizations to maintain and replenish the diversity and abundance of fish and wildlife species and their habitat in the transboundary watersheds of Canada and Southeast Alaska and to encourage the adoption of long-term conservation-based planning to ensure the survival of these magnificent river systems.

<http://riverswithoutborders.org/>

Yukon Conservation Society

<http://www.yukonconservation.org/>

Northwatch is a coalition of environmental and social justice groups in northeastern Ontario. Key areas of work are forestry, mining, and energy.

www.northwatch.org

The Inter-Church Uranium Committee Educational Cooperative (ICUC) is a public interest group in Saskatchewan addressing nuclear issues, including uranium mining, nuclear waste and nuclear weapons.

<http://www.icucec.org/about.html>

Steelworkers Humanity Fund While social and labour development projects are the central activity, the Humanity Fund also focuses on member education, worker-to-worker exchanges and policy advocacy.

<http://www.uswa.ca/program/content/humanity.php>

The Pembina Institute for Appropriate Development is an independent, not-for-profit environmental policy research and education organization.

<http://www.pembina.org/>

IncoWatch raises awareness about Inco and its effects on the environment and human health: Inco's environmental track record speaks for itself - it is one of the top 10 polluters (carcinogens) since 1998. It is also one of the top 15 for releasing toxic substances into the environment.

<http://www.incowatch.ca/>

Mining, Minerals and Sustainable Development (MMSD) is a project run on behalf of the mining industry by the International Institute for Environment and Development and the World Business Council for Sustainable Development, in the lead-up to the 2002 World Summit on Sustainable Development in Johannesburg.

<http://www.iied.org/mmsd/>

The Canadian Nuclear Safety Commission (CNSC) is Canada's regulator of the nuclear industry, including uranium mines, mills and refineries and nuclear reactors and waste facilities.

<http://www.cnscc.gc.ca/eng/>

The Canadian Environmental Assessment Agency (CEAA) is the federal agency with the lead role in the conduct of environmental assessments under the federal Canadian Environmental Assessment Act.

Online at <http://www.ceaa-acee.gc.ca>

Canadian Coalition for Nuclear Responsibility (CCNR) is dedicated to education and research on all issues related to nuclear energy, whether civilian or military.

http://www.ccnr.org/index_uranium.html

Western Mining Action Network (WMAN) works to foster a strong network that protects communities, land, water, air, and wildlife by encouraging reform of mining practices and holding government and corporations accountable.

<http://www.wman-info.org/>

Deline Uranium Team is dedicated to cleaning up the Port Radium mine and mill and addressing the health concerns of the Deline Dene.

<http://www.delineuraniumteam.com/>

The Association for Responsible Mining has a mandate is to enhance equity and well-being in mining communities through improved social/environmental mining practices, governance and the implementation of ecosystem restoration practices.

<http://communitymining.org/index.htm>

Mine Projects in Advanced Exploration and Early Development Stage				
Name	Company	Location or Landmark	Province	Product
Buffalo Head Craton	Ashton Mining / Pure Gold Minerals Inc.	Buffalo Hills	AB	diamonds
Pembina/Gleichen Properties	DRC Resources Corp	Evansburg	AB	diamonds
Legend / Jazz Properties	Montella	Buffalo Hills	AB	diamonds
Seal / Whitefish Tower	New Claymore	Lubicon Lake	AB	diamonds
Ruby Creek Project	Adanac Moly Corp.	22 km NE of Atlin	BC	molybdenum
Red Chris	American Bullion Minerals	Stikine District	BC	metal
Five Cabins	Hillsborough Resources		BC	
Silvertip Project	Imperial Metals	Watson	BC	silver-lead-zinc
Taurus Project	International Taurus Resources	Watson Lake	BC	gold
Kemess North	Northgate Minerals Corporation	430 km NW of Prince George	BC	copper, gold
Tulsequah Chief Project	Redfern Resources Ltd	Atlin	BC	copper-lead-zinc-gold-silver
Sustut Copper		Northgate Minerals	BC	
Trend			BC	coal
BHP Expl Permit 161	BHP Diamonds	Hudson Bay Lowlands	MB	diamonds
Canmine Expl Permit 99-16	Canmine Resources	S. Churchill	MB	nickel-copper
Maskwa Mill	Canmine Resources	Nopiming Provincial Park	MB	cobalt-copper
Cominco Expl Permit 180-181	Cominco	Baldock Lake	MB	nickel-copper
Bucko Lake Nickel Project	Crowflight Resources	Wabawden	MB	nickel
De Beers Expl Permit 184-205	De Beers Exploration Cda Ltd	Gods Lake	MB	diamonds
Debeers 167-170	Debeers Exploration	Hayes R. Upland	MB	diamonds
Falconbridge Expl Perm 2001-07	Falconbridge	Gillam	MB	nickel-copper
Hudson Bay Expl Permit 215	Hudson Bay Mining & Smelting Co. Ltd.	Pelletier Lake	MB	copper-zinc
Indicator Expl Permit 2001-13	Indicator Explorations Ltd	Karloske River	MB	
Iriana	Iriana Resources	S Hayes River	MB	diamonds
Kennecott Expl Permit 2000-04	Kennecott Cda Explorations	Bear Head Lake	MB	diamonds
Oasis 2001-05	Oasis Diamonds	Ilford	MB	diamonds
Hammerdown Mine	Richmont Mines	King's Point	NFLD	gold
Pine Cove Gold Mine	Nova Gold / Pine Cover Resources	Harbour Grace	NFLD	gold
Beaverbrook			NFLd	
Michelin			NFLd	Uranium
Moran Lake			NFLd	Uranium
Pine Cove			NFLd	
Prairie Creek	Canadian Zinc Corporation	Nahanni	NWT	zinc
Gacho Kue Project	De Beers Canada Inc	90 km se of Snap Lake	NWT	diamonds
Snap Lake Project	De Beers Canada Inc	200 km NE of Yellowknife	NWT	diamonds
Pine Point Mine	Kent-Ross Group (prev. Cominco Ltd)	Pine Point	NWT	lead-zinc
Cantung Mine	North American Tungsten Corp. Ltd	310 km of watson lake	NWT	tungsten
Black Fox Project,	Apollo Gold Corpration	8 km E of Matheson	ON	gold
Werner Lake Project	Canmine Resources Corporation	Werner Lake	ON	cobalt
Kasabonika Diamond Exploration	De Beers	Pickle Lake	ON	diamonds
Victor Project	De Beers Canada Inc	90 km W of Attawapiskat, James Bay Lowland Region	ON	diamonds

Aquarius Project	Echo Bay Mines Ltd	Timmins	ON	gold
McWaters	Liberty Mines Inc		ON	Nickel-copper
Redstone Mine	Liberty Mines Inc	24 km SE of Timmis	ON	Nickel
Holloway Mine	Newmont Canada Limited	60 km N of Kirkland Lake	ON	gold
South Africa Minerals	outhern Africa Minerals Corporation	Foleyet	ON	Anorthosite
Detour Lake	Pelangio Mines	Detour Lake	ON	gold
Marathon Project	Polymet	Marathon	ON	palladium
Island Gold	Richmont Mines	Wawa	ON	gold
Moss Lake Gold Mines Ltd	River Gold	Shebandowan	ON	gold
Matachewan Gold Mine	Royal Oak Mines	Matachewan	ON	gold
Spider Resources	Spider Resources	Wawa	ON	diamonds
Taylor AE Project	St.Andrews		ON	gold
Black Fox			ON	gold
La Ronde II	Agnico-Eagle	Cadillac	PQ	gold
Lapa	Agnico-Eagle	Cadillac	PQ	gold
Foxtrot Property	Ashton Mines	n of Otish Mountains	PQ	diamonds
Langlois	Breakwater Resurcees		PQ	
Raglan South	Canadian Royalties Inc	Ungava	PQ	nickel
Bloom Lake	Consolidated Thompson Iron Mines		PQ	iron
Eleonore	Goldcorp	James Bay Area	PQ	
Raglan West	Knights Resources Ltd	Ungava	PQ	nickel
Midway Project	Northern Star Mining	Malartic (east of)	PQ	gold
Canadian Malarctic	Osisko Exploratin		PQ	gold
Perseverence	Xstrata	Mattagami	PQ	zinc-copper
Raglan Expansion	Xstrata	Ungava	PQ	nickel
Fire Lake			PQ	
Goldex			PQ	
Lac Herbin			PQ	
Renard Project			PQ	
Bloom Lake Property	consolodate Thompson Iron Mines Limited	Normanville twp, Duplessis cty	QC	iron
Corner Bay Project	MSV Resources Inc., wholly owned subsid of campbell Resources Inc.,	55 km S of Chibougamau	QC	copper
Dore Lake	Osisko Exploration Ltee (?)	Chicoutimi	QC	vanadium
Amisk Lake Joint Venture	Cameco Corp	Denare Beach	SK	gold
Cigar Lake Project	Cameco Corp, Cogema Resources Inc, Idemitsu Uraniu	Cigar Lake	SK	uranium
Mid West Joint Venture	Cogema Resources, Uranerz Ltd, Denison Mines	Wollaston Lake	SK	uranium
Mcllvenna Bay Deposit	Foran Mining Co	Hanson Lake	SK	base metals
Goldfields Project	Greater Lenora Resources Corporation	Uranium City	SK	gold
Star Project	Share Gold Inc	Prince Albert	SK	Diamonds
Fort a la Corne Project	Shore Gold Inc	Prince Albert	SK	diamonds
Finlayson Project	Expatriate Resource	Pelly River	YK	lead-zinc
Keno Hill	BLM Mines	Mayo District	YT	lead-zinc-silver
Division Mountain	Cash Resources	Whitehorse Division	YT	coal

Schleelite Dome	Copper Ridge	Mayo District	YT	gold
Ice	Expatriate Resources	Ross River	YT	copper
Minto Project	Minto Exploration Ltd	Dawson City	YT	copper-gold-silver
Dublin Gulch Project	New Millennium Mining Ltd	Mayo	YT	gold
Wellgreen Property	Northern Platinum Ltd.	Haines Junction	YT	platinum-palladium-copper-nickel
Skukum Creek	Omni Resources	Wheaton	YT	gold-silver-lead-zinc
Fyre Lake	Pacific Ridge Exploration	Finlayson Lake	YT	copper- cobalt-gold
Clear Creek	Redstar Resources	Dawson District	YT	gold
Carmacks Project	Western Copper Holdings	Whitehorse Division	YT	copper
Ketza River	YGC Resources Ltd.	Ross River	YT	gold-silver
Mt Milligan	Terrane Metals	Prince George	BC	Coal
Brule			BC	Coal

Operating Mines						
Mine Name	Company	Location or Landmark	Province	Metal or Product		
Genessee Operations	Fording Coal Limited	Warburg	AB	coal	53 25 N	114 16 W
Grande Cache Coal	Grande Cache Coal	Grande Cache	AB	coal		
Cheviot Mine Project	Luscar Ltd, Consold of Canada Inc	Hinton	AB	coal	52 55 N	117 16 W
Paintearth Mine	Luscar Ltd.	Forestburg	AB	coal	52 N	112 W
Sheerness Mine AB	Prairie mines and royalty ltd	200 km NE of Calgary	AB	coal	51 27 N	111 48 W
Whitewood Operations	TransAlta Utilities Corp	Wabamun	AB	coal	53 30 N	114 50 W
Highvale Mine	TransAlta Utilities Corp.	Seba Beach	AB	coal	53 30 N	114 33 W
Eskay Creek Mine	Barrick Gold Corporation	83 km N of Stewart	BC	Gold, Silver		
Willow Creek	Global Tex / Dire Valley Coal	Chetwynd	BC	coal	56 00	122 00
Kemess Mine	Northgate Minerals Corporation	430 km NW of Prince George	BC	copper, gold		
Dillon	Western Canadian Coal Corp.	Chetwynd	BC	coal		
Wolverine Mine	Western Canadian Coal Corp.	25 km W of Tumbler Ridge	BC	coal		
Table Mountain			BC	gold		
Bernic Lake	Cabot Corporation	Lac du Bonnet	MB	lithium-cesium-rubidium	50 26 N	95 27 W
Tantalum Mining Operations	Cabot Corporation	Lac Du Bonnet	MB	tantalum-lithium	50 26 N	95 27 W
Birchtree Mine	CVRD Inco	48 km S of Thompson	MB	copper, nickel	55 ' 42 " N	97 ' 55 " W
Thompson Mine (T-1 & T-2)	CVRD Inco Limited	Thompson	MB	nickel-copper	55 43 N	97 51 W
777 Mine	HudBay Minerals Inc.	Flin Flon	MB	copper-zinc-gold-silver	54 63 N	101 50 W
Trout Lake Mine	Hudson Bay Mining & Smelting Co. Ltd.	Flin Flon	MB	copper-zinc-gold-silver	54 50 N	101 49 W
Callinan Mine	Hudson Bay Mining and Smelting Co. Ltd.	Flin Flon	MB	copper-zinc-gold-silver	54 45 N	101 40 W
Chisel North Mine	Hudson Bay Mining and Smelting Co., Limited	Snow Lake	MB	zinc, copper	54 50	100 W
Rice Lake Mine	San Gold Corporation	Bissett , 60 mi W of Campbell Red lake	MB	gold	51 1 N	94 40 W
San Gold # 1 Mine	San Gold Corporation	E of rice lake mine, near Bissett	MB	gold		
Rice Lake			MB	gold		
Voisey's Bay Deposit	Inco	Nain	NFLD	nickel	56 19 N	62 05 W
Iron Ore Company of Canada	Iron Ore Company of Canada	Labrador City	NFLD	iron	53 04 N	66 57 W
Duck Pond	Queenston Mining	Buchans	NFLD	copper-zinc-lead	48 45	57 15
Wabush Mine	Stelco Inc.	Labrador City	NFLD	iron	53 05' N	66 52' W
Meadowbank Project NU	Cumberland Resources Ltd.	70 km N of Baker Lake	NU	gold		
Jericho Mine	Tahera Diamond Corporation	400 km of NE Yellowknife	NU	diamonds		
Lupin			NU	gold		
Ekati Mine	BHP Billiton	300 km NE of Yellowknife	NWT	diamonds	64 45	110 30 W
Diavik Diamond Mine	Diavik Diamond Mine Inc., Aber Diamong Corp.,	300 km NE of Yellowknife, Lac de Gras area	NWT	diamonds		
Agrium Phosphate Mine	Agrium Products Inc.	Kapaskasing	ON	phosphate	49 15 ' N	82 45 ' W
Montalm Project	Falconbridge	Timmins	ON	nickel-copper	48 40	82 05

Kidd Creek Mine	Falconbridge Ltd.	Timmins	ON	zinc-copper-silver-lead-cadmium	48 41 N	81 22 W
Campbell Mine	Goldcorp Inc	Balmertown, Red Lake Twp.	ON	Gold	51 03 N	93 46 W
Red Lake Mine	Goldcorp Inc	Balmerton	ON	gold	51 03 N	93 43 W
Hoyle Pond	Kinross Gold Corporation	Schumacher	ON	gold	48 32	81 05
Macassa Mine	Kinross Gold Corporation	Kirkland Lake	ON	gold	48 14 N	80 07 W
Redstone Mine	Liberty Mines Inc		ON	nickel		
Lac des Iles Mine	North American Palladium Ltd	Thunder Bay	ON	platinum grp metals-gold-copper-nickel-palladium	49 10 N	89 37 W
Musselwhite Mine	Placer Dome Inc, TVX Normandy Americas	Pickle Lake	ON	gold	52 57' N	90 22' W
Dome Mine	Placer Dome Inc.	South Porcupine	ON	gold	48 00 N	80 50 W
Eagle River Mine	River Gold Mines Ltd.	Wawa	ON	gold	47 59 N	85 28 W
Clavos Mine	St-Andrews Goldfields Ltd.	10 km NW of Stock Mine & Mill	ON	gold		
David Bell Mine	Teck Corp, Homestake Canada Inc.	Marathon	ON	gold	48 40 N	85 53 W
Williams Mine	Teck Corp, Homestake Canada Inc.	Marathon	ON	gold	48 42 N	85 55 W
Casa Berardi West	Aurizon Mines Ltd		PQ	Gold		
Croinor	South-Malartic Explorations Inc.	Val d'Or	PQ	gold		
East Amphi			PQ	Gold		
Kiena			PQ	Gold		
Langlois			PQ	zinc		
LaRonde Mine	Agnico-Eagle Mines Ltd	Val d'Or	QC	gold-silver-copper-zinc	48 15 N	78 26 W
Langlois Mine	Breakwater Resources Ltd	Val d'Or	QC	zinc-copper-gold-silver	49 15 N	76 45 W
Mouska Mine	Cambior Inc.	Destor	QC	gold	48 17 N	78 34 W
Doyon Mine	Iamgold	Rouyn-Noranda	QC	gold	48 15 N	78 31 W
Niobec	Iamgold	Chicoutimi	QC	niobium	48 32 N	71 09 W
Sleeping Giant Mine	Iamgold	Amos	QC	gold	49 08 N	77 58 W
Troilus Mine	Inmet Mining Corporation	175 km N of Chibougamau	QC	copper, (Gold? 2001)	51 00 N	74 30 W
Orleans Wollastonite Operation	Orleans Resources Inc.	Lac St-Jean	QC	wollastonite	49 10 N	71 33 W
Mont-Wright	Quebec Cartier Mining Company	Mount Wright	QC	iron	52 46 N	67 20 W
Lac Tio	Quit-Fer et Titane Inc.	Havre St-Pierre	QC	iron-titanium	50 33 N	63 25 W
Beaufor Mine	Richmont Mines Inc.	Val d'Or	QC	gold	48 33 N	77 33 W
East Amphi U/G Project	Richmont Mines Inc.	Malartic	QC	gold	48 10 N	78 10 W
Tio Mine	Rio Tinto / QIT - Fer et Titane Inc.	Havre Saint-Pierre	QC	ilmenite & titanium	50 33 N	63 25 W
Kiena Complex	Wesdome Gold Mine Ltd.	Malartic	QC	gold	48 06 n	77 35 w
Raglan Mine	Xstrata	65 km S of the Northern Tip of Ungava Peninsula (Katinniq)	QC	cobalt, copper, nickel, precious metals	61 39 N	73 41 W
McClellan Lake Mine	AREVA Resources	Wollaston Lake	SK	uranium	58 22 N	103 50 W
McArthur River Mine	Cameco Corp, Cogema Resources Inc.	Key Lake	SK	uranium	57 46 N	105 03 W
Key Lake	Cameco Corporation	Pine House	SK	uranium	57 11 N	105 34 W
Seabee	Claude Resources Inc.	La Ronge	SK	gold	54 41 N	103 37 W
Keno Hill			YK	zinc-lead-silver		

