Mining Sector Performance Report

2014–2023

Energy and Mines Ministers' Conference
Prince Edward Island July 2025

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Executive Summary

The Mining Sector Performance Report (MSPR) presents economic, social, and environmental indicators to measure trends in Canada's minerals sector. The MSPR is intended to provide a baseline understanding of the sector's performance based on credible and reliable data. These data provide a foundation for understanding and managing areas of strengths and weaknesses in the sector.

The indicators are selected based on:

- international mineral performance reporting practices,
- input from provinces and territories,
- consultation with an external advisory committee composed of individuals from academia, the industry, and Indigenous and non-governmental organizations, and
- data availability.

The MSPR benefits from the insight and guidance of academia, the industry, industry associations, non-governmental organizations, and provincial, territorial, and federal governments. It is presented to federal, provincial, and territorial Mines Ministers every three years at the Energy and Mines Ministers' Conference.

The main findings of the current report, based on the economic, social, and environmental indicators are highlighted below.

Canada is widely regarded as a high-performing jurisdiction within the global minerals sector, already demonstrating excellence across these indicators. The country has a strong regulatory framework helping ensure responsible mining practices that balance economic growth with environmental stewardship and social responsibility. While continual improvement is a key objective (e.g., addressing climate change, advancing social equity), Canada's regulatory, environmental, and social practices are often considered benchmarks for other nations. However, maintaining this leadership role requires ongoing innovation and collaboration to address emerging challenges.[1]

The **economic performance** of Canada's minerals sector over the 10-year period from 2014 to 2023 has been largely positive with respect to many economic indicators, which is consistent with global mineral and metal price trends. The table below summarizes the gains across many indicators. A decrease was seen for public geoscience expenditures while all other indicators demonstrated increases.

[1] https://natural-resources.canada.ca/minerals-mining/responsible-mining

Economic Indicators at a Glance (2014-23 unless otherwise indicated)	
Real value of mineral production	+3% average annual increase
Gross Domestic Product (minerals sector)	+0.3% average annual increase
International trade	A. +3% average annual growth in exports B. Consistently positive contribution to balance of trade
Public geoscience expenditures	-1% average annual decrease*
Exploration and deposit appraisal expenditures	+8% average annual increase
Capital expenditures	+5% average annual increase
Business expenditures on research and development (2016, 2018-23)	+1% average annual increase
Government revenues (2013–2022)	+14% average annual increase

Improved performance
> +1.0%

Limited change between
+1.0% and -1.0%

Decline in performance
< -1.0%

* Performance cannot be determined based on this metric and no colour-coding is applied.

Overall, trends in the minerals sector's **social performance** have been variable between 2014 and 2023 (see Indicators at a Glance, below). Improvements were seen in terms of public funding for participation in the impact assessment process; representation of women and employees identifying as Indigenous, immigrants, and visible minorities; and rates of fatal workplace incidents. Marginal change or decreasing trends were seen in overall employment numbers; average hourly wages of women and employees identifying as either immigrants or visible minorities; nonfatal workplace incidents; mine closures; and strikes and lockouts.

Social Indicators at a Glance
(2014–2023 unless otherwise specified)

Employment	+1% average annual increase
Indigenous employment	+7% average annual increase
Skilled Labour Supply (2014-2021)	-1% average annual decrease
Public funding for participation in the impact assessment process (mining-related projects 2014/15-2019/20)	+18% average annual increase*
Gender, diversity, and inclusion (colour coding is approximate, based on medians)	**Women:** • +2% average annual increase (% of employees) • +1% average annual increase (average hourly wage)
	Immigrant employees (2014-21): • +1% average annual increase (% of employees) • +0.3% average annual increase (average hourly wage)**
	Visible minority employees (2014-21): • +2% average annual increase (% of employees) • +0.2% average annual increase (average hourly wage)**
Workplace health and safety* ** (2014-22)	-3% average annual decrease (fatal)
	+3% average annual increase (non-fatal)
Mine closures and openings* **	10 closed/suspended operations per year (average) 7 opened/re-opened operations per year (average) (30% difference favouring closed/suspended)
Strikes and lockouts* **	+20% average annual increase

Improved performance > +1.0%

Limited change between +1.0% and -1.0%

Decline in performance < -1.0%

* Performance cannot be determined based on this metric and no colour coding is applied. Please refer to the Appendix A – Data Considerations for more information.

** Median of average hourly wage between upstream mineral and mining and downstream mineral and mining subsectors

*** Negative average annual growth rate in some performance indicators implies improvement.

Environmental performance of the minerals sector has improved in limited areas between 2014 and 2023 while other areas show little change or decreased performance (see Indicators at a Glance, below).

Quantities of waste and tailings disposal and reported quantities of National Pollutant Release Inventory (NPRI) substances released to surface water have all increased. Compliance rates for NPRI-prescribed deleterious substances, pH, and fish toxicity have remained consistently between 99% and 100%, except for 2022 when the rate was 98%. However, it is important to note here that changes in these indicators do not provide direct evidence of environmental performance.

Environmental Indicators at a Glance
(2014–2023 unless otherwise specified)

Waste and tailings disposal	+4% average annual increase in reported quantity of NPRI substances per facility*
Mine effluent and discharges to surface water	-0.03% average annual decrease in percent of MDMER-submitted data within authorized limits
	+2% average annual increase in the reported quantity of NPRI substances released to surface water*[t]
Air emissions**	-9% average annual decrease (tonnes SO_2/facility)
	-0.02% average annual decrease (tonnes NO_x/facility)
	+0.3% average annual increase (tonnes $PM_{2.5}$/facility)
	+4% average annual increase (tonnes PM_{10}/facility)
Energy consumption and intensity**	+2% average annual increase in energy consumption
	+2% average annual increase in energy intensity
GHG emissions	-3% average annual decrease in GHG emissions intensity
Environmental expenditures (2014, 2016, 2018-21)	+10% average annual increase in environmental protection expenditures

Improved performance > +1.0%

Limited change between +1.0% and -1.0%

Decline in performance < -1.0%

* Performance cannot be determined based on these metrics and no colour coding is applied as these quantities do not provide direct evidence of environmental performance. Please refer to the *Data Considerations* subsection for this indicator for more information.

** Negative average annual growth rate in some performance indicators implies improvement.

[t] 2014 does not include releases resulting from Mount Polley incident.

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Preface

The 2025 edition of the *Mining Sector Performance Report* (MSPR) examines the economic, social, and environmental performance of the Canadian minerals industry from 2014 to 2023. The report is intended for all interested readers including government decision-makers, academic researchers, industry, industry associations, non-governmental organizations, and members of the public. It benefits from insight, comments, and review from the provinces and territories and a multi-stakeholder advisory committee with membership from industry, industry associations, non-governmental organizations, and academia.

The MSPR was initiated at the 2008 Energy and Mines Ministers' Conference (EMMC) in response to concerns about uranium exploration and mining, and the negative public perception that threatened the industry's social licence to operate. Following the release of the Earning a Social Licence to Operate report in 2009, the ministers agreed to assess the minerals sector's social, economic, and environmental performance over the previous decade. This assessment, published as the first MSPR in 2010, provided evidence to guide future priorities and communicate progress with stakeholders. The MSPR has been published every three years since.

The current report was prepared by the Intergovernmental Working Group on the Mineral Industry for submission in July 2025 to the EMMC in Prince Edward Island.

The 10-year range of interest in this edition of the report is 2014–2023.

The report focuses on:

- domestic activities of the sector,
- national-level indicators and, when possible and relevant, data by jurisdiction, and
- describing performance trends rather than determining causality among metrics.

In this report, the terms *minerals sector* and *minerals industry* are used interchangeably and include the following North American Industry Classification System (NAICS) codes:

- NAICS 212 – mining and quarrying (excluding oil and gas);
- NAICS 327 – non-metallic mineral product manufacturing;
- NAICS 331 – primary metal manufacturing; and,
- NAICS 332 – fabricated metal product manufacturing.

In this context, *mining industry* would generally refer to activities within NAICS 212 – mining and quarrying (excluding oil and gas). For some indicators (e.g., gross domestic product, employment, investment), additional data related to the mineral exploration subsector are available and included in sector totals.[2] This is noted in the text, figures, or tables when relevant.

[2] Within Statistics Canada's *System of National Accounts,* data related to a special tabulation titled NAICS 21311B – support activities for mining are available. This special classification is an aggregation of NAICS 213117 – contract drilling (except oil and gas) and NAICS 213119 – other support activities for mining, and captures establishments engaged in mineral exploration and drilling, as well as service companies operating on a fee or contract basis. This subsector does not include mining industry suppliers that service multiple sectors (e.g., transportation, construction, finance, legal).

The data excludes oil sands activity, which falls under Code 211120 – Crude Petroleum Extraction (crude petroleum from oil sand). Data and analysis considerations are explained where applicable to provide the reader with an understanding of specific data constraints.[3] Relevant data are complete to year-end 2023 unless otherwise noted.

In contrast to previous editions, the current report attempts to correct data expressed in Canadian dollars with respect to effects of inflation. This change was made in light of the relatively high inflation rates of recent years which could otherwise obscure trends in value- or dollar-based datasets. The constant dollars calculation was done using implicit price index data from Statistics Canada (StatCan table 36-10-0130-01) and setting 2023 as the base year (2023 = 1.00).

A similar correction for the effects of inflation was also applied to datasets regarding dollar values of mineral production and commerce (e.g., production value, international trade). The calculation was based on the Bank of Canada's Metals and Minerals Price Index where the index for each year was divided by the 2023 value (i.e., 2023 = 1.00). This annual value was then applied as a denominator to dollar values in the various datasets.

[3] For example, nominal values are used for most indicators as data in real terms are unavailable due to the lack of a mineral-specific deflator. As such, trends highlighted in the report for some indicators (e.g., production and exports) reflect price fluctuations.

Introduction

Canada's natural resources are central to its economy and history. The minerals industry has been and continues to be a key driver of growth and prosperity across the country. Mining supports the livelihood of many rural, remote, and northern communities.

Our society relies on mined products to supply raw materials for industries such as technology, construction, energy, and manufacturing. Mined commodities like copper,[4] nickel,[5] and gold are crucial for domestic production, driving economic growth and technological advancement. Canada is positioning itself as a global leader and secure and reliable source of critical minerals for emerging technologies and in support of our security and modern economy.

With abundant mineral and metal reserves, Canada ranks among the top producers of over 60 minerals and metals at 200 mines and 6,500 pits and quarries. Canada ranks among the top producers of many commodities including potash, uranium, gold, aluminum, nickel, and diamonds. Canada's clean electricity grid makes its production of these materials among the least carbon-intensive worldwide.

Canada faces a generational opportunity in critical minerals for its workers, economy, and net-zero future (see Section 1.1, below). As Canada and the rest of the world move towards a greener and more digital economy, the demand for critical minerals and the products made from them is expected to rise significantly in the coming years. Projections suggest that without increased production, processing, and recycling of these minerals, supply shortages will occur. Further, the production and processing of many critical minerals are concentrated in a few regions, which makes the supply chain vulnerable to economic, geopolitical, and environmental risk factors. With its abundant resources and strong manufacturing capabilities, Canada is well placed to become a key and dependable supplier of critical minerals and value-added products to global markets.

By strengthening expertise across the critical mineral supply chain, Canada can drive economic growth, tackle climate change, and enhance supply chain resilience for itself and its allies. This should be done in alignment with the Government of Canada's commitment to reconciliation with Indigenous Peoples, emphasizing meaningful consultation, engagement, environmental stewardship, and economic opportunities. Critical mineral development must prioritize sustainability and minimize environmental impacts through conservation, reclamation, and a "nature-forward" approach. This approach includes preserving biodiversity, protecting endangered species, and integrating innovative recycling technologies.

Other global trends are also coming to bear on Canada's minerals sector, including coordinated border management, supply chain traceability (Box 4), and tariffs and market manipulation (see Section 1.1, below). As a major global player, Canada exports substantial volumes of minerals, metals, and their products, which requires collaboration with international partners to manage the logistics of cross-border trade, regulatory compliance, and environmental standards. Ensuring traceability throughout the supply chain is critical to meeting growing demand for transparency in mining, particularly in areas like critical minerals where ethical and environmental aspects of trade are increasingly scrutinized.

Canada has frameworks in place to address some of these concerns, but issues such as market manipulation (e.g., export control, supply disruption, tariffs) remain a risk in the global market. The Canadian government and industry stakeholders continue to push for stronger regulations and technologies to mitigate these risks and ensure fair practices and integrity within the minerals sector.

All of these opportunities and risks only serve to highlight the need for reliable data on Canada's minerals sector. Accurate and transparent data is essential for decision-making and ensuring the sector remains resilient, able to effectively manage potential risks, and ready to capitalize on emerging trends.

[4] Included on Canada's critical minerals list.

[5] Included on Canada's critical minerals list.

Canada's long history in mining has made it a leader in knowledge, skills, and innovation, helping to drive its prosperity. However, the wealth from mining comes with environmental responsibilities. These responsibilities include managing, mitigating, or eliminating habitat loss, tailings spills, greenhouse gas emissions, and abandoned mines.

To measure progress and identify gaps in these areas, federal, provincial, and territorial governments have collaborated with stakeholders from academia, industry, and non-governmental organizations to produce this report.

The Mining Sector Performance Report (MSPR, Box 1) is presented to federal, provincial, and territorial Mines Ministers every three years and it has three objectives:

1. To provide Canadians with a baseline understanding of the sector's performance based on credible and reliable data;
2. To identify areas where improvements have been made and where progress is still needed; and
3. To inform development of priorities for collaborative work being carried out by the federal-provincial/territorial Energy and Mines Ministers' Conference and the Intergovernmental Working Group on the Mineral Industry.

Box 1: Mining Sector Performance Report, 2011–2020

Presented to Canada's Mines Ministers at their annual conference in July 2022, the report examined the economic, social, and environmental performance of the minerals sector from 2011 to 2020.

To achieve these objectives, the current report measures the performance of 22 indicators over the period 2014–2023.[6] These indicators are generally the same as those used in previous editions so that trend comparisons can be made over time; however, some changes are noted in the paragraphs below.

The dataset supporting the indicator *Agreements Between Mineral Companies and Indigenous Communities*, which appeared in previous editions, was retired because these agreements have become commonplace as companies increasingly recognize the need to engage and partner with communities. As establishing agreements became the standard approach, their reporting became unreliable and the quality of the dataset could not be assured.

The *Gender Diversity* indicator from the 2022 edition has been expanded and renamed *Gender, Diversity, and Inclusion* to reflect a broader range of indicators enabled by additional datasets and to align with the terminology used by Statistics Canada.[7] Similarly, the *Skilled Labour Supply* section now includes additional data on age, education, and demographics of the minerals sector workforce.

[6] As with the 2022 Edition, the data time sets for this report were shifted back by one year compared to pre-2019 editions. The original decision to do so was based on the feedback of advisory committees to facilitate data collection and reduce chances of error based on late-arriving data.

[7] https://www.statcan.gc.ca/hub-carrefour/gdis-sgdi/index-eng.htm

Performance indicators were selected based on those included in previous editions of the MSPR as well as: (i) international mineral performance reporting practices; (ii) input from provinces and territories; (iii) consultation with an external advisory committee composed of individuals from academia, industry, and Indigenous and non-governmental organizations; and (iv) data availability.

The structure of previous editions of the MSPR was modelled on a set of desired performance outcomes for the minerals sector drawn from the Whitehorse Mining Initiative (1993)[8] and the Mining, Minerals, and Sustainable Development North America initiative[9] multi-stakeholder frameworks.

While the overall structure of the current edition of the MSPR remains unchanged, the conceptual basis for the MSPR now draws from several key frameworks and initiatives influencing Canada's minerals and metals sector. These frameworks include the Canadian Critical Minerals Strategy,[10] the Canadian Minerals and Metals Plan (CMMP)[11] and the UN's Sustainable Development Goals,[12] in addition to the Mining, Minerals and Sustainable Development North America initiative.

The report is organized into four sections:

- **Section I** provides an overview of the key **global trends** and developments currently shaping the operating context of the minerals sector; and
- **Sections II, III, and IV** present the minerals sector's **economic, social, and environmental** performance based on the selected indicators.

This report presents the reader with the long-term trends of selected indicators for social, environmental, and economic performance. While considering these trends, it is critical to bear in mind that these three pillars are interwoven, and the reader must consider the data herein as a whole to assess the performance of the mining industry.

Finally, this report was developed in collaboration with federal, provincial, and territorial governments, and in consultation with the external multi-stakeholder advisory committee. As such, all data, findings, and broad conclusions contained in this report have been reviewed by a range of stakeholders.

[8] At the 1992 Mines Ministers' Conference in Whitehorse, Yukon, ministers agreed to become co-sponsors and trustees of a process called the Whitehorse Mining Initiative. This multi-stakeholder process included representatives from five sectors of society: the mining industry, senior governments, labour unions, Aboriginal peoples, and the environmental community. The initiative concluded with the Leadership Council adopting a signed Accord on September 13, 1994, which expressed a vision of "a socially, economically, and environmentally sustainable, and prosperous mining industry, underpinned by political and community consensus."

[9] The Mining, Minerals, and Sustainable Development (North America) initiative was established by the World Business Council for Sustainable Development as one of a number of projects being supported by the Global Mining Initiative. It was formed as an independent process of multi-stakeholder engagement and analysis with the objective of "identifying how mining and minerals can best contribute to the global transition to sustainable development."

[10] https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadas-critical-minerals-strategy.html

[11] At the 2019 Prospectors and Developers Association of Canada (PDAC) conference, federal, provincial and territorial Mines Ministers, along with industry and Indigenous representatives, launched the **Canadian Minerals and Metals Plan (CMMP)**. A bold new vision for Canada's minerals and metals sector, the CMMP includes targets and actions for governments, industry, and stakeholders to support a competitive, sustainable, and responsible industry that adapts to the realities of the modern economy.

[12] The United Nations' Sustainable Development Goals (SDGs) are a collection of 17 global goals set by the United Nations General Assembly in 2015. The SDGs are part of Resolution 70/1 of the United Nations General Assembly: "Transforming our World: the 2030 Agenda for Sustainable Development."

Section 1: Canada's Minerals Industry Operates in a Dynamic and Evolving Global Context

1.1 Global economic trends influence Canada's minerals industry[13]

Sluggish global economic growth

Demand for most minerals and metals is linked to global economic growth, which is expected to remain modest in 2025, expanding 3.3% annually through 2026, below the historical average of 3.7%. Slowdowns in the U.S., European area, and Japan will be offset by growth in emerging economies, particularly China and India.

U.S. growth is projected to decline from 2.7% in 2025 to 2.1% in 2026, while the European area grows at 1.0%, with Germany at risk of recession. Japan's growth is expected at 1.1% in 2025 and 0.8% in 2026.

China's growth will slow from 5.2% in 2023 to 4.5% in 2025, due to urbanization decline, a property slump, and trade restrictions. India's economy is projected to grow 6.5% in 2024-25, driven by strong private consumption despite inflation and slow credit growth.

Lacklustre demand for minerals and metals apart from gold

In 2025, metals and minerals markets may face challenges from global economic fracturing, protectionist trade policies, slow economic growth, and inflation. A more hawkish U.S. Federal Reserve could strengthen the U.S. dollar, pressuring commodity markets. Geopolitical tensions, trade issues, and efforts to reduce reliance on China for critical minerals will continue to disrupt supply chains and trade, leading to volatile prices.

Global demand for base metals like aluminum, nickel, and copper is expected to grow modestly or remain stable. The **aluminum** market is stable but could face disruptions with the imposition of U.S. tariffs, while Canada's industry remains competitive due to low energy costs. **Nickel** is in surplus, with low prices driven by increased Indonesian production and shifting EV demand. **Copper** demand will rise, though U.S. policy changes and lower output from major mines could limit growth.

Steel demand has declined for three years, but a modest recovery is expected in 2025, driven by India and Southeast Asia, while China's demand continues to decline.

Iron ore supply growth is slowing, with Canadian exports stable at 60 million tonnes. Strong performance in Brazil and South Africa is offset by a decline in China, with a further slowdown expected in 2025.

The **lithium** market remains oversupplied, with weak prices, while **cobalt** prices are anticipated to stay low due to oversupply and reduced demand from changes in battery technology. **Metallurgical coal** demand is weak despite growth in India, but supply will rise in 2025 from new projects and restarts in Australia and Canada.

Factors such as U.S. interest rate uncertainty, geopolitical tensions, and trade policies could push the already record-high **gold** prices ever higher.[14] Canada, the fourth-largest gold producer globally, mined gold in 10 provinces and exported 19 tonnes of mined and 320 tonnes of refined gold in 2023, valued at Can$27.4 billion. The U.S. and U.K. were the main export destinations. Gold is expected to remain Canada's most valuable mineral commodity.

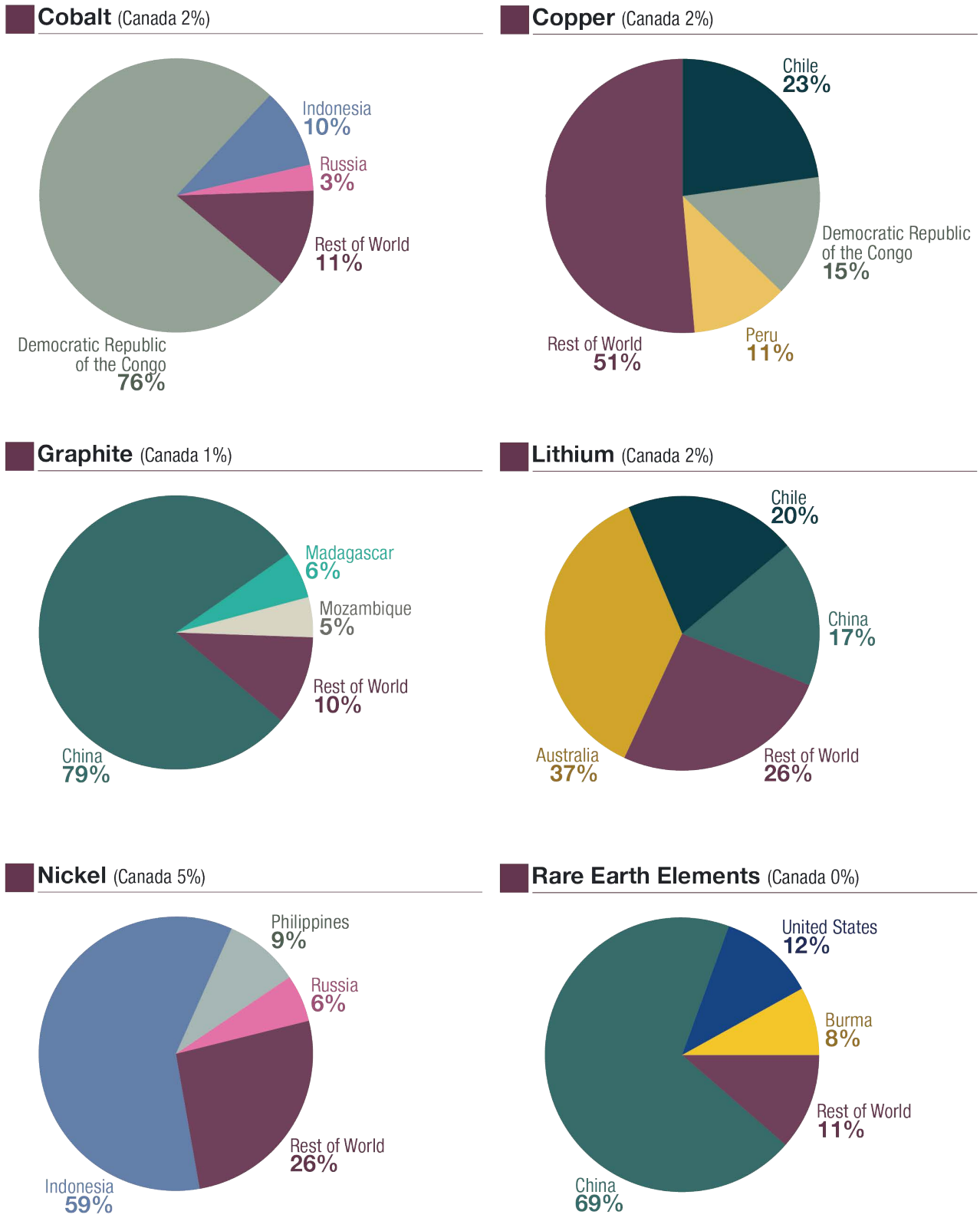
Critical minerals

Of Canada's 34 critical minerals (Box 2), six are "prioritized for their distinct potential to spur Canadian economic growth and their necessity as inputs for priority supply chains" (Canadian Critical Minerals Strategy, 2022). These six critical minerals are lithium, natural graphite, nickel, cobalt, copper, and rare earth elements (Figure 1).

[13] This chapter is current as of February 21, 2025.

[14] Gold price was Can$4,304 per oz as of March 26, 2025 (World Gold Council).

Figure 1: Share of top three producing countries in production of key critical minerals, 2024



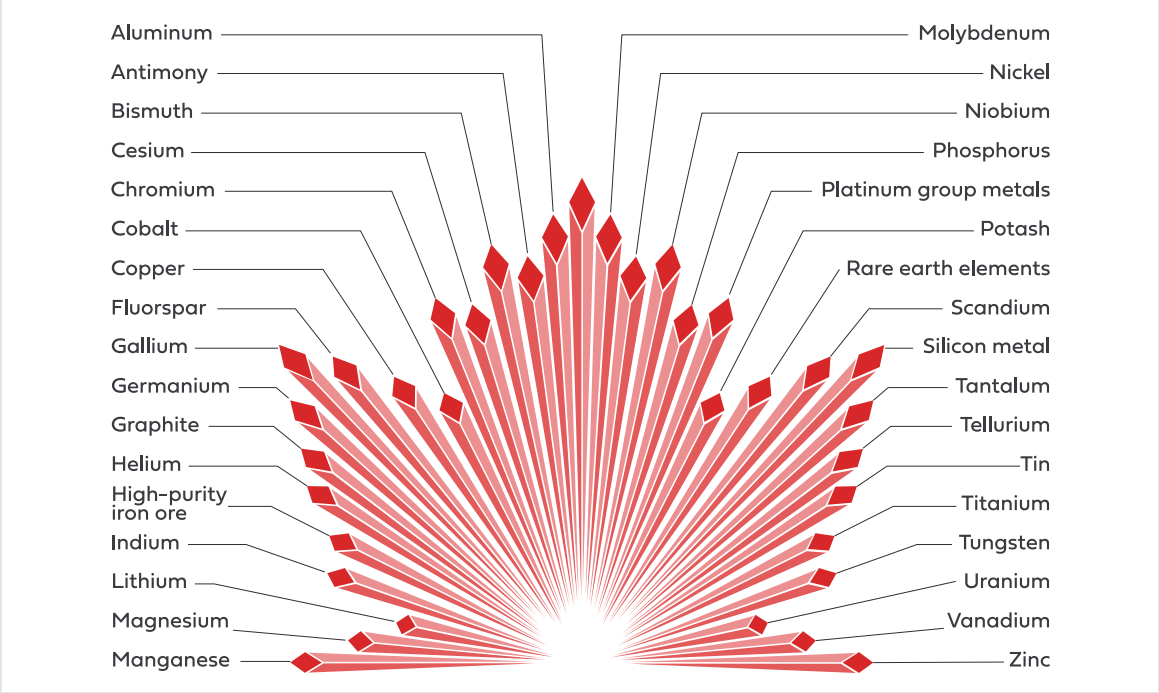
Source: USGS

In 2025, production of key critical minerals will be highly concentrated, with the top three producing countries controlling over three quarters of global output. The Democratic Republic of the Congo and China account for 75% and 80% of global cobalt and graphite production, respectively. Indonesia produces 60% of global nickel, while China mines 70% of the world's rare earth elements.

The level of concentration is even higher for processing operations where China has a strong presence across the board (IEA, 2024). High levels of concentration, compounded by complex supply chains, increase the risks that could arise from physical disruption, trade restrictions, or other developments in major producing countries.

Box 2: Critical Minerals

Canada's updated critical minerals list was published on June 10, 2024. Canada's criteria for a critical mineral are that it be either essential to Canada's economic security and supply is threatened, required for the transition to a low-carbon economy, or needed by our partners and allies. The original 31 critical minerals remained on the list according to these criteria and three new minerals were added: high-purity iron (HPI), phosphorus, and silicon metal (see below).



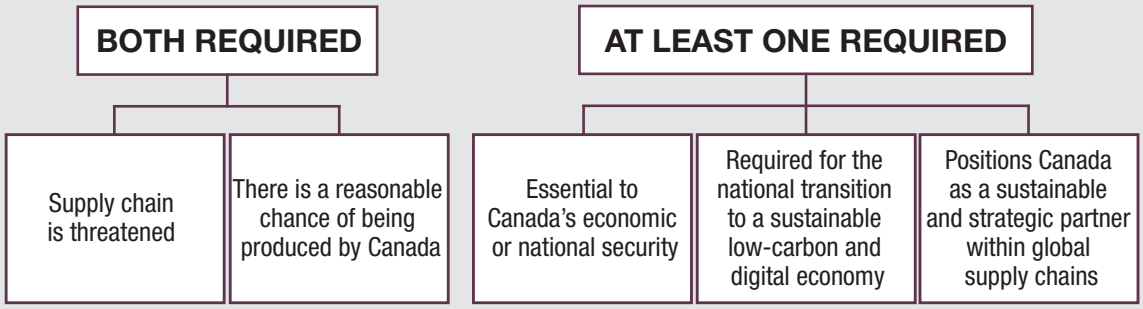
HPI was selected for its crucial role in the steel industry's decarbonization. The inclusion will bolster Canada's burgeoning green steel value chain, which has recently received significant investment.

Phosphorus was added for its use in lithium-iron-phosphate (LFP) batteries—a next-generation battery that does not need cobalt and boasts an extended lifespan. It is an important ingredient in fertilizers, making it essential to food security. Processing of phosphorus and production of LFP batteries is currently concentrated in China.

Silicon metal is essential in solar cells, semiconductors, and next-generation energy storage, and has virtually no substitutes. Silicon metal is considered a critical mineral by six other countries, and the governments of Quebec, Newfoundland and Labrador, Saskatchewan, and the Northwest Territories advocated for its inclusion.

The process to update Canada's critical minerals list included public engagement sessions and submissions from industry, Indigenous organizations, environmental groups, and members of the public, along with federal government departments and provincial, territorial, and municipal governments. Public consultation lasted from December 11, 2023, until February 16, 2024, and over 150 stakeholder submissions were received and reviewed.

The engagement process led to an expanded definition of a critical mineral in Canada:



Mine lead times

Mine lead times, from discovery to production, are a major concern in the mining industry. The process has three stages: (1) discovery, exploration, and feasibility studies (this stage includes permitting); (2) construction decision; and (3) construction to production startup. Data from 136 projects show that lead times vary based on factors including the target commodity, processing method, geography, mine type (e.g., underground, open pit), and government regulation. Nickel mines take the longest, while gold mines take the least time. Exploration budgets in Canada provide an indication to potential future mine operations entering the development pipeline. In 2023, gold had the largest share of exploration budgets by far, at 57% of the top 14 commodities[15] , followed by nickel[16] (12%), copper[17] (9%), lithium[18] (8%), and uranium[19] (5%).

Canada performs well in construction to startup time, but the discovery and feasibility stages (14.1 years) exceed the average of 12.3 years (Table 1). It should be noted that globally speaking, the shorter lead times for some jurisdictions can be associated with less robust environmental permitting regimes, thereby complicating any direct comparisons between the lead times of countries.

[15] S&P Global

[16] Included on Canada's critical minerals list.

[17] Included on Canada's critical minerals list.

[18] Included on Canada's critical minerals list.

[19] Included on Canada's critical minerals list.

Table 1: Average lead times of mines from discovery to production in years, 2002 to Q1 2024

Country*	Average lead time (years)	Discovery, Exploration, Feasibility Studies (years)	Construction Decision (years)	Construction to Startup (years)	Number of mines (years)
Russia	21.8	17.8	1.8	2.2	5
New Caledonia	21.5	13.5	1.5	6.5	2
Indonesia	21.0	16.2	1.0	3.8	5
Brazil	20.2	15.3	1.7	3.2	6
Philippines	19.0	14.3	2.3	2.5	4
Canada	**18.0**	**14.1**	**1.3**	**2.6**	**11**
Australia	17.1	12.4	3.3	1.4	14
All mines	**16.3**	**12.3**	**1.7**	**2.3**	**136**
Ghana	17.5	13.0	1.5	3.0	4
Chile	17.4	14.3	1.1	2.0	7
Mexico	16.4	12.9	1.1	2.4	8
Ecuador	15.5	8.5	2.5	4.5	2
China	15.2	12.4	1.4	1.4	5
Peru	14.8	10.8	2.1	1.9	8
Zambia	14.7	8.3	1.7	4.7	3
Burkina Faso	14.4	12.1	1.0	1.3	9
Argentina	14.3	11.3	1.0	2.0	4
Democratic Republic of the Congo	14.0	11.3	2.0	0.8	4
United States	13.0	8.7	1.3	3.0	3
Mongolia	13.0	9.0	1.5	2.5	2
Türkiye	12.0	7.8	2.0	2.3	4
Laos	11.3	9.0	1.7	0.7	3
Côte d'Ivoire	10.0	8.0	0.5	1.5	2

*The list includes countries with at least two mines

Sources: S&P Global Market Intelligence and Wood Mackenzie

1.2 Expectations for socially conscious and environmentally responsible mining continue to rise

The minerals sector continues to progress in performing resource development activities in a more responsible and sustainable manner. Efforts in these areas support the strength of what earlier editions of the MSPR referred to as the industry's *social licence to operate*,[20] an idea that companies must adopt to maintain the acceptance of communities and stakeholders for their operations, acknowledging that a regulatory licence alone is insufficient to secure community support for mining.

Industry associations have established principles, programs, and guidelines underscoring the importance for companies to engage in a meaningful manner with host communities, contribute to community development and social well-being, apply ethical business practices, respect human rights, protect the environment, adopt responsible governance and

[20] https://mininghalloffame.ca/jim-cooney/

management systems, commit to project due diligence and risk assessment, and safeguard the health and safety of workers and local populations.[21]

The concept of environmental, social, and governance (ESG) criteria continues to gain momentum in investment decision-making across a range of Canadian industries including mining (Box 3). Canadian mining has been at the forefront of this trend since 2004 when the Mining Association of Canada launched the Towards Sustainable Mining® (TSM®) Standard as the first mining-focused and independently assured ESG mining standard with Community-of-Interest oversight in the world.

Box 3: ESG Investing and the Minerals Sector

Society's expectations for sustainable business practices are growing and investors are increasingly incorporating non-financial ESG considerations in their decision-making process. This puts pressure on mining companies to strengthen their ESG reporting. ESG has three main considerations:

- Environmental: physical risks from climate change, greenhouse gas (GHG) emissions, energy use, waste management, water management, and biodiversity.
- Social: supply chain efficiency, human rights, Indigenous rights, diversity, inclusion, and representation of all genders in the workplace, employee health and safety, and community relations and safety.
- Governance: integrity of a company's corporate activities and leadership, transparency, ethics, and board composition.

ESG is consistently identified as both a top opportunity and risk for companies in the natural resources sector.[22] Please refer to Box 4 on *Traceability* as these topics are closely related.

ESG frameworks provide a mechanism to monitor and report on sustainability initiatives needed to attract capital, foster talent, and cultivate the social licence that supports the green energy transition and low-carbon projects. Measurement and monitoring of ESG is challenging, especially when ambitious targets for reducing emissions, scaling of clean technologies, and contributions to community well-being are included.

ESG standards used by the Canadian mining industry include the International Financial Reporting Standards (IFRS), Sustainability Disclosure Standards, and the Mining Association of Canada's Towards Sustainable Mining program (Box 11) with some regional mining associations (e.g., Quebec Mining Association) following suit.[23] The Prospectors and Developers Association of Canada (PDAC) recently marked 20 years of its *Driving Responsible Exploration* initiative (formerly Environmental Excellence in Exploration or "e3 Plus") by updating their toolkits for environmental stewardship, health and safety, and social responsibility.[24] Natural Resources Canada's Critical Minerals Infrastructure Fund has funded projects incorporating ESG principles such as community access and safety, connection to low-emission electricity grids, improved infrastructure, and partnerships with Indigenous communities.[25]

[21] See: https://www.minescanada.ca/en; https://natural-resources.canada.ca/minerals-mining/mining-policy-taxation-industry/minerals-metals-policy ; https://pdac.ca/driving-responsible-exploration ; and http://mining.ca/towards-sustainable-mining.

[22] https://www.ey.com/en_ca/mining-metals/risks-opportunities

[23] https://mining.ca/towards-sustainable-mining/how-tsm-works/components-of-tsm/

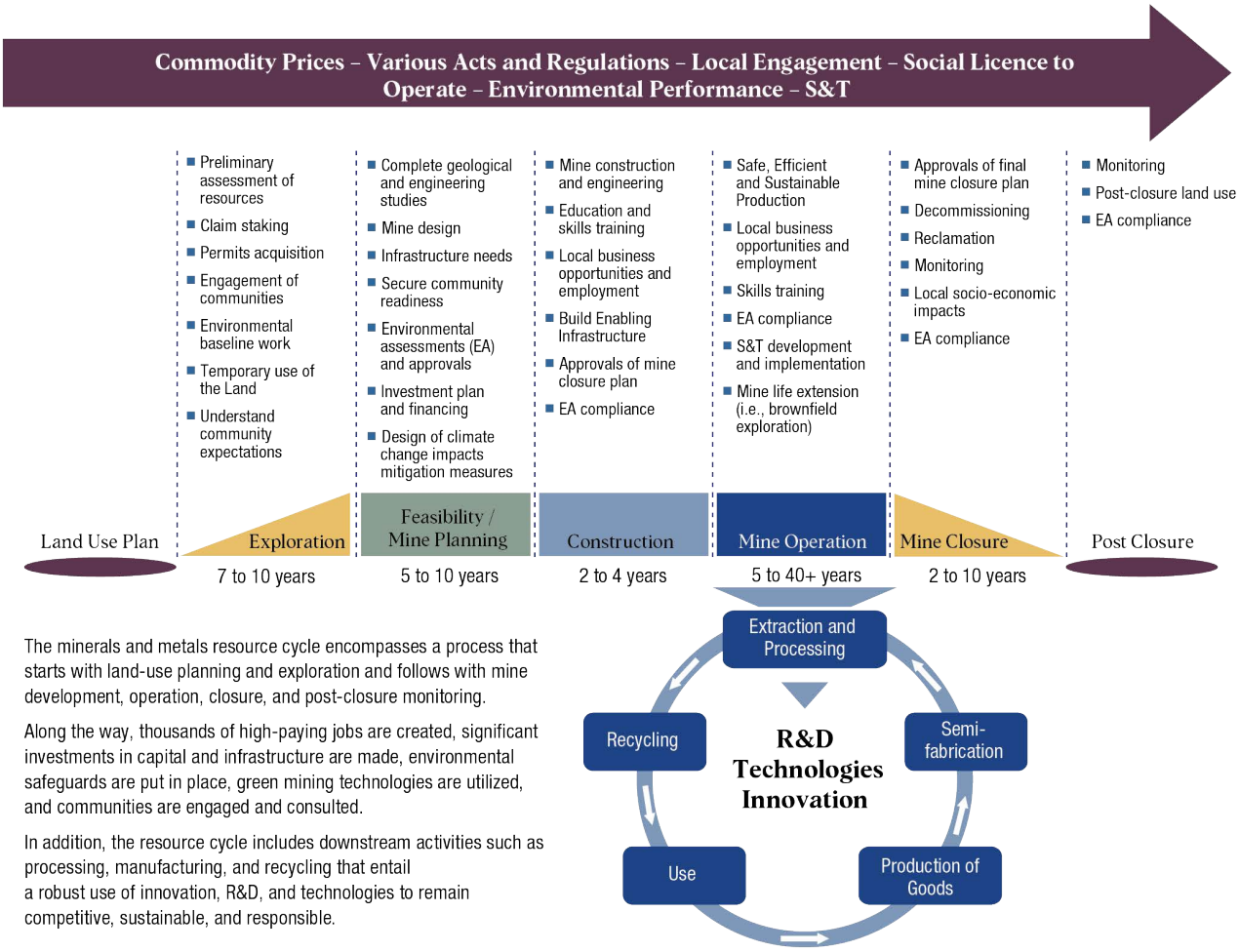
[24] https://issuu.com/pdac-web/docs/pdac_annual_report_2023_e624c23b0c5941?fr=sZTMyMjYzNTI5MzY

[25] https://www.canada.ca/en/natural-resources-canada/news/2024/09/canada-announces-significant-funding-to-unlock-more-critical-minerals-development-in-northern-british-columbia-and-the-yukon.html

Experience shows that responsible and respectful business practices are essential. Early engagement of local and Indigenous communities in meaningful collaboration and incorporating traditional and community knowledge into project design facilitates a more effective review process. Ultimately, these practices support sustainable resource development including maximizing benefits to local communities.

The mineral development continuum is dynamic (Figure 2). A responsible and sustainable life-of-project approach to mineral development has become an essential condition for companies and host governments at all stages to avoid project delays and disruptions, to create supportive conditions for long-term socio-economic benefits, and to maintain investor interest.

Figure 2: Mineral development continuum



The minerals and metals resource cycle encompasses a process that starts with land-use planning and exploration and follows with mine development, operation, closure, and post-closure monitoring.

Along the way, thousands of high-paying jobs are created, significant investments in capital and infrastructure are made, environmental safeguards are put in place, green mining technologies are utilized, and communities are engaged and consulted.

In addition, the resource cycle includes downstream activities such as processing, manufacturing, and recycling that entail a robust use of innovation, R&D, and technologies to remain competitive, sustainable, and responsible.

Concerns of climate change continue to have a profound impact on societies, economic growth, and the way natural resources are developed in new and perhaps more environmentally sensitive areas.

Box 4: Traceability in Minerals Sector Supply Chains

Traceability along mineral value chains is of growing importance for several reasons including tracking the origin of materials (also known as provenance), demonstrating transparency, and verifying their performance on ESG standards. Stakeholders, investors, and consumers have a growing interest in taking this information and overall performance in consideration when making decisions.

Traceability can include tracking the chain of custody for minerals at any point in the supply chain including locations, ports, transportation modes, and refining. At the same time, traceability supports the circular economy for minerals while helping eliminate illicit flows of resources or funds.

In practice, traceability involves the collection of data in various formats (hardcopies, digital credentials, blockchain) and carrying that data forward as materials and products change hands from mining through processing and manufacturing to consumers and even recycling. Data on mineral quality and volume can also be collected as a key aspect of traceability.

As key enablers of clean technology and energy, traceability of critical minerals has taken a prominent role in ensuring transparency and ESG standards within the Canadian minerals sector.

The *Canadian Critical Minerals Strategy* (2022)[26] prioritizes Canada's work in enhancing critical minerals supply chain sustainability and transparency to help maintain high ESG standards in light of growing global demand and supply of energy transition minerals, to leverage Canada's strong ESG performance, and to improve supply chain resiliency among like-minded countries. Advocacy for greater interoperability of traceability technologies is promoted in part via multilateral forums such as the International Energy Agency (IEA), International Organization for Standardization (ISO), United Nations Centre for Trade Facilitation and Electronic Business (UNCEFACT), and Global Battery Alliance (GBA).

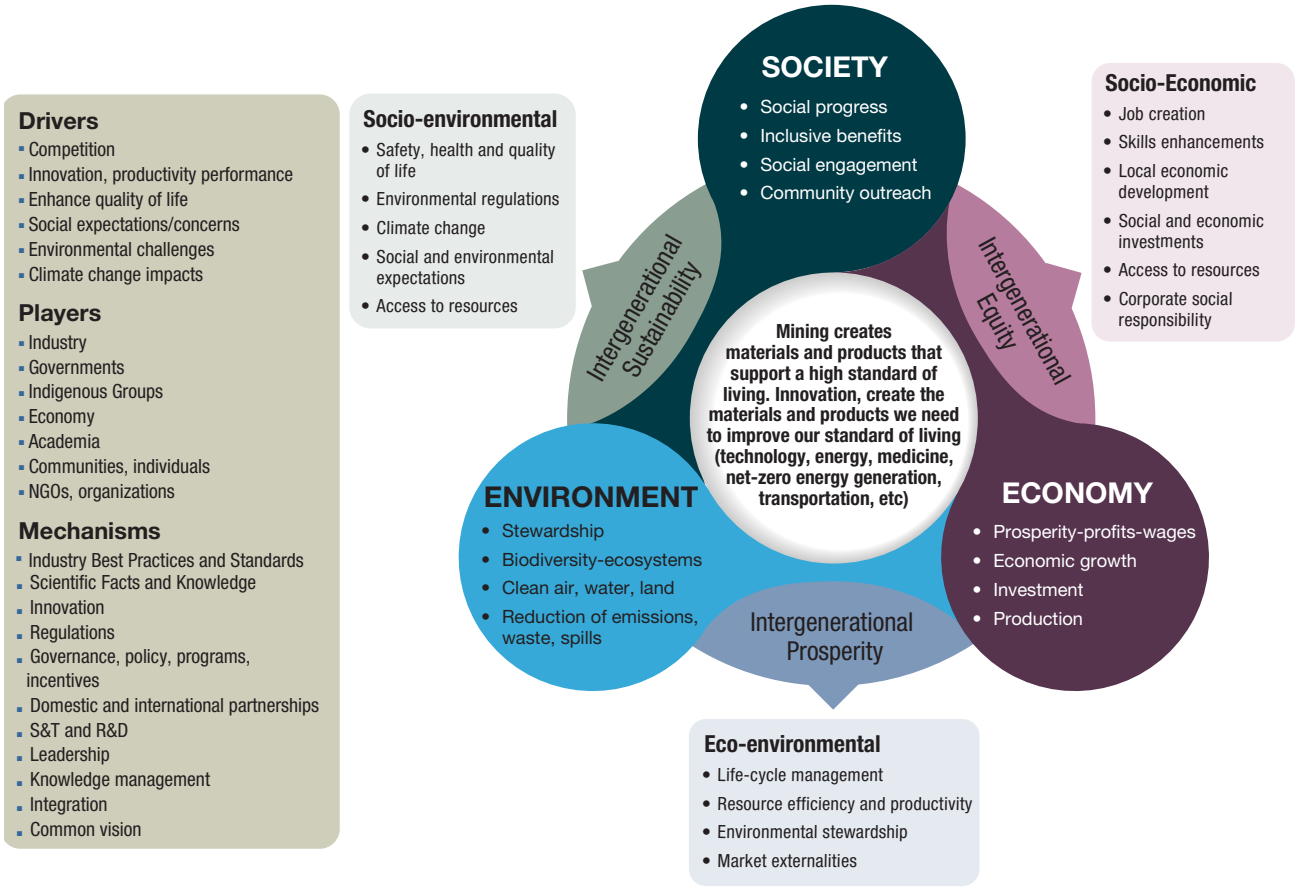
The Government of Canada and Canada's mining industry are committed leaders in traceability technology. The Critical Minerals Traceability Projects Grant was launched by Natural Resources Canada in 2023 with a funding commitment of $675,000 over three years (2024–2027). Five companies from across Canada have so far been awarded grants. This program will support commercial-stage critical minerals supply chain traceability projects that will track critical minerals and their ESG impacts across supply chain segments.

Societal concerns, including water availability, greenhouse gas emissions, increased incidence and severity of wildfires, and tailings dam and leach pad failures, represent challenges that must drive innovation and the leveraging of emerging technologies to improve the exploration, development, extraction, processing, and marketing of the mineral resources needed to realize long-term economic, social, and environmental goals (Figure 3).

Greater recycling capacity and throughput will be increasingly demanded by ESG investors to reduce pressure on sourcing of raw materials, to establish the circular economy, and to shift to more energy- and materials-efficient production.

[26] https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html

Figure 3: Elements of a responsible and sustainable approach

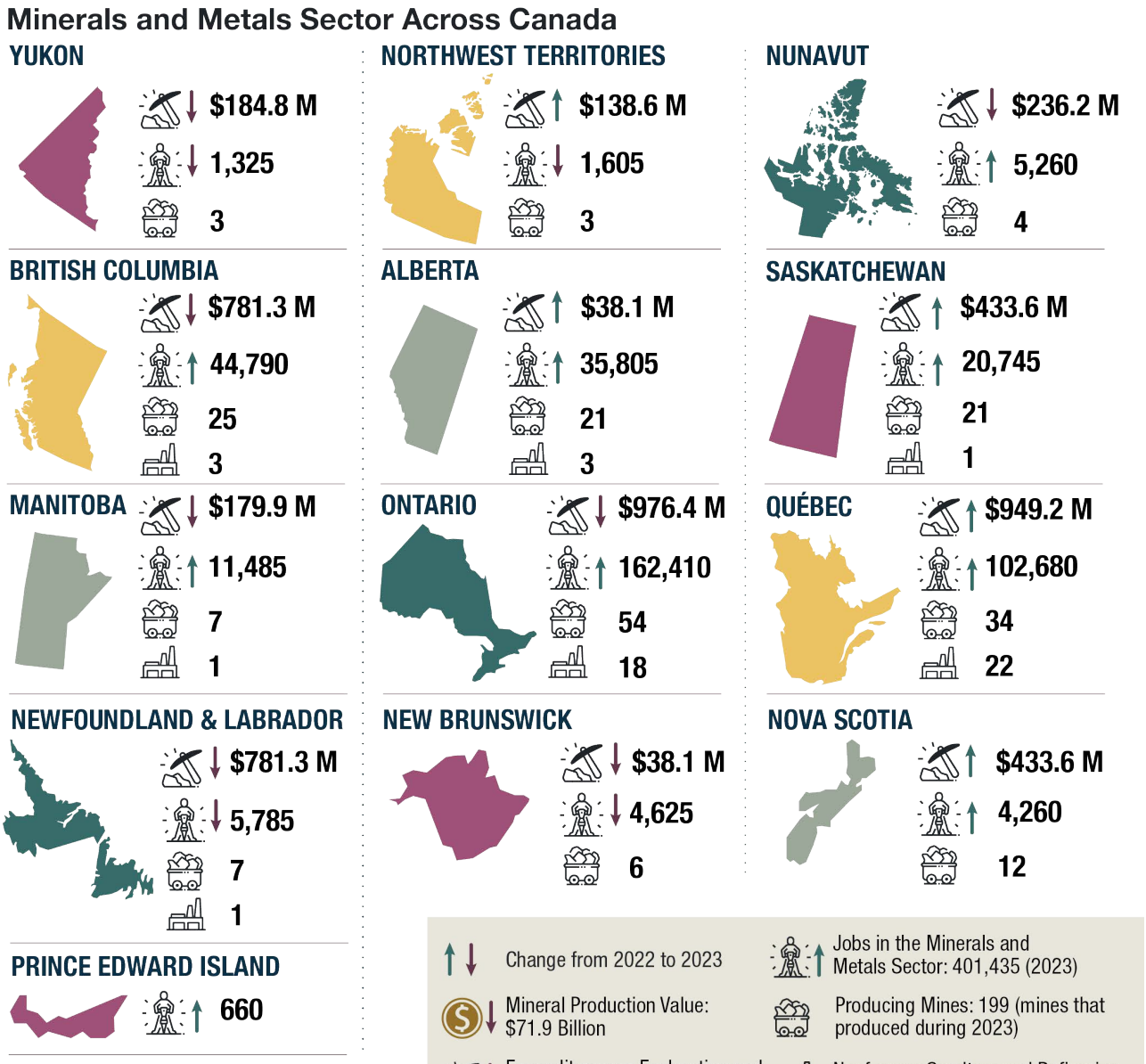


1.3 Canada's mineral resource advantage

Canada's minerals sector is a major contributor to Canada's economic health (Figure 4). In 2023, the sector:

- accounted for almost $114 billion in nominal Gross Domestic Product (GDP) (4% of total Canadian GDP),
- directly employed just over 401 thousand workers, with a presence in every region of the country, and
- contributed just under $33 billion to Canada's trade balance.

Figure 4: The minerals sector in 2023—A pan-Canadian industry



Data were current as of February 19, 2025.
Sources: Natural Resources Canada, Statistics Canada.
Note 1: GDP data consist of mining (except oil and gas), non-metallic mineral product manufacturing, primary metal manufacturing, and fabricated metal product manufacturing (NAICS 212+327+331+332). Employment data consist of mining (except oil and gas), support activities for mining, non-metallic mineral product manufacturing, primary metal manufacturing, and fabricated metal product manufacturing (NAICS 212+21311B+327+331+332).
Note 2: Mineral production value was not available at the jurisdiction level due to suppression for reasons of confidentiality.

Sources: Natural Resources Canada; Statistics Canada.
Gross domestic product and employment consist of the following: NAICS 212 – mining and quarrying (except oil and gas); NAICS 21311B – support activities for mining; NAICS 327 – non-metallic mineral product manufacturing; NAICS 331 – primary metal manufacturing; and NAICS 332 – fabricated metal product manufacturing.
* Due to data confidentiality, employment data may be underrepresented as subsector data is unavailable and mineral production value was not available at the jurisdiction level.
** Trade data include ores, concentrates, and semi- and final-fabricated mineral products.[27]

[27] https://mmsd.nrcan-rncan.gc.ca/trad-comm/sta-eng.aspx

In addition, the sector:

- contributes directly to the economic vitality of communities, especially in remote and northern communities with few alternative economic drivers, and remains an important employer of Indigenous People (17,500 employees in 2023),
- is a capital-intensive, high-tech industrial sector that plays an important part in Canada's role in advanced technology use and development,
- consistently adds to Canada's balance of trade, contributing nearly $245 billion in constant 2023 Can$ over 10 years (2014–2023), and
- produces more than 60 minerals and metals and ranks among the top producers of many critical minerals such as potash, uranium, nickel, aluminum, and cobalt.

Table 2: Canadian global production ranking by volume, 2023

Commodity	Global Rank
Potash*	1st
Indium* (refined)	1st
Niobium*	2nd
Uranium* (2022)	2nd
Diamonds	3rd
Platinum group metals*	4th
Aluminum* (primary)	4th
Gold	4th
Tellurium* (refined)	5th
Cobalt*	6th
Nickel*	6th
Titanium*	6th
Salt	6th
Iron*	8th
Zinc* (2022)	9th
Graphite*	11th
Copper*	12th

Sources: Natural Resources Canada; U.S. Geological Survey.

NB: as noted, only 2022 data was available for uranium and zinc at the time of writing.

*Denotes a commodity included in Canada's critical minerals list. Note that high-purity iron is also included on the critical minerals list.

With its vast land area and diverse geological settings, Canada is well positioned for future prosperity in the minerals industry. As a global leader in economics, social development, and environmental sustainability, Canada boasts world-class science and engineering expertise, strong educational systems (now facing financial pressures putting programs and institutions at risk), and a public policy framework that supports responsible mineral development. The country also has a skilled workforce and an innovation-driven ecosystem in the sector. These strengths give Canada significant potential to meet global demand for minerals during the energy transition, reinforcing its position as a major producer of minerals and mineral products.

Box 5: The Canadian Minerals and Metals Plan

The launch of the Canadian Minerals and Metals Plan (CMMP) in March 2019 was a milestone in Canadian mining history.[28] It provided a nationwide policy framework to build Canada's position as a global mining leader in an evolving global economy. The plan was developed by federal, provincial, and territorial governments with the extensive engagement of industry, Indigenous Peoples, civil society, and other partners.[29] It includes a vision, principles, targets, and areas for action within six strategic directions that can drive the competitiveness and long-term success of the Canadian mining industry.

The CMMP has helped foster federal, provincial, and territorial collaboration to tackle common challenges and opportunities and work towards a shared vision for the minerals sector. The plan has made considerable progress towards achieving its targets, with more than 490 actions undertaken by governments, industry, and Indigenous and other organizations in support of the CMMP's targets and areas for action.

These actions include several pan-Canadian initiatives that were developed and implemented collaboratively with provinces and territories, industry, and Indigenous and other partners. These include a Local Procurement Checklist to advance the participation of Indigenous Peoples; a Pan-Canadian Geoscience Strategy to support the economic development and competitiveness of the mining sector; initiatives such as the "Canadians of Mining" social media campaign to attract future talent to the mining sector; two prize-based innovation challenges to advance mining technology and innovation in Canada; co-hosting the annual Orphaned and Abandoned Mines Workshop (Box 12); and, publishing a one page information bulletin to showcase Canada's leadership in innovation, sustainability, and responsible business conduct.

Further information on the CMMP and its progress is available at MinesCanada.ca.

[28] https://www.minescanada.ca/en/about-plan

[29] https://www.minescanada.ca/en/about-plan/what-we-ve-heard-about-canada-s-mining-future

Section 2: Economic Performance

The Canadian minerals sector plays a vital role in the country's economy, both directly and indirectly through extensive supply chains and the skilled personnel and service providers that support its operations. Many rural, remote, and northern communities in Canada depend on mining as a primary source of economic activity. Minerals sector hubs like Toronto, Vancouver, Sudbury, Montréal, Rouyn-Noranda, and Val-d'Or, as well as Saskatchewan benefit significantly from the industry, also serving as financial hubs and the home of numerous exploration and mining companies.

As discussed in Section 1, the current conceptual basis of the MSPR draws on several key frameworks and initiatives influencing Canada's minerals sector. For the current and previous editions of the MSPR, the Intergovernmental Working Group that develops and guides its contents chose the following desired outcome to frame the economic performance of the sector:

> *Maintain and enhance the vitality of the sector, ensuring its long-term viability and competitiveness, so it can continue to make an economic contribution to the local, regional, national, and global economies of the future.*

While this outcome is still relevant, the launch of the CMMP in 2019 and Action Plan 2020 (Box 5) have further articulated the targets and outcomes for the minerals and metals sector.[30,31] Therefore, the frameworks on which this edition is based include the CMMP, the Canadian Critical Minerals Strategy (Box 2),[32] the United Nation's Sustainable Development Goals,[33] and the Mining, Minerals and Sustainable Development North America initiative.[34]

The following strategic directions of the CMMP were selected to support and frame the desired outcomes for the economic performance of the sector:

- **Economic development and competitiveness**
  - Canada's business and innovation environment for the minerals sector is the world's most competitive and most attractive for investment.
- **Global leadership**
  - A sharpened competitive edge and increased global leadership for Canada.[35]
- **Science technology and innovation**
  - A modern and innovative industry supported by world-leading science and technology—across all phases of the mineral development cycle.

The indicators chosen to measure the sector's performance related to these outcomes are:

- **Value of mineral production** – Measures the value of commodities produced based on market prices in constant 2023 Can$. It helps determine the sector's vitality as it is linked to the revenues and incomes generated.

[30] "At the 2019 Prospectors and Developers Association of Canada (PDAC) conference, federal, provincial, and territorial Mines Ministers, along with industry and Indigenous representatives, launched the **Canadian Minerals and Metals Plan (CMMP)**. A bold new vision for Canada's minerals and metals sector, the CMMP includes targets and actions for governments, industry, and stakeholders to support a competitive, sustainable, and responsible industry that adapts to the realities of the modern economy."

[31] https://www.minescanada.ca/sites/minescanada/files/2022-04/cmmp-actionplan2020_rev52_feb_29_2020-a_en.pdf

[32] https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html

[33] The United Nations' Sustainable Development Goals (SDGs) are a collection of 17 global goals set by the United Nations General Assembly in 2015. The SDGs are part of Resolution 70/1 of the United Nations General Assembly: "Transforming our World: the 2030 Agenda for Sustainable Development."

[34] The Mining, Minerals and Sustainable Development (North America) initiative was established by the World Business Council for Sustainable Development as one of a number of projects being supported by the Global Mining Initiative. It was formed as an independent process of multi-stakeholder engagement and analysis with the objective of "identifying how mining and minerals can best contribute to the global transition to sustainable development."

[35] There were Can$220.4 billion of Canadian mining assets abroad in 2023, a 5% increase compared to 2022 (Natural Resources Canada. (2025). Canadian Mining Assets Information Bulletin. Retrieved from: https://natural-resources.canada.ca/minerals-mining/mining-data-statistics-analysis/minerals-mining-publications/canadian-mining-assets).

- **Gross domestic product (GDP)** – Nominal GDP measures the market value of all final goods and services produced by a sector. It is one of the primary indicators used to measure economic performance and the contribution of a sector to the economy. Real GDP is adjusted for inflation. This indicator measures the sector's direct contribution to the economy's total GDP.
- **International trade** – International trade is the exchange of capital, goods, and services across international borders or territories. Trade is critical to Canada's minerals sector (as most production is exported) and to the country's prosperity, fuelling economic growth, supporting jobs, raising living standards, transferring technologies, and providing affordable goods and services.
- **Exploration and deposit appraisal expenditures** – Mines have a finite life. Exploration activity is necessary to find mineral deposits that support future mining development and downstream production in Canada. Exploration spending is a key measure of the health of the sector. Measuring spending levels in exploration and deposit appraisal activity provides an indication of the future potential for mineral production and downstream activities.
- **Public geoscience expenditures** – Includes the geological, geophysical, and geochemical data, information, and knowledge provided by governments as a public resource. High-quality data is widely recognized as one of Canada's key competitive advantages in attracting and de-risking mineral exploration. It allows grassroots exploration companies to make informed decisions about their activities. Evaluating public geoscience expenditures offers insight into government efforts to support early-stage mineral exploration.
- **Capital expenditures** – Capital expenditures are made by companies to purchase or upgrade physical assets such as property, equipment, or buildings. They help maintain or increase production capacity, as well as improve an industry's productivity. Measuring trends in capital expenditures provides an indication of a sector's future output and competitiveness.
- **Research and development** – Innovation improves the productivity and competitiveness of firms as well as the minerals sector overall. Research and development expenditures indicate the extent to which firms are committed to improving production processes and are pivotal to the innovation performance of any industry.
- **Government revenues** – Government revenues from the mining sector are collected through taxes and royalties. Measuring these types of payments to governments shows the sector's direct contribution to government finances.

2.1 Value of Mineral Production

Highlights

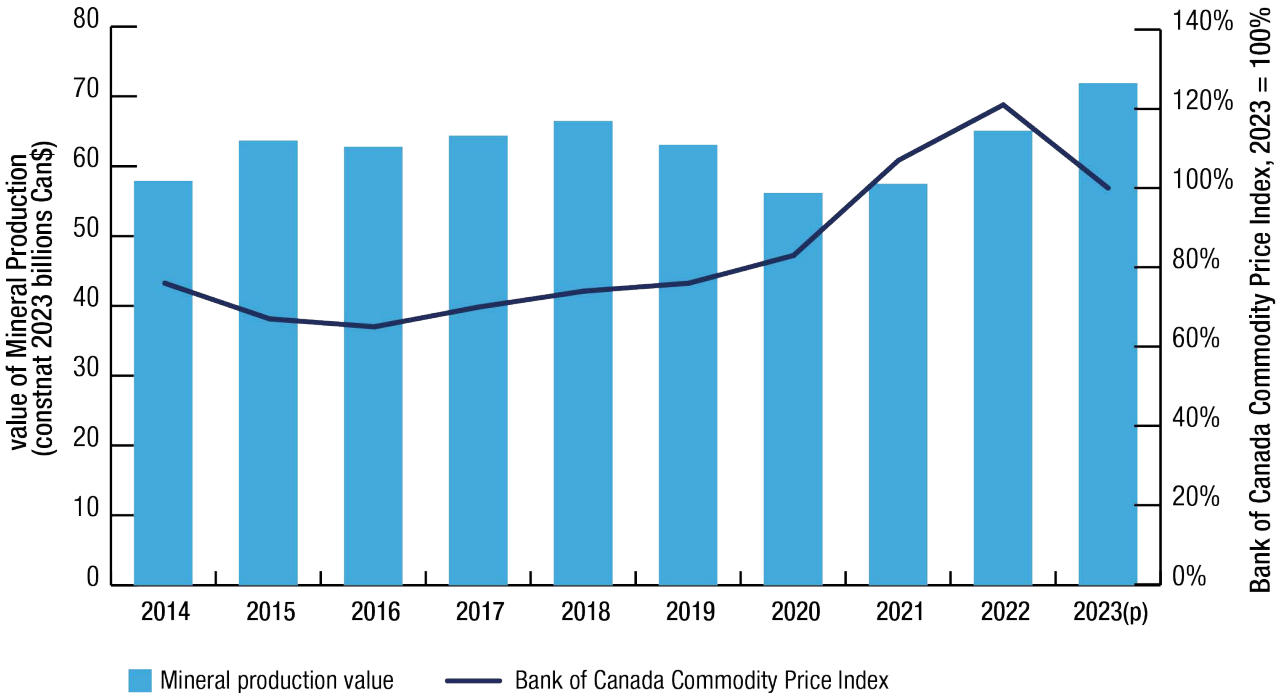
- The total value of Canadian mineral production in 2023 increased 24% or almost $14 billion in constant 2023 Can$ compared to 2014.
- The trend in mineral production value was consistent with the Bank of Canada's minerals and metals price index, which increased 32% between 2014 and 2023.
- Ontario was the leader in terms of value of mineral production between 2014 and 2023, except in 2019 and 2021 when Quebec was the leader.
- Quebec, Ontario, and British Columbia collectively accounted for an average of just over 62% of Canada's value of total production from 2014 to 2020. Data for British Columbia was suppressed for reasons of confidentiality between 2021 and 2023.

Analysis

Mineral production value[36] helps determine the vitality of the mineral extraction sector as it is linked to the revenues being generated. The value of mineral production fluctuates because of changes in the quantity of production from mines and the respective prices of the minerals and metals they produce, which are set on global markets. Events that can impact these values include mine openings and closings, strikes and lockouts, surging demand from developing countries, incidents such as Mount Polley in 2014 or Eagle Gold Mine in 2024, weather events, and pandemics.

Figure 5 shows that changes in the value of Canadian mineral production over the 2014–2023 period have risen alongside the Bank of Canada's metals and minerals price index, with an overall increase throughout the period and peaks in 2022 (price index) and 2023 (value of production).[37]

Figure 5: Value of Canadian mineral production, constant 2023 Can$, 2014–2023 (p)



Sources: Natural Resources Canada; Statistics Canada; Bank of Canada.
(p) Preliminary.

The value of individual major metals and non-metal commodities varied significantly between 2014 and 2023 (Table 3). Gold was the top commodity in terms of dollar value of production for both years, followed by potash.[38] While gold is a highly valued and precious metal often used for investment and jewellery, its electrical conductivity and resistance to corrosion lends it to applications in electronics and technology. Copper[39] occupied the third spot in 2014 but was replaced by coal in 2023.

[36] Glossary

[37] Appendix A – Data Considerations

[38] Included on Canada's critical minerals list.

[39] Included on Canada's critical minerals list.

Coal production declined over the 2014–2023 period. While Canada produces both thermal and metallurgical coal, the latter had the largest impact on production value. This is largely due to the Canadian government's implementation of plans to phase out coal-fired electricity generation, which uses thermal coal, by 2030 and a commitment to net-zero emissions in the electricity sector by 2035.[40] Metallurgical coal remains an important mineral and now accounts for most of the total value of coal production.

Table 3: Canada's top 10 metallic and non-metallic mineral products, by value of production, 2014 and 2023 (p)

Rank (by Value)	2014 Commodity	2014 Unit of Measure	2014 Quantity	2014 Value (millions current Can$)	2014 Value (millions constant 2023 Can$)	2023 (p) Commodity	2023 (p) Unit of Measure	2023 (p) Quantity	2023 (p) Value (millions current Can$)
1	Gold	t	151	6,817	8,995	Gold	t	151	15,144
2	Potash (MOP)	kt	17,633	5,581	7,364	Potash (MOP)	kt	21,875	12,927
3	Copper	kt	655	4,984	6,576	Coal	kt	48,067	12,214
4	Iron Ore	kt	43,173	4,174	5,507	Iron Ore	kt	59,422	6,054
5	Nickel	kt	218	4,069	5,369	Copper	kt	508	5,176
6	Coal	kt	69,035	3,897	5,142	Nickel	kt	159	4,326
7	Diamonds	000 ct	12,012	2,236	2,950	Diamonds	000 ct	16,161	2,331
8	Uranium	t	9,780	934	1,232	Uranium	t	11,373	1,633
9	Zinc	kt	323	771	1,017	Zinc	kt	x	402
10	Silver	t	472	320	423	Silver	t	306	219

Sources: Natural Resources Canada; Statistics Canada.
(p) - Preliminary
x - Suppressed to meet confidentiality requirements
Note: Shipments of potash to Canadian potassium sulphate plants are not included in this table.
* Denotes a commodity included in Canada's critical minerals list. Note that high-purity iron is also included on the critical minerals list.

Table 4 shows value of mineral production broken down by province and territory for selected years. The percent contribution of each jurisdiction to total value of mineral production between 2014 and 2023 is shown below in Figure 6. Much of the data for 2023 has been suppressed for confidentiality, making it difficult to provide meaningful summary statements.

Table 4: Value of mineral production by jurisdiction, constant 2023 Can$, 2014, 2019, and 2023 (p)

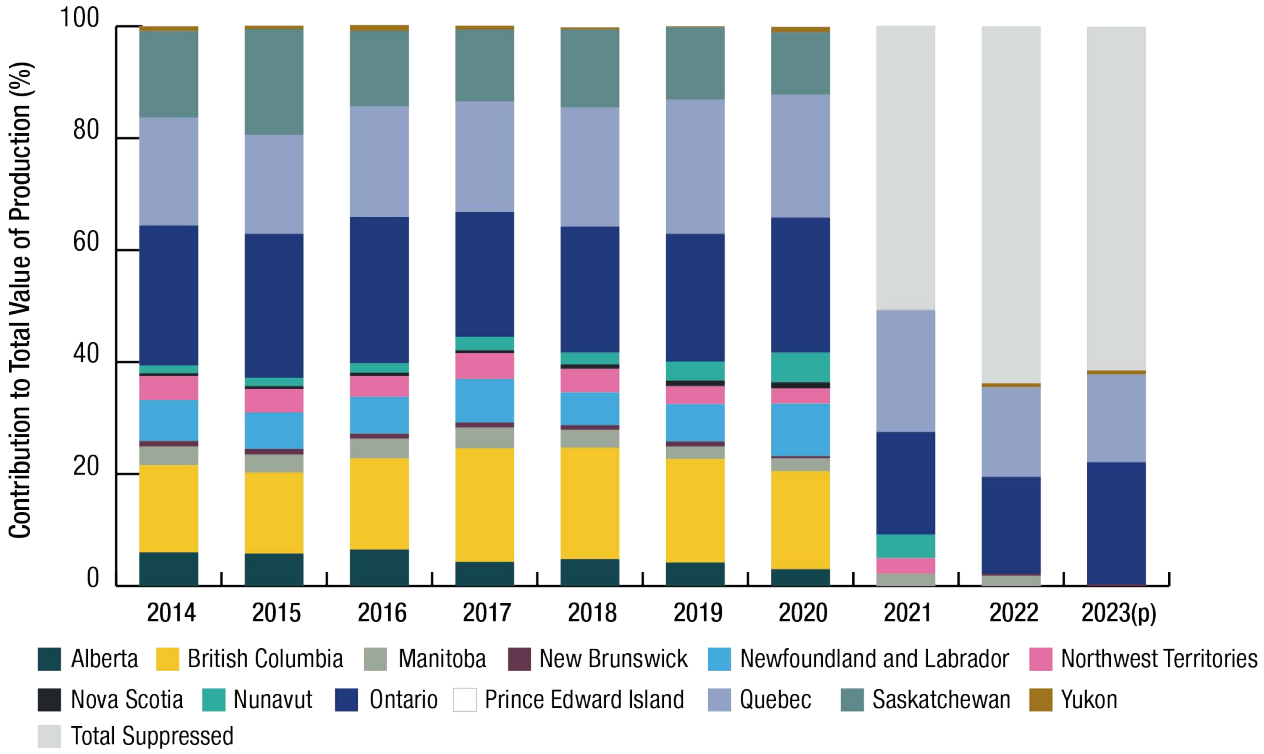
Province or Territory	Category	2014	2019	2023 (p)
Alberta	Value of production (000)	3,451,273	2,648,017	x
	% of total	6.0%	4.2%	x
British Columbia	Value of production (000)	9,011,014	11,688,142	x
	% of total	15.6%	18.5%	x
Manitoba	Value of production (000)	1,884,675	1,413,948	x
	% of total	3.3%	2.2%	x

[40] https://www.canada.ca/en/environment-climate-change/news/2021/11/canada-and-the-world-move-closer-to-powering-past-coal-with-more-climate-ambition-at-cop26.html

Province or Territory	Category	2014	2019	2023 (p)
New Brunswick	Value of production (000)	579,342	543,851	241,338
	% of total	1.0%	0.9%	0.3%
Newfoundland and Labrador	Value of production (000)	4,235,830	4,204,890	x
	% of total	7.3%	6.7%	x
Northwest Territories	Value of production (000)	2,483,720	2,018,853	x
	% of total	4.3%	3.2%	x
Nova Scotia	Value of production (000)	260,775	633,226	x
	% of total	0.5%	1.0%	x
Nunavut	Value of production (000)	839,737	2,158,105	x
	% of total	1.4%	3.4%	x
Ontario	Value of production (000)	14,507,332	14,384,797	15,692,148
	% of total	25.0%	22.8%	21.8%
Prince Edward Island	Value of production (000)	5,525	3,876	x
	% of total	0.01%	0.01%	x
Quebec	Value of production (000)	11,201,852	15,159,432	11,282,966
	% of total	19.3%	24.0%	15.7%
Saskatchewan	Value of production (000)	8,943,400	8,136,599	x
	% of total	15.4%	12.9%	x
Yukon	Value of production (000)	538,342	100,755	538,710
	% of total	0.9%	0.2%	0.7%
Total	**Value of production (000)**	**57,942,915**	**63,094,493**	**71,922,216**

Source: Natural Resources Canada; Statistics Canada.
(p) - Preliminary
.. - Amount too small to be expressed.
x - Suppressed to meet confidentiality requirements

Figure 6: Contribution to total value of mineral production, by jurisdiction, 2014–2023 (p)



Source: NRCan

2.2 Gross Domestic Product

Highlights

- The real gross domestic product (GDP) of the minerals sector experienced a small 2% increase from 2014 to 2023 compared to a 16% increase for the total Canadian economy.
- A large increase of 24% in the non-metallic mineral product manufacturing subsector offset decreases in the primary metal and fabricated metal product manufacturing subsectors.
- Minerals sector contribution to Canada's total GDP remained stable at an average of 3% over the last 10 years.

Analysis

GDP[41] is a widely used economic indicator to evaluate the size and health of an economy and measure the relative economic contribution of an industry sector or subsector. Real GDP data is used to remove the effects of price variations and inflation over time to determine the extent of output gains or losses within an industry.

[41] Glossary

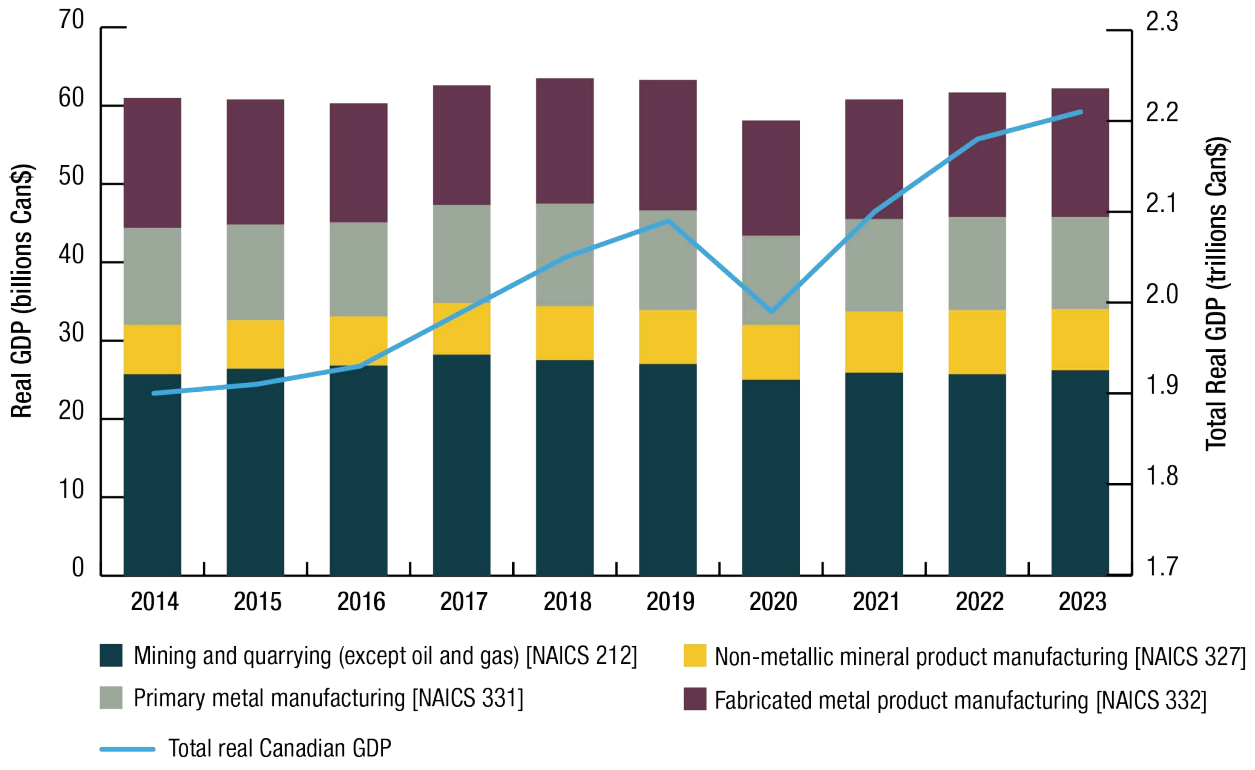
The minerals sector experienced only a slight upward trend (2%) in real GDP from 2014 to 2023 compared to Canada's real GDP, which increased by 16% (Figure 7). The sector's share of Canada's total GDP averaged 3% over the same period.

The mining and quarrying (except oil and gas) subsector [NAICS 212] was the largest contributor to the minerals sector's GDP between 2014 and 2023. Non-metallic mineral product manufacturing [NAICS 327] is a smaller component of the minerals sector, but the subsector experienced the highest growth among the subsectors at 24%, which offset small decreases in primary metal [NAICS 331] and fabricated metal product manufacturing [NAICS 332].

Looking more closely at mining and quarrying (except oil and gas) [NAICS 212], a large decline in coal mining was offset by increased activity for other commodities including iron ore,[42] gold and silver, stone mining and quarrying, and potash.[43] The decline in coal mining over the 10-year period would be expected given the Government of Canada's phase-out of thermal coal. With respect to primary metal manufacturing [NAICS 331], a 36% decline in non-ferrous metal (except aluminum) production and processing was offset by increases in iron and steel mills and ferro-alloy manufacturing, as well as alumina and aluminum[44] production and processing.

A breakdown of fabricated metal product manufacturing [NAICS 332] reveals that architectural and structural metals manufacturing was the largest contributor to the subsector with an average of 38% of total subsector, experiencing a modest increase of 3% between 2014 and 2023. Other sub-industries exhibited smaller changes over the 10-year period except for hardware manufacturing, which increased by 32%. However, hardware averaged only 4% of the larger fabricated metal product manufacturing subsector [NAICS 332].

Figure 7: Minerals sector real gross domestic product (constant 2017 Can$), 2014–2023



Source: Statistics Canada.

[42] High-purity iron is included on Canada's critical minerals list.

[43] Included on Canada's critical minerals list.

[44] Included on Canada's critical minerals list.

2.3 International Trade

Highlights

- The value of Canada's minerals sector exports increased 28% overall between 2014 and 2023.
- The minerals sector routinely makes a positive contribution to Canada's overall trade balance, contributing a surplus of just over $275 billion between 2014 and 2023.
- Gold was the top export among minerals and metals in 2023, with the U.S. being the leading destination by value.
- Aluminum[45] and potash[46] also ranked within the top five Canadian minerals and metals exports in 2023. Aluminum consistently ranked third between 2014 and 2023, while copper[47] frequently ranked fourth or fifth.

Canada is an open economy that depends heavily on foreign markets and international trade to support the nation's prosperity and sustain a high standard of living for its citizens. A positive trade balance contributes to Canada's prosperity as it fuels economic growth, creates jobs, supports high living standards, fosters the adoption of innovation and new technologies, and provides affordable goods and services.

Trade is critical to the minerals sector as mineral commodities are bought and sold on global markets.

Free trade, investment, and taxation agreements are key to boosting mining trade and attracting investment. They lower barriers, increase transparency, and foster cooperation, helping Canadian companies compete globally. The reduction or removal of tariffs enhances the competitiveness of Canadian mineral products, enabling market share growth.

Investment agreements, especially those with dispute resolution mechanisms, offer mining investors more certainty in foreign markets. Provisions on labour mobility and regulatory cooperation assist companies in accessing specialized skills and navigating complex approval processes.

Canada's continued leadership in the mining sector relies on modern, comprehensive trade and investment agreements that reflect evolving global market dynamics. These agreements are essential for maintaining the industry's competitiveness in a rapidly changing environment.

The strength of Canada's mining industry is also reflected in its trade relationships, where minerals and metals are central to many international trade flows. These flows are reinforced by strategic trade agreements that position Canadian products competitively in the global marketplace.

The value of Canada's minerals and metals exports,[48] which include ores, concentrates, and semi- and final-fabricated mineral products was $157 billion in 2023, representing 20% of Canada's total merchandise export value (Figure 8).[49,50] The minerals sector is one of the few industrial sectors that consistently makes a positive contribution to Canada's overall balance of trade, having recorded no negative trade balance since 2000.

[45] Included on Canada's critical minerals list.

[46] Included on Canada's critical minerals list.

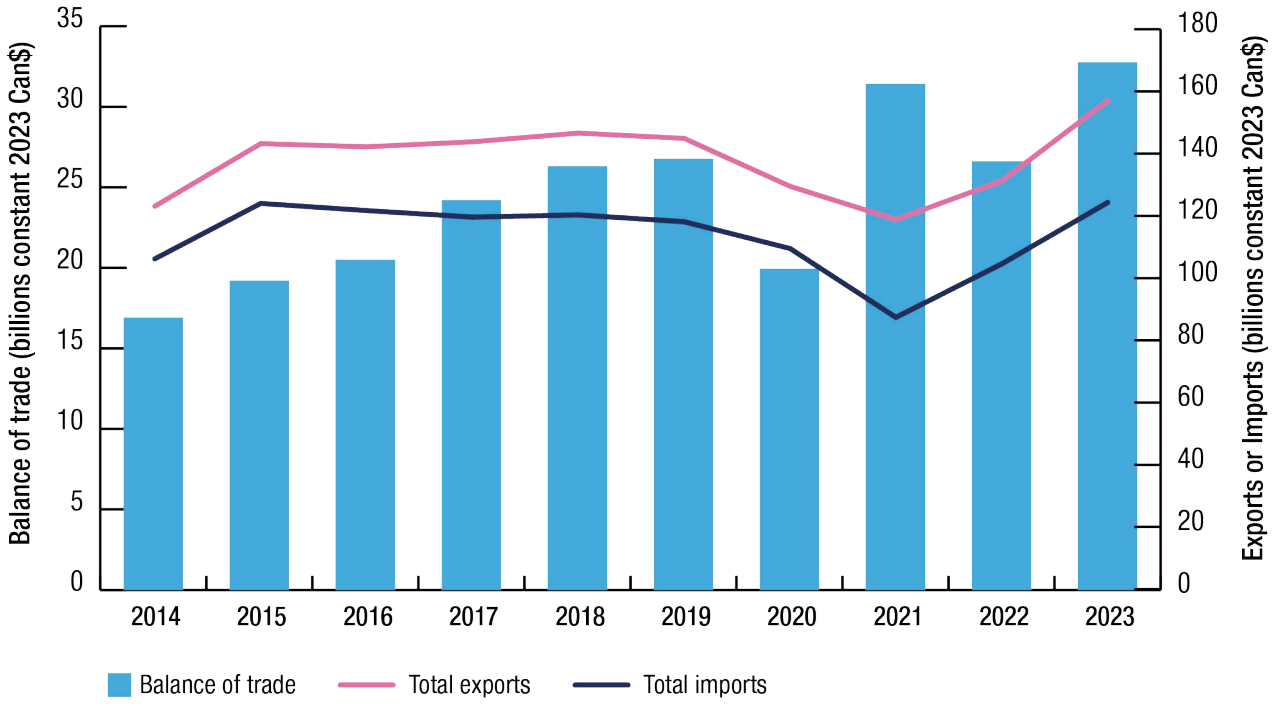
[47] Included on Canada's critical minerals list.

[48] For this section, "exports" refer to domestic exports. Total exports, which include re-exports, is used only when calculating the balance of trade.

[49] https://www150.statcan.gc.ca/n1/daily-quotidien/240509/dq240509a-eng.htm

[50] Appendix A – Data Considerations

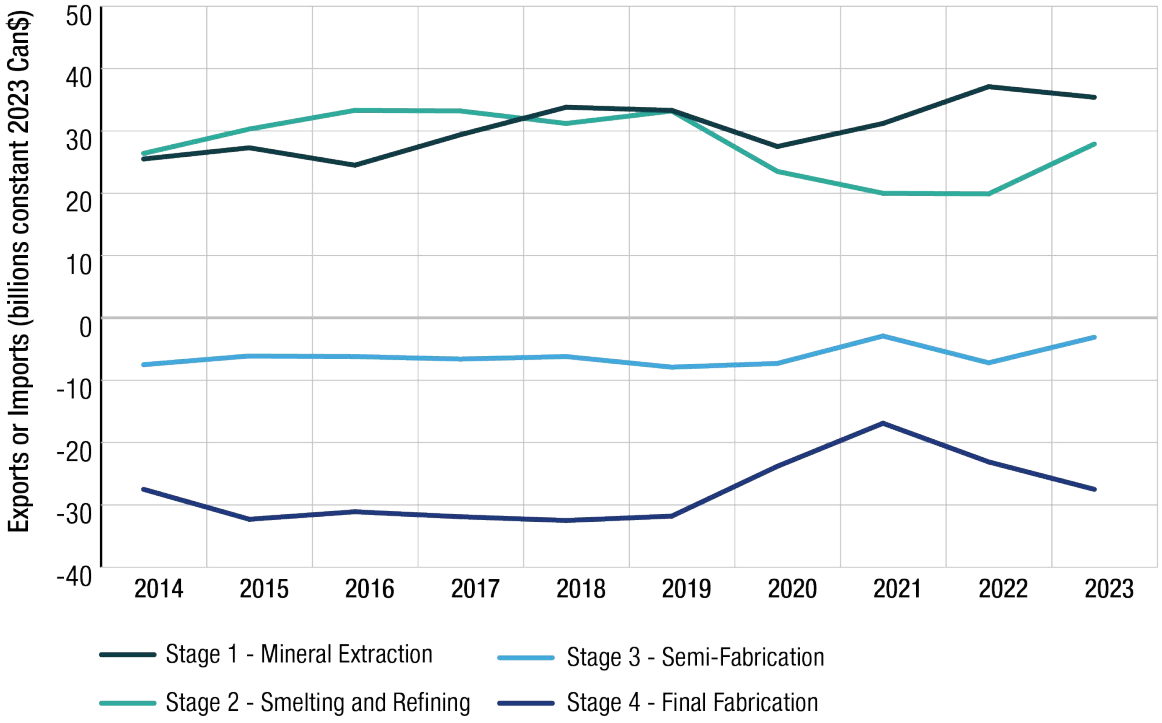
Figure 8: Minerals sector trade in billions of constant 2023 Can$, 2014–2023



Sources: Natural Resources Canada; Statistics Canada.

A closer examination at the subsector level reveals Canada's strength in mineral extraction and smelting and refining (Figure 9). Canada generally runs large, positive trade balances in *Stage 1 – Mineral Extraction* and *Stage 2 – Smelting and Refining*. Trade balances in *Stage 3 – Semi-Fabrication* tend to be neutral or slightly negative, while trade balances for *Stage 4 – Final Fabrication* are usually large and negative.

Figure 9: Minerals sector balance of trade, by subsector, 2014–2023



Sources: Natural Resources Canada; Statistics Canada.

Table 5 shows the top five commodities exported by Canada's minerals sector in 2014 and 2023, by value. The value of gold exports increased substantially during this period due to the production volume and the price, which has continued an overall increase since experiencing a low in 2015, reaching over US$2,000 per ounce by the end of the 10-year period. The largest destination by value for Canada's gold in 2023 was the U.S.; however, the U.K. ranked a close second, with London being a global centre for gold trading. Critical minerals are of ever-increasing interest, and it is worth noting that several, including aluminum, copper, and potash, appear in the top five mineral commodities exported by value in 2014 and 2023. High-purity iron is also included on Canada's critical minerals list. Therefore, iron and steel's second-place ranking in 2014 and 2023 is notable. Canada aims to promote critical minerals production and export through a various means, which include support from the federal government (Box 6).

Table 5: Top five mineral commodities exported by Canada, by value, 2014 and 2023

2014 Commodity	(billions constant 2023 Can$)	2023 Commodity	(billions constant 2023 Can$)	Main Destination by Value (2023)
Gold	23.6	Gold	30.2	U.S. (44%)
Iron and steel*	18.1	Iron and steel*	21.9	U.S. (91%)
Aluminum*	12.9	Aluminum*	16.9	U.S. (90%)
Copper*	9.2	Coal	12.7	Japan (30%)
Other metals	8.3	Potash*	11.6	U.S. (43%)
Total domestic mineral exports	**118.1**		**150.7**	**n.a.**

Sources: Natural Resources Canada; Statistics Canada.
n.a. Not applicable; U.K. United Kingdom; U.S. United States.
* Denotes a commodity included in Canada's critical minerals list. Note that high-purity iron is also included on the critical minerals list.[51]

[51] https://www.canada.ca/en/campaign/critical-minerals-in-canada/critical-minerals-an-opportunity-for-canada.htm

Box 6: Federal support for critical minerals projects

The Canadian Critical Minerals Strategy was released in December 2022 following extensive engagement with industry, academia, Indigenous groups, and other governments, including provinces and territories. Supported by nearly $4 billion in funding from Budgets 2021 to 2024, the Strategy's vision is to increase the supply of responsibly sourced critical minerals and support the development of the green and digital economy at home and abroad.

Federal support for critical minerals projects takes many forms, from research and development grants to tax incentives and direct project funding. Some major supports are listed below:

Clean Technology Manufacturing Investment Tax Credit (CTM-ITC)

A refundable tax credit supporting those investing capital in acquisitions of clean technology manufacturing property used in manufacturing or processing activities or the extraction and processing of key critical minerals.

Critical Mineral Exploration Tax Credit (CMETC)

The 30% non-refundable CMETC supports certain critical minerals exploration expenses incurred in Canada and renounced to flow-through share (FTS) investors.

Critical Minerals Geoscience and Data (CMGD) Initiative

Funds fundamental geoscience research to better understand domestic critical mineral sources and accelerate the development of responsibly sourced critical minerals.

Critical Minerals Infrastructure Fund

Funds clean energy and transportation infrastructure projects to enable the sustainable development and expansion of critical minerals production in Canada.

Critical Minerals Research, Development and Demonstration Program (CMRDD)

Funds R&D projects focused on early-stage technology development and demonstration projects in the pre-commercialization phase.

Indigenous Natural Resource Partnerships (INRP) Program

Funds Indigenous organizations to increase the economic participation of Indigenous communities in the development of natural resource projects that support the transition to a clean energy future. Includes dedicated funds to support the building of capacity by communities to engage in critical mineral projects.

Strategic Innovation Fund

Makes major investments in innovative critical minerals projects, primarily in mineral processing, manufacturing, and recycling.

Table 6 shows the value of Canadian minerals sector exports by commodity group and jurisdiction. By value of production, metallic ores and manufactured products represent most of Canada's exports by a large margin. That commodity group averaged 78% of the total between 2014 and 2023.

Table 6: Export by commodity group, 2014–2023

Year	Coal and Coke Products (thousands of constant 2023 Can$)	Metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Non-metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Total (thousands of constant 2023 Can$)
2014	5,969,370	94,680,428	17,479,034	118,128,832
2015	5,682,601	108,211,424	23,029,284	136,923,309
2016	7,257,984	104,381,940	19,151,743	130,791,667
2017	10,074,849	108,090,278	20,079,040	138,244,167
2018	10,744,191	108,823,712	21,885,457	141,453,361
2019	9,898,945	109,248,063	20,953,646	140,100,654
2020	5,951,264	101,127,820	17,267,139	124,346,223
2021	7,550,371	92,769,756	15,198,985	115,519,112
2022	12,121,441	92,052,370	23,109,765	127,283,576
2023	12,760,557	115,490,831	22,408,970	150,660,358

Sources: Natural Resources Canada; Statistics Canada.

Table 7 shows that most Canadian mineral exports originated from Ontario, Quebec, and British Columbia. Since interprovincial trade is not reported, export values may include the value of raw material imported from other provinces. The top five jurisdictions in 2023 in terms of their contribution to total value of exports were Ontario (42%), Quebec (24%), British Columbia (14%), Saskatchewan (9%), and Alberta (4%).

Table 7: Canada's mineral exports, by jurisdiction of origin and commodity group, 2014 and 2023

2014

Province/Territory	Coal and Coke Products (thousands of constant 2023 Can$)	Metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Non-metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Total (thousands of constant 2023 Can$)
Alberta	679,724	3,058,188	572,059	4,309,971
British Columbia	4,829,063	7,968,849	1,063,379	13,861,291
Manitoba	44	1,983,450	307,955	2,291,450
New Brunswick	-	470,075	542,944	1,013,019
Newfoundland and Labrador	-	2,756,142	39,373	2,795,515
Northwest Territories	-	66,839	2,678,431	2,745,270
Nova Scotia	8	276,028	83,529	359,565
Nunavut	-	594	207	801
Ontario	383,265	51,961,826	3,471,026	55,816,117
Prince Edward Island	-	21,161	7,287	28,448
Quebec	2,431	24,644,587	2,008,789	26,655,807
Saskatchewan	74,834	1,327,248	6,704,025	8,106,107
Yukon	-	145,442	28	145,471
Canada	**5,969,370**	**94,680,428**	**17,479,034**	**118,128,832**

2023

Province/Territory	Coal and Coke Products (thousands of constant 2023 Can$)	Metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Non-metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Total (thousands of constant 2023 Can$)
Alberta	1,923,459	3,333,867	1,030,981	6,288,307
British Columbia	10,335,947	9,182,959	1,085,866	20,604,772
Manitoba	-	919,252	335,903	1,255,155
New Brunswick	-	146,264	250,103	396,366
Newfoundland and Labrador	-	3,958,320	33,031	3,991,351
Northwest Territories	-	245	1,843,452	1,843,698
Nova Scotia	1	401,664	146,030	547,695
Nunavut	-	2,012,187	2	2,012,189
Ontario	497,877	60,100,958	3,369,776	63,968,610
Prince Edward Island	-	10,619	8,331	18,949
Quebec	3,256	32,862,623	2,593,932	35,459,811
Saskatchewan	17	2,458,564	11,711,494	14,170,075
Yukon	-	103,309	70	103,379
Canada	**12,760,557**	**115,490,831**	**22,408,970**	**150,660,358**

Sources: Natural Resources Canada; Statistics Canada.
- Nil.
Notes:

- Natural Resources Canada's Trade Retrieval and Aggregation System allows for aggregation by Harmonized System (HS) codes (HS 8 for exports and HS 10 for imports). The advantage to aggregating by HS code is that it captures specific products, providing more complete data across all NAICS codes.
- Some provincial and territorial export numbers may include value from raw materials imported from other provinces as products are only captured once they cross international boundaries. For example, a Stage 1 product (nickel concentrate from Manitoba) is transported to Ontario for smelting. In Ontario, it is transformed into a Stage 2 product and exported. Because the final stage of manufacturing occurred in Ontario, the product would be captured as a Stage 2 product originating in Ontario.

Canada's imports by commodity group for 2014 and 2023 are compared below in Table 8. For metallic and non-metallic ores and manufactured products, as was the case above for exports, most imports flowed to Ontario, Quebec, and British Columbia. The picture for coal and coke products was only slightly more complex with Ontario and Quebec being the largest importers for 2014, followed by New Brunswick and Nova Scotia. In 2023, Ontario and Nova Scotia became the top importers, followed closely by Quebec. Ontario was the top importer in 2023, accounting for 62% of Canada's total imports, compared to 17% for Quebec and 9% for British Columbia.

Table 8: Canada's mineral imports, by jurisdiction of origin and commodity group, 2014 and 2023

2014

Province/Territory	Coal and Coke Products (thousands of constant 2023 Can$)	Metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Non-metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Total (thousands of constant 2023 Can$)
Alberta	13,260	6,232,660	1,378,987	7,624,907
British Columbia	5,365	9,009,970	2,029,108	11,044,443
Manitoba	5,084	3,506,055	1,086,498	4,597,637
New Brunswick	175,293	1,223,886	170,351	1,569,530

Province/Territory	Coal and Coke Products (thousands of constant 2023 Can$)	Metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Non-metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Total (thousands of constant 2023 Can$)
Newfoundland and Labrador	-	330,981	23,352	354,332
Northwest Territories	-	-	-	-
Nova Scotia	214,262	459,659	75,541	749,462
Nunavut	-	1	2	2
Ontario	844,216	53,656,847	7,793,397	62,294,460
Prince Edward Island	-	636	31,440	32,076
Quebec	226,493	12,439,978	2,488,698	15,155,169
Saskatchewan	2,536	2,257,124	520,513	2,780,172
Yukon	-	3,531	31	3,562
Canada	**1,486,509**	**89,121,326**	**15,597,918**	**106,205,754**

2023

Province/Territory	Coal and Coke Products (thousands of constant 2023 Can$)	Metallic Ores and Manufactured Products (thousands of constant 2023 Can$)	Non-metallic Ores and Manufactured Products (thousands of c onstant 2023 Can$)	Total (thousands of constant 2023 Can$)
Alberta	4,587	4,493,940	1,127,541	5,626,068
British Columbia	6,945	9,456,614	2,008,892	11,472,451
Manitoba	6,378	3,275,960	1,814,793	5,097,131
New Brunswick	118,010	406,745	165,599	690,354
Newfoundland and Labrador	-	98,231	21,058	119,289
Northwest Territories	-	0.2	-	0.2
Nova Scotia	256,082	398,840	78,938	733,861
Nunavut	-	185	1,701	1,886
Ontario	1,642,024	66,364,062	8,943,844	76,949,930
Prince Edward Island	-	1,552	34,261	35,813
Quebec	231,247	18,076,929	2,785,923	21,094,099
Saskatchewan	417	1,690,815	731,248	2,422,479
Yukon	0.1	3,885	28	3,913
Canada	**2,265,690**	**104,267,760**	**17,713,826**	**124,247,276**

Sources: Natural Resources Canada; Statistics Canada.
- Nil.
Notes:

- See Table 7 above.

2.4 Exploration and Deposit Appraisal Expenditures

Highlights

- Exploration and deposit appraisal expenditures in Canada increased 66% between 2014 and 2023, reaching $4.2 billion in constant 2023 Can$ by the end of the 10-year period.
- Ontario and Quebec led in terms of spending by jurisdiction in 2023, followed by British Columbia and Saskatchewan. These four jurisdictions together accounted for 75% of total Canadian exploration and deposit appraisal expenditures.
- Precious metals was the leading commodity group with respect to expenditures, averaging 57% of total spending between 2014 and 2023.
- The "Other" commodity group (coal, other metals, nonmetals), including battery minerals such as lithium[52] and graphite,[53] averaged 12% of total spending between 2014 and 2023, but increased 50% over the same period.
- Gold reserves increased by just over 50% between 2014 and 2023, while reserves of other select commodities remained relatively stable or declined. Lead reserves were highly variable over the 10-year period and declined 34% overall.

Analysis

Mineral exploration activity to advance the development of known mineral deposits and discover new deposits is vital to sustaining mineral production and meeting the future needs of society. It is also the foundation of a minerals sector with the potential to remain an important engine of economic growth across Canada. Without sufficient levels of investment in exploration and deposit appraisal, mine production and downstream activities in the minerals supply chain (smelting, refining, manufacturing) will be jeopardized.

Trends in exploration and deposit appraisal expenditures[54] in service of finding and defining those new mineral deposits are an indicator of the health and future success of the mining industry.[55]

Canada has an opportunity to supply critical minerals necessary for the energy transition, such as those used in battery manufacturing (Box 7). Progress on land access, regulatory efficiency, permit approval times, enabling infrastructure, and other ongoing challenges facing the industry will facilitate the Canadian minerals sector's ability to satisfy these new demands.

Figure 10 shows trends in exploration and deposit appraisal expenditures between 2014 and 2023. Total expenditures increased 66% between 2014 and 2023, with expenditures by junior companies increasing 106% and senior companies increasing 38%. Changes in total deposit and appraisal expenditures roughly mirror changes in the Bank of Canada's commodity price index.

[52] Included on Canada's critical minerals list.

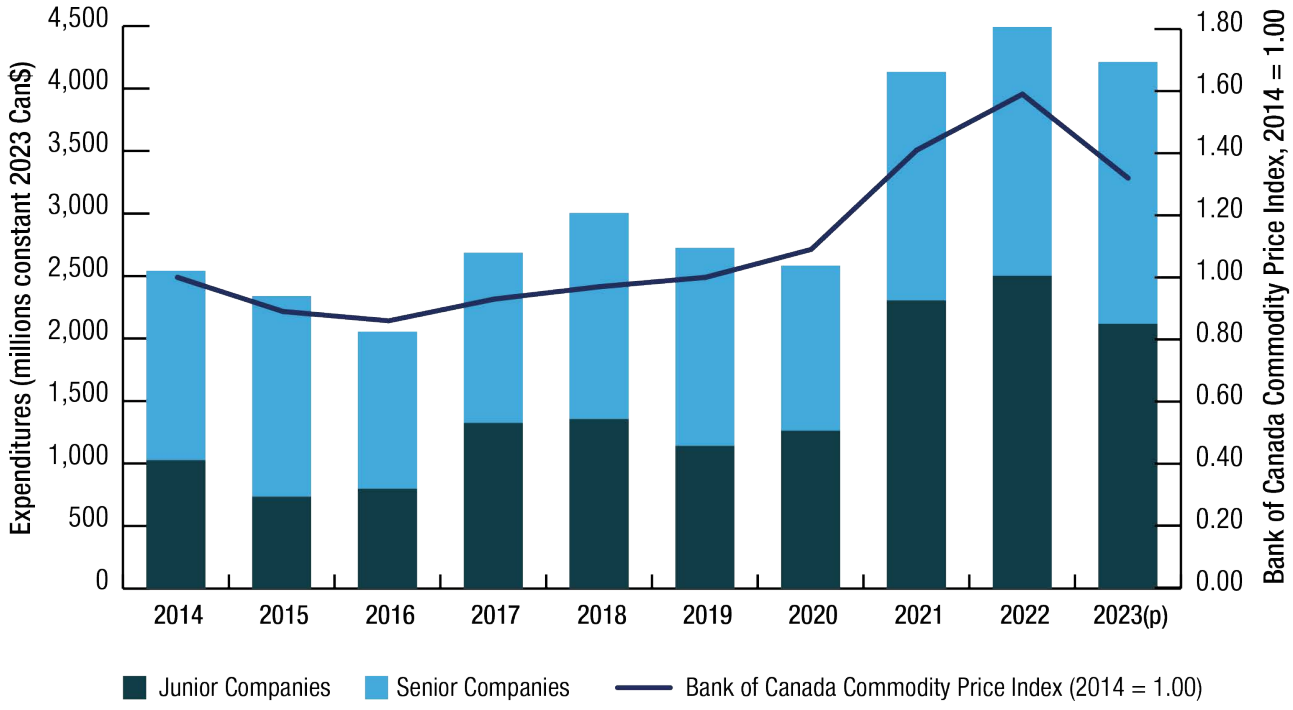
[53] Included on Canada's critical minerals list.

[54] Glossary

[55] *Exploration* is defined as the search for, discovery, and first delimitation of a previously unknown mineral deposit or the re-evaluation of a submarginal or neglected mineral deposit in order to enhance its potential economic interest based on delimited tonnage, grade, and other characteristics. *Deposit appraisal* reflects the steps undertaken to bring a delimited deposit (by definition drilling, comprehensive tests, and planning) to the stage of detailed knowledge required for an exhaustive and complete feasibility study that will fully justify and support a production decision and the investment required (Source: Natural Resources Canada, http://sead.nrcan.gc.ca/expl-expl/RG-GR-eng.aspx).

The important role of junior mining companies in the discovery and development of mineral deposits in Canada is also demonstrated in Figure 10.[56] Junior companies contributed an average of 46% of total expenditures, ranging from a low of $734 million (2015) to a high of $2.50 billion (2022).

Figure 10: Exploration and deposit appraisal expenditures, by company class, with Commodity Price Index, 2014–2023 (p)



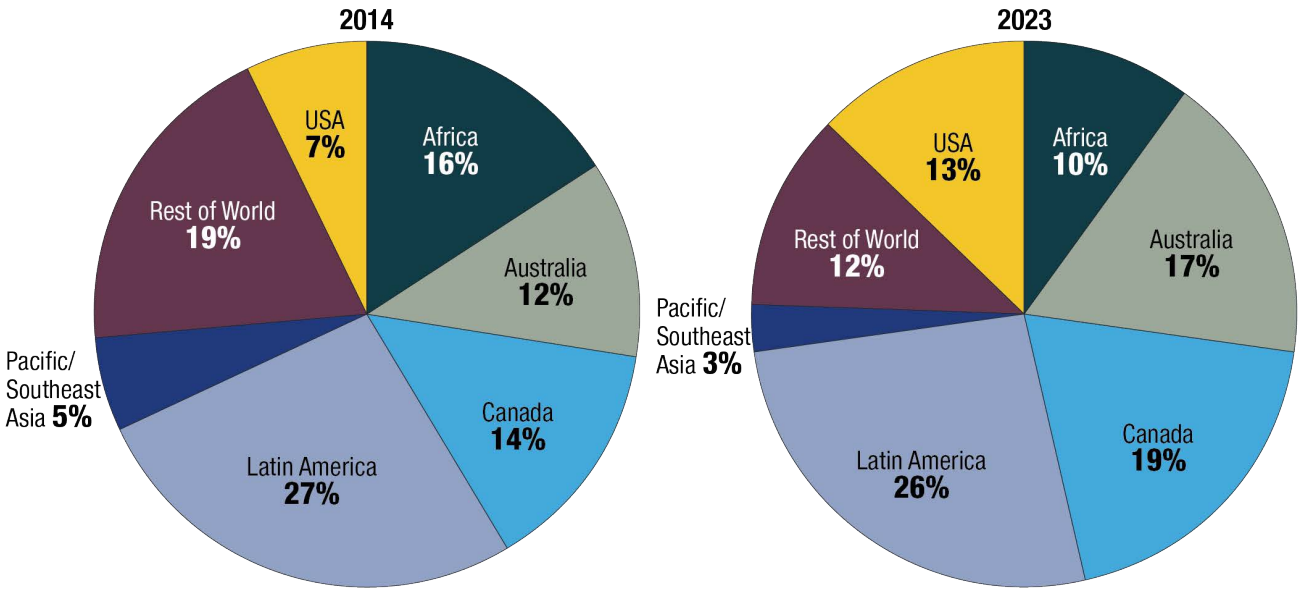
Sources: Natural Resources Canada; Bank of Canada.
(p) Preliminary.
Canada's share of global exploration spending increased from 14% in 2014 to 19% in 2023 (Figure 11).

Five Canadian jurisdictions ranked among the top 10 globally in the Fraser Institute's Annual Survey of Mining Companies (2023): Saskatchewan (3rd), Quebec (5th), Manitoba (6th), Newfoundland and Labrador (9th), and Ontario (10th).[57] was considered the third most attractive region globally for investment behind the United States and Australia. All global regions experienced decreased investment attractiveness in the results of the 2023 survey, except for Canada, the United States, and Argentina.

[56] *Junior companies* are neither a producing company (i.e., a senior company) nor the recipient of operating income from production or other business segments. A junior's company's principal business is mineral exploration, for which it is required to raise funds through the issuance of treasury shares. *Senior companies* normally derive their operating income from mineral extraction or other business segments (they need not be mining companies) rather than from the issuance of shares (Natural Resources Canada: http://www.nrcan.gc.ca/mining-materials/statistics/8854).

[57] Julio Mejía and Elmira Aliakbari (2024). *Fraser Institute Annual Survey of Mining Companies*, 2023. Fraser Institute. <http://fraserinstitute.org>

Figure 11: Global exploration spending by location, 2014 and 2023



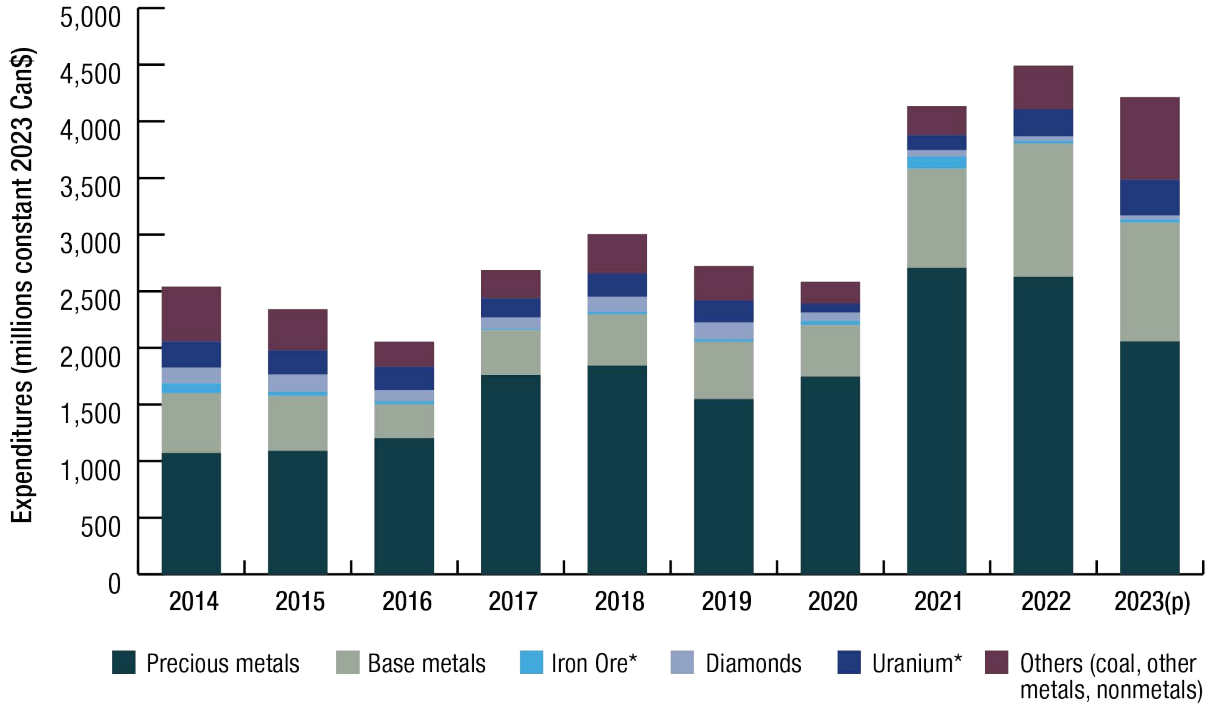
Source: S&P Global Market Intelligence

In terms of spending, precious metals (largely driven by gold) accounted for an average of 57% of total expenditures between 2014 and 2023, increasing 92% over the 10-year period. Base metals were the second most attractive commodity group, accounting for an average of 19% of total expenditures and increasing 98% between 2014 and 2023. The "other" category contributed an average of 12% to total expenditures between 2014 and 2023 while uranium[58] averaged 7%. Spending on diamonds experienced the largest decrease among the commodity groups between 2014 and 2023 (-75%) followed by iron ore[59] (-68%). It is noted that iron ore exploration annual expenditures were generally low between 2014 and 2023, suggesting that higher values seen in 2014 and 2021 may have been due to anomalously high spending.

[58] Included on Canada's critical minerals list.

[59] High-purity iron ore is included on Canada's critical minerals list.

Figure 12: Exploration and deposit appraisal expenditures, by commodity group, 2014–2023 (p)



Source: Natural Resources Canada.
(p) Preliminary.
*Included on Canada's critical minerals list. Note that high-purity iron is included on the list.

In terms of regional allocations, exploration and deposit appraisal expenditures between 2014 and 2023 were concentrated in Ontario, Quebec, British Columbia, and Saskatchewan (Table 9). The 10-year trend from 2014 to 2023 showed a substantial increase in exploration and deposit appraisal spending across most jurisdictions, except for New Brunswick.

Table 9: Exploration and deposit appraisal expenditures, by province and territory, 2014, 2019, and 2023 (p)

Province/Territory	2014 (millions of constant 2023 Can$)	2019 (millions of constant 2023 Can$)	2023(p) (millions of constant 2023 Can$)
Canada	2,542	2,725	4,214
Alberta	33	63	38
British Columbia	566	463	781
Manitoba	35	92	180
New Brunswick	37	15	16
Newfoundland and Labrador	102	60	230
Northwest Territories	128	95	139
Nova Scotia	9	45	49
Nunavut	199	139	236

Province/Territory	2014 (millions of constant 2023 Can$)	2019 (millions of constant 2023 Can$)	2023(p) (millions of constant 2023 Can$)
Ontario	590	624	976
Québec	400	600	949
Saskatchewan	309	331	434
Yukon	135	198	185

Source: Natural Resources Canada.
(p) Preliminary.

Mineral exploration and deposit appraisal activities are critical to restocking Canada's metal resources, which in turn provide a pipeline of potential reserves.[60] Figure 13 shows the relative change in quantity of Canadian reserves of various metal commodities.[61] Quantities of reserves from year to year are sensitive to exploration increasing reserves, commodity prices impacting extraction economics, and production depleting reserves. Reserves are expanded through exploration, but also through technology advancements that enhance extraction efficiency and economics.

Gold reserves showed a steady increase between 2016 and 2023, while silver and nickel[62] ended the 10-year period at levels similar to those in 2014. Reserves of all other commodities decreased, with zinc[63] experiencing the largest drop (-89%). Lead reserves were especially volatile over the 10-year period and declined 34% overall. The volatility of lead reserves reflects the low value in tonnes of reserves relative to those of other commodities. Lead reserves made up 0.2% to 1.1% of the total tonnes for all commodities considered in this analysis.

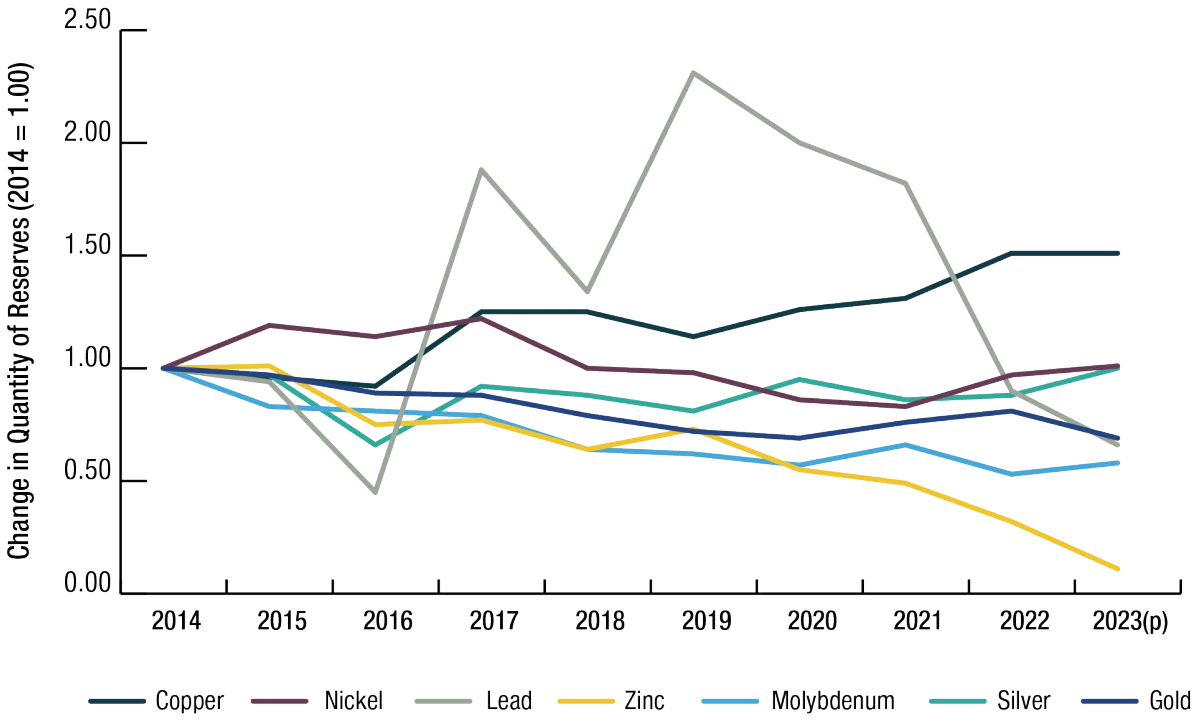
[60] Glossary

[61] Reserves by jurisdiction in Canada is included in Appendix B – Additional Information

[62] Included on Canada's critical minerals list.

[63] Included on Canada's critical minerals list.

Figure 13: Relative change in Canadian reserves of select metals, 2014–2023



Source: Natural Resources Canada.
(p) Preliminary.
*Included on Canada's critical minerals list.

Box 7: Canadian EV Battery Materials

Global demand for electric vehicle (EV) battery materials is rising as the world seeks to reduce global carbon emissions and combat climate change. Domestically, the Government of Canada has committed to achieving 100% zero-emission vehicle sales by 2035 for all new light-duty vehicles. Since 2022, four manufacturers have announced plans to build EV battery factories in Canada: Stellantis-LGES, Volkswagen-PowerCo, Northvolt, and Honda.[64]

Canada has an opportunity to build an end-to-end domestic value chain for EV battery materials, including upstream mineral production and processing which can ensure a reliable supply for these factories and reduce our reliance on materials from jurisdictions that may have poor human rights records and environmental standards.

Estimates reveal that Canada would need as many as four new lithium mines, five graphite mines, and six nickel mines to supply these EV battery factories with the minerals they need. Fortunately, there are enough mining projects in development to meet the demand, but mines take many years to develop[65] and need to overcome technical, financial, and permitting requirements before they can reach production.

[64] https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadas-critical-minerals-strategy/canadian-critical-minerals-strategy-annual-report-2024.html

[65] Average lead time of 18 years in Canada based on data from 2002 to Q1 2024.

Canada faces gaps in the midstream processing of the minerals required for the planned EV battery factories. There are advanced projects that could produce enough primary lithium hydroxide, lithium carbonate, and coated spherical graphite, but an additional seven average-sized nickel sulphate plants would be needed.

Canada is also investing in the recycling and reprocessing of materials needed for EV batteries through the Strategic Innovation Fund (SIF) and the Critical Minerals Research, Development and Demonstration (CMRDD) program.

Canada's Critical Minerals Strategy and efforts by various levels of government are working towards meeting the rising demand for EV battery materials, although geopolitical issues may create significant challenges. With ongoing investments and development in mining and processing, Canada is well positioned to supply these critical minerals while balancing environmental and social considerations, and has a unique opportunity to build a sustainable, ethical domestic supply chain, ensuring a reliable future for the EV industry.

2.5 Public Geoscience Expenditures

Highlights

- Total government expenditures on public geoscience were $176.1 million in 2023–2024 representing a 14% decrease compared to 2014–2015.
- Federal government expenditures on public geoscience averaged 49% of total public geoscience expenditures over the 10-year period and 54% in 2023–2024.
- Public geoscience expenditures decreased for all provinces and territories and the Government of Canada (-10%) between 2014–2015 and 2023–2024, except for British Columbia, which recorded a 58% increase in spending.

Analysis

The availability of public geoscience data[66] (Box 8) and analysis enables exploration companies to make informed decisions regarding their exploration plans. With a better understanding of geological environments through maps, databases, tools, and models, mineral exploration can focus on areas of higher prospectivity and a reduction in investment risk. Assessing public geoscience expenditures provides an indication of government efforts to support mineral exploration. In addition to benefiting industry, it also signals a general commitment to science and evidence-based decision-making. Public geoscience can be used in land management and conservation and infrastructure planning.

In 2023–2024, total public geoscience expenditures were $176.1 million compared to an average of $180.4 million between 2014–2015 and 2023–2024 (± $23.2 million) in constant 2023 Can$ (Table 10). Federal government expenditures (i.e., Natural Resources Canada) in 2023–2024 were $94.4 million, or 54% of total expenditures. This proportion is relatively consistent across the 10-year period.

[66] Glossary

Table 10: Public geoscience expenditures, 2014–2015 to 2023–2024 (millions of constant 2023 Can$)

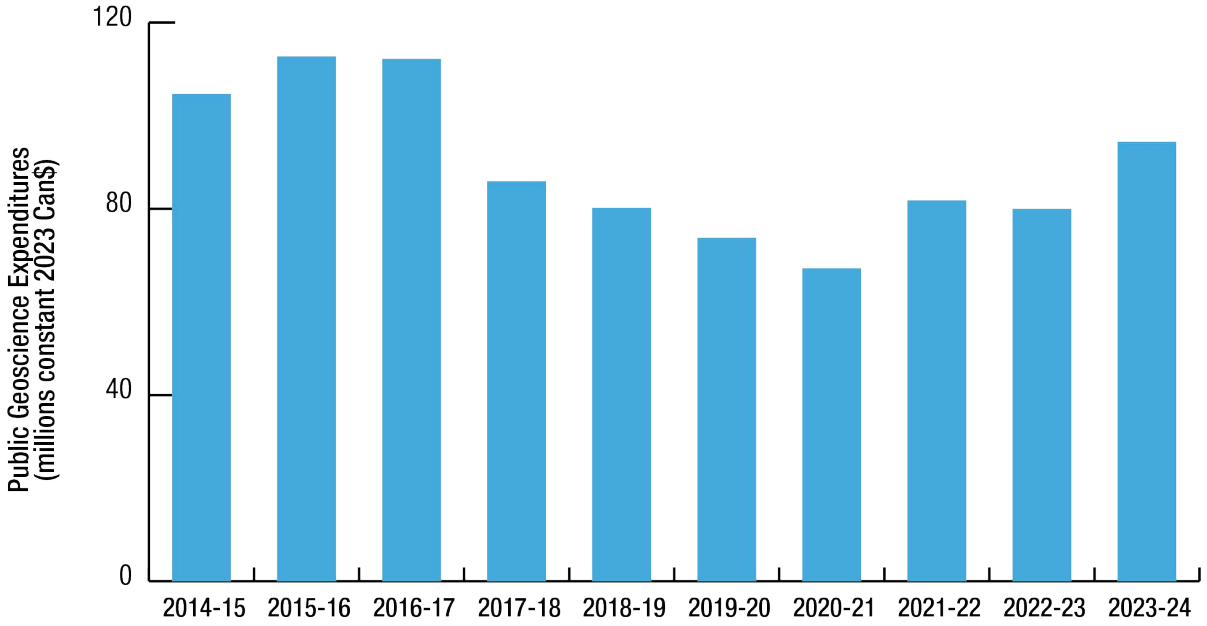
Jurisdiction	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
British Columbia	4.0	4.8	4.8	4.9	4.9	5.2	4.9	5.0	5.3	6.3
Alberta	9.4	9.5	10.1	9.3	8.4	9.6	10.0	9.9	9.1	9.0
Saskatchewan	5.5	5.8	5.7	6.0	6.7	6.6	6.5	5.1	4.8	5.1
Manitoba	6.1	6.1	6.2	5.7	4.9	4.5	4.7	4.9	4.9	5.4
Ontario	22.5	21.4	22.8	21.9	19.9	17.3	14.5	13.1	14.2	16.4
Quebec	18.8	23.2	20.1	21.6	18.1	16.2	16.3	15.9	13.4	14.6
New Brunswick	4.0	3.5	3.5	3.3	3.4	3.8	3.7	3.1	2.8	3.5
Nova Scotia	3.2	3.1	3.4	3.2	3.3	3.3	3.4	3.2	2.6	2.4
Newfoundland and Labrador	6.9	7.0	6.5	6.0	5.5	5.5	5.0	3.9	3.7	5.9
Yukon	6.2	6.3	6.1	6.5	5.3	5.9	5.4	6.7	6.1	5.3
Northwest Territories	8.8	13.0	8.8	8.0	7.7	8.8	6.9	7.0	6.3	6.3
Nunavut	4.0	3.8	3.0	3.7	3.6	3.5	4.9	1.5	1.2	1.5
Natural Resources Canada	104.7	112.7	112.2	85.9	80.2	73.8	67.2	81.8	80.0	94.40
Total	**204.1**	**220.2**	**213.0**	**186.1**	**171.9**	**164.0**	**153.4**	**161.2**	**154.3**	**176.1**

Sources: Natural Resources Canada; Committee of Provincial and Territorial Geologists.
NB: In some cases, funding received from the Geological Survey of Canada (NRCan) was included in expenditure totals for the provinces and territories. These double-counted amounts are assumed to be relatively low.

Many jurisdictions saw downward trending expenditures between 2014–2015 and 2023–2024, except for British Columbia where expenditures increased 58% over the 10-year period. Spending by Natural Resources Canada is shown below in Figure 14— an overall 10% decrease over the 10-year period. Trends in Table 10 and Figure 14 show an increase in expenditures following a low in 2020–2021. While spending was on an overall downward trend over the 10-year period, new support has been committed in recent years in connection with the Critical Minerals Strategy.[67] New funding will target processing and refining technologies and mineral value chains, and will advance reconciliation via the *Indigenous Natural Resource Partnerships Program*.

[67] https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html

Figure 14: Natural Resources Canada public geoscience expenditures, 2014–2015 to 2023–2024 (millions of constant 2023 Can$)



Source: Natural Resources Canada.

Box 8: Public Geoscience Promotion

Public geoscience supports understanding and managing natural resources, mitigating natural hazards, addressing environmental challenges, and assisting government at all levels in making informed decisions. Not only does this essential public information establish the foundation for exploring and interpreting the country's geological framework, but it also supports competitive and sustainable resource development, counters scientific mis- and disinformation, and boosts public awareness about the importance of geoscience across Canada.

The federal, provincial, and territorial governments of Canada are committed to delivering accessible public geoscience data and knowledge for all Canadians as outlined in the Pan-Canadian Geoscience Strategy.[68]

[68] https://www.canada.ca/en/natural-resources-canada/news/2022/02/pan-canadian-geoscience-strategy-enhancing-data-knowledge-and-access-for-a-stronger-future.html

The Geological Survey of Canada (GSC) publishes high-quality open access geoscience data, models, and tools—including nearly 100,000 publications in GEOSCAN[69] —to ensure researchers, industry, and decision makers across Canada have access to the latest information. To engage the broader public, the GSC shares geoscience through social,[70] NRCan's Simply Science platform,[71] and the GSC website,[72] as well as in media interviews, during student outreach, at community visits (particularly in Canada's Northern and Indigenous communities), and in plain-language products. There are a number of current and ongoing geoscience initiatives including the Critical Minerals Geoscience and Data Initiative, the Targeted Geoscience Initiative, and Geo Mapping for Energy and Minerals for the North.

The federal government is far from being the only contributor to public geoscience. Effective geoscience promotion happens across many organizations, in academia, and at all levels of government. Every province and territory in Canada has expertise for their own particular regional geoscience and publishes a range of resources online for interested users to access. A list of examples of these resources are included in the table below, but a search of any province's or territory's name and "geoscience" yields a trove of accessible resources. Please note that the list provided here is intended as a sample of online resources and is by no means comprehensive.

Select Public Geoscience Portals and Resources of Canadian Provinces and Territories

Province or Territory	Description	Link
Alberta	Alberta Geological Survey's Open Data Portal publishes a huge swath of data including geological and surficial deposit mapping, whole-rock and oil and gas well brine geochemistry, resource mapping, geological hazards, and airborne geophysical surveys.	https://ags.aer.ca/
British Columbia	The British Columbia Geological Survey creates and disseminates comprehensive public geoscience to support effective mineral exploration, sound land-use management, and responsible governance, and to attract investment.	https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/geology

[69] https://ostrnrcan-dostrncan.canada.ca/collections/c55ee05e-a198-489d-b9b4-8de8615afbb2?scope=c55ee05e-a198-489d-b9b4-8de8615afbb2&spc.sf=dc.date.issued&spc.sd=DESC

[70] https://twitter.com/NRCan?ref_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7Ctwgr%5Eauthor; https://www.facebook.com/EnvironmentandNaturalResourcesinCanada/

[71] https://natural-resources.canada.ca/simply-science

[72] https://natural-resources.canada.ca/science-and-data/research-centres-and-labs/geological-survey-canada/17100

Province or Territory	Description	Link
Manitoba	Understanding that a strong public geoscience knowledge base is recognized internationally as a key competitive advantage in profiling a jurisdiction's geological potential and attracting investment in mineral exploration and development, Manitoba makes a range of geoscience publications and data available via the Economic Development, Investment, Trade and Natural Resources website. Its Resource Centre publishes information about the province's geology, mineral and petroleum resources, and industry.	https://www.manitoba.ca/iem/geo/index.html https://www.gov.mb.ca/iem/info/library/index.html
New Brunswick	The PARIS database of government geoscience reports. Published geoscience includes borehole, core sample, fossil, mineral history, and granular aggregate databases as well as a searchable bibliography of published articles on provincial geological surveys/projects.	https://www1.gnb.ca/0078/geosciencedatabase/
Newfoundland and Labrador	The Geological Survey of Newfoundland and Labrador carries out impartial, state-of-the-art geoscientific investigations throughout the province in order to interpret and explain the province's geological evolution, and to describe and interpret the distribution, quantity, and origin of the province's mineral resources. Data includes mineral occurrence, drill core data, and other geological documents.	https://www.gov.nl.ca/iet/mines/geoscience/
Northwest Territories	The Northwest Territories Geological Survey Web Applications provides a database of publications and reports, mineral showings, and a licensed Geoscience Data Portal hosted on ArcGIS Online.	https://app.nwtgeoscience.ca/

Province or Territory	Description	Link
Nova Scotia	The Nova Scotia Department of Natural Resources publishes the Geoscience Atlas, an interactive online map providing the public with a single point source for geoscience maps, databases, and images maintained by the Department's Geoscience and Mines Branch.	https://novascotia.ca/natr/meb/geoscience-online/geoscience_about.asp
Nunavut	Nunavut Geoscience, a collaboration of the Canada-Nunavut Geoscience Office, Crown-Indigenous Relations and Northern Affairs Canada, and the Government of Nunavut disseminates geoscience data and information.	https://nunavutgeoscience.ca/en/
Ontario	The Ontario Geological Survey is the province's public geoscience steward, providing access to related information and knowledge holdings. Data is made available in a range of formats and includes mineral exploration and mining claims, critical minerals, and the Abandoned Mines Information System (AMIS).	https://www.geologyontario.mndm.gov.on.ca/ogsearth.html
Prince Edward Island	Open-data repository that covers wide-ranging topics, including those related to the geosciences, such as water quality, surface water, groundwater monitoring, and land use.	https://data.princeedwardisland.ca/search?collection=dataset
Quebec	Provides 150 years of geoscience data via SIGÉOM, a spatially referenced geomining information system that includes maps, documents and publications, and geophysical products.	https://sigeom.mines.gouv.qc.ca/signet/classes/I1102_indexAccueil?l=a
Saskatchewan	Saskatchewan Geological Survey's (SGS) Public Geoscience Initiative is investing $10 million over 10 years to provide industry with high-quality public data to support informed investment decisions.	https://www.saskatchewan.ca/government/news-and-media/2024/may/13/public-geoscience-investment-drives-exploration-spending
Yukon	The Yukon Geological Survey provides an integrated data system with access to data information, including mineral occurrences, surficial geology, and publications.	https://yukon.ca/en/geology-publications-data

2.6 Capital Expenditures

Highlights

- Capital expenditures in the minerals sector, including support activities for mining, experienced an overall increase of almost 12% in constant 2023 Can$ between 2014 and 2023.
- The increase was driven by the mining and quarrying subsector, which accounted for an average of 71% of minerals sector total investment with spending increasing 21% between 2014 and 2023.
- The non-metallic mineral product manufacturing and primary metal manufacturing subsectors experienced declines of 36% and 24% between 2014 and 2023, respectively.

Analysis

Information on capital spending[73] provides a useful indication of market conditions, both in the economy as a whole and in particular industries. In addition, information on the relative size of planned expenditure programs, particularly for industrial sectors, gives an indication of the views held by management on future market demands in relation to present productive capacity.

Capital investment is closely linked to mine capacity, or its ability to produce mineral and metal ores and concentrates, which is in turn dependent on various other factors whose influence changes over time.[74] Factors that tend to reduce capacity are permanent closures, temporary shutdowns, and the erosion in the ability of some mines to produce without a direct change in capacity (such as ore depletion).

Elements leading to an increase in capacity are re-openings of mines that were temporarily closed, expansion of existing mines, and new mines reaching production. Mining company executives make decisions on these factors based on their estimates of future commodity prices and supply and demand conditions.

Firms tend to curtail expenditures when market conditions are unfavourable and accelerate investment plans when the outlook improves. Macroeconomic conditions including interest rates, economic growth rates, and inflation can also influence capital expenditure decisions.

Capital expenditures in the mining and quarrying subsector account for the bulk of total sector investment expenditures. Mining projects are large-scale operations that have extended lead times and entail a sizable upfront investment in machinery, equipment, infrastructure, and site preparation that can extend over multiple years (possibly over a decade). This step can therefore affect industry-wide capital expenditure trends.

Canadian minerals sector capital expenditures are shown below between 2014 and 2023 (Figure 15).[75] The sector experienced overall growth from 2014 to 2023, with the mining and quarrying (except oil and gas) [NAICS 212] subsector being the largest contributor. The surge in expenditures into 2023 coincides with high interest rates and rising cost of materials and equipment.[76]

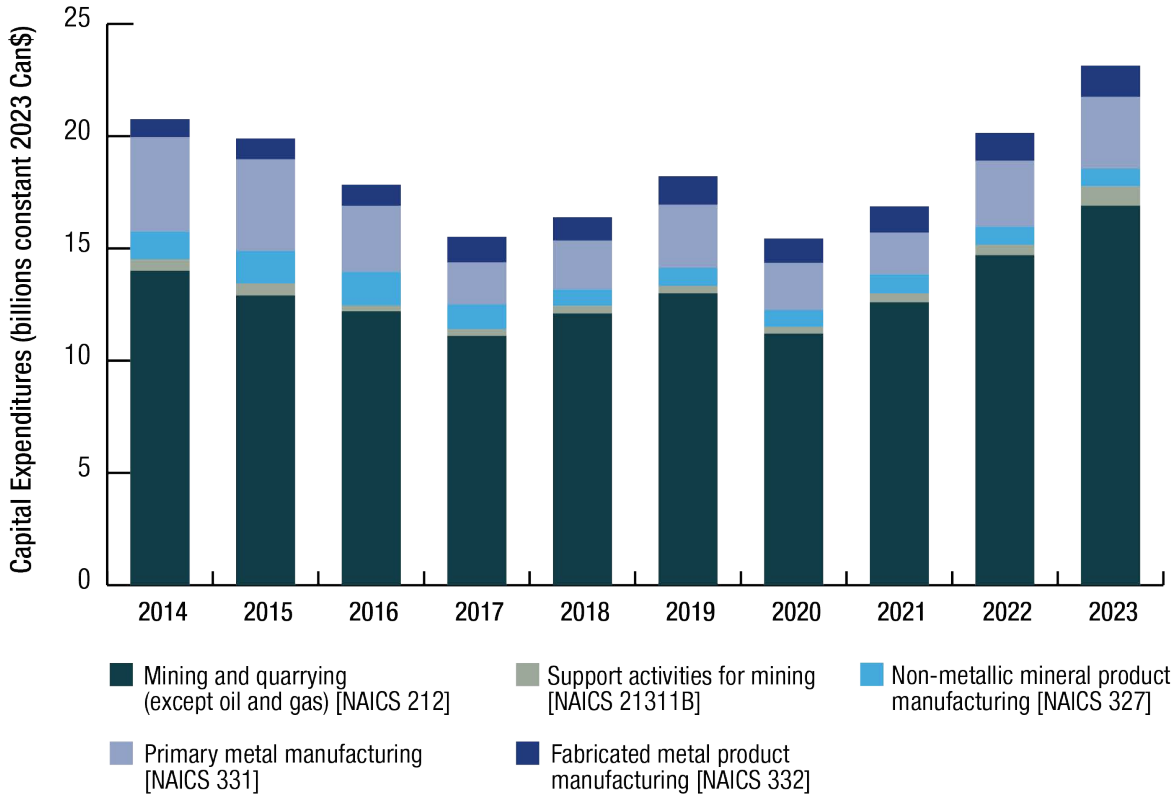
[73] Glossary

[74] Crowson, Phillip, 2008, *Mining Unearthed*, United Kingdom: Aspermont.

[75] Appendix A – Data Considerations

[76] https://natural-resources.canada.ca/maps-tools-and-publications/publications/minerals-mining-publications/capital-expenditures/17980

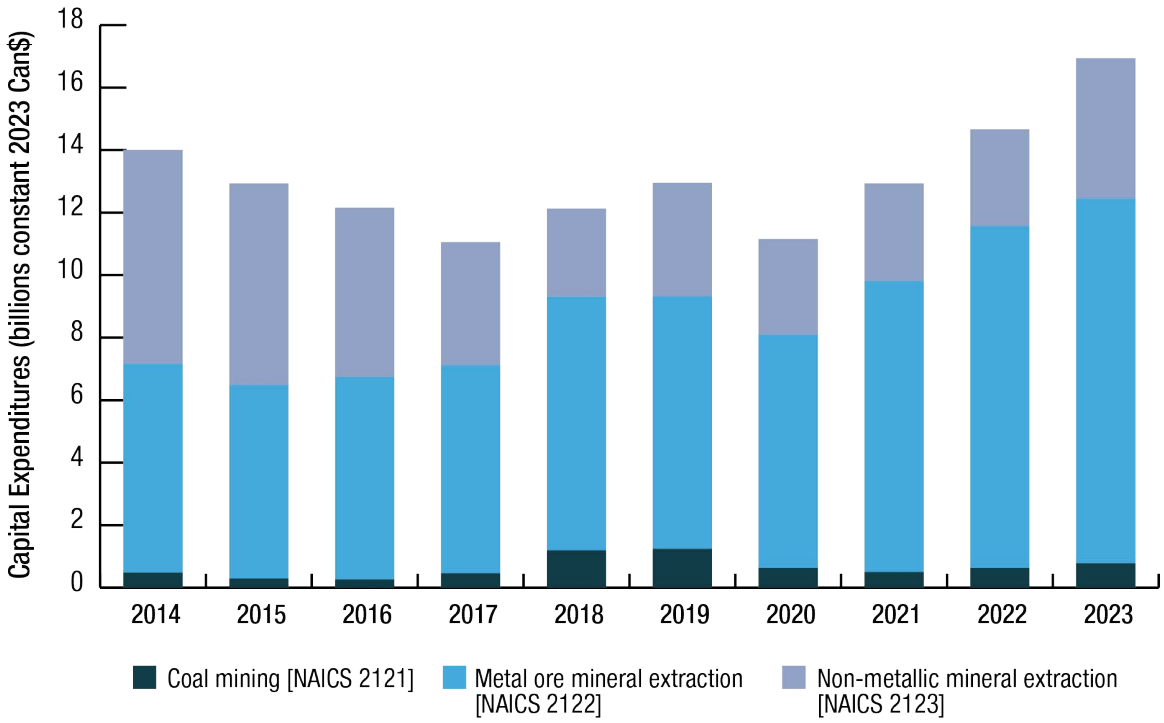
Figure 15: Minerals sector capital expenditures, by subsector, constant 2023 Can$, 2014–2023



Sources: Natural Resources Canada; Statistics Canada.

Capital expenditures in the mining and quarrying (except oil and gas) subsector [NAICS 212] are further broken down below in Figure 16. Metal ore mineral extraction [NAICS 2122] was the biggest contributor to the subsector and expenditures almost doubled between 2014 and 2023.

Figure 16: Mineral extraction capital expenditures, by commodity group, in constant 2023 Can$, 2014–2023



Source: Statistics Canada.

2.7 Research and Development

Highlights

- Business expenditures in research and development (BERD) within Canada's mining, support services, and mineral processing industries totalled $759 million in 2023, a substantial 20% decrease from 2016 (the earliest year for which complete data was available).
- Research and development (R&D) personnel in the minerals sector numbered 4,170 employees in 2022, representing a 23% decrease from 5,444 employees in 2014.

Analysis

R&D[77] plays a key role in innovation. R&D activity is pivotal to the performance of an industry and demonstrates that firms are making a commitment to new or improved production processes. R&D is important for any company or industry to remain competitive, minimize costs, and improve profitability in the long term. It can also enhance ESG investing scores by decreasing negative environmental benefits and human health impacts, improving sustainability as it drives progress, creates new technology, and identifies weakness in existing practices within the minerals industry.

[77] Glossary

Constantly evolving conditions in mining drive innovation by leveraging emerging technologies to meet long-term economic, social, and environmental goals. Collaboration and forward thinking are required to appropriately respond to the challenges faced by the natural resource sectors.

Economically, innovation seeks to enhance productivity, address skilled labour shortages, solidify global competitiveness, and develop and implement the technologies necessary to extract mineral resources in more technically challenging conditions.

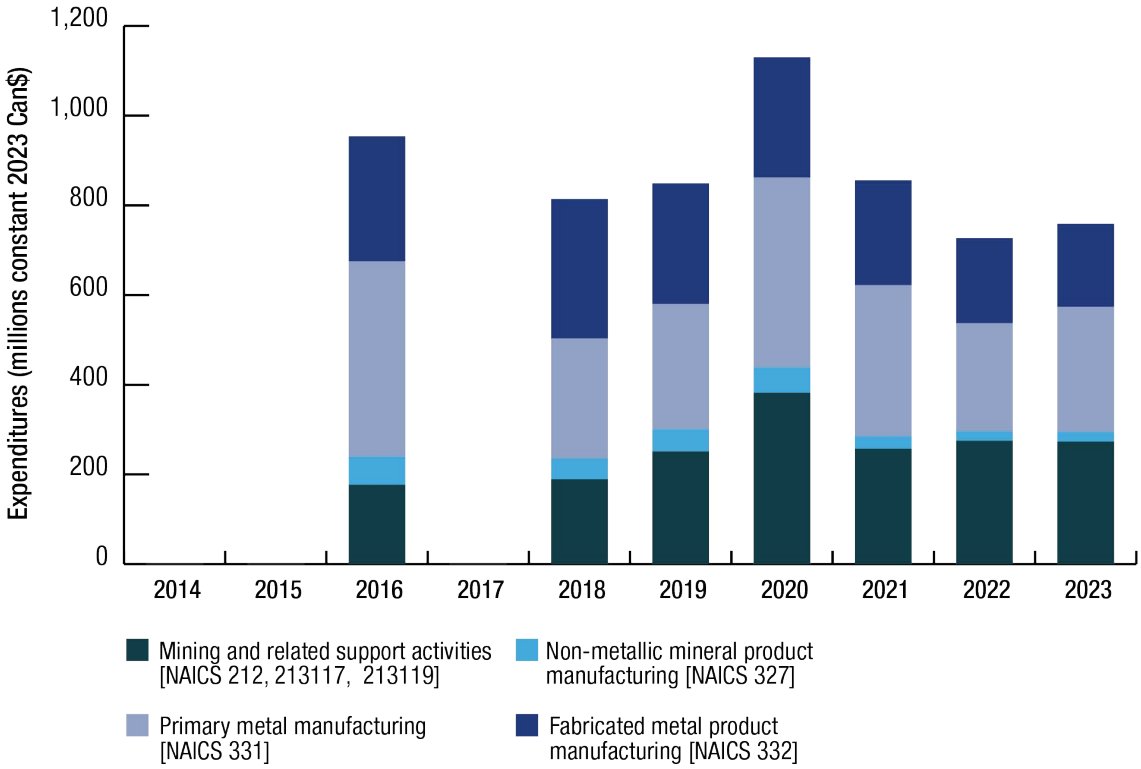
Socially, innovation can produce new technologies, practices, and processes that accelerate development and adoption of green technologies, minimize and mitigate disruptions to communities, and support early engagement of communities with the goal of fully realizing benefits of economic development.

Environmentally, innovation is important to mitigate the adverse impacts of climate change on the minerals sector, to develop new technologies and materials that are safer, to reduce greenhouse gas emissions, to promote energy efficiency, to minimize the environmental footprint, and to better manage the resources required to operate.

Canada's minerals sector business expenditures on research and development (BERD) totalled $759 million in 2023 (Figure 17).[78,79] Complete data was not available for 2014, 2015, and 2017 due to data suppression by Statistics Canada for reasons of confidentiality.

The largest subsector contribution to overall BERD spending came from primary metal manufacturing [NAICS 331] at an average of 37% of the total minerals sector. Primary metal manufacturing [NAICS 331] and mining and related support activities [NAICS 212, 213117, and 213119] were the most significant subsectors in driving the peak seen in 2020.

Figure 17: Minerals sector business expenditures on research and development, by subsector, constant 2023 Can$, 2014–2023



Source: Statistics Canada.
NB: subsector data was unavailable for certain years.

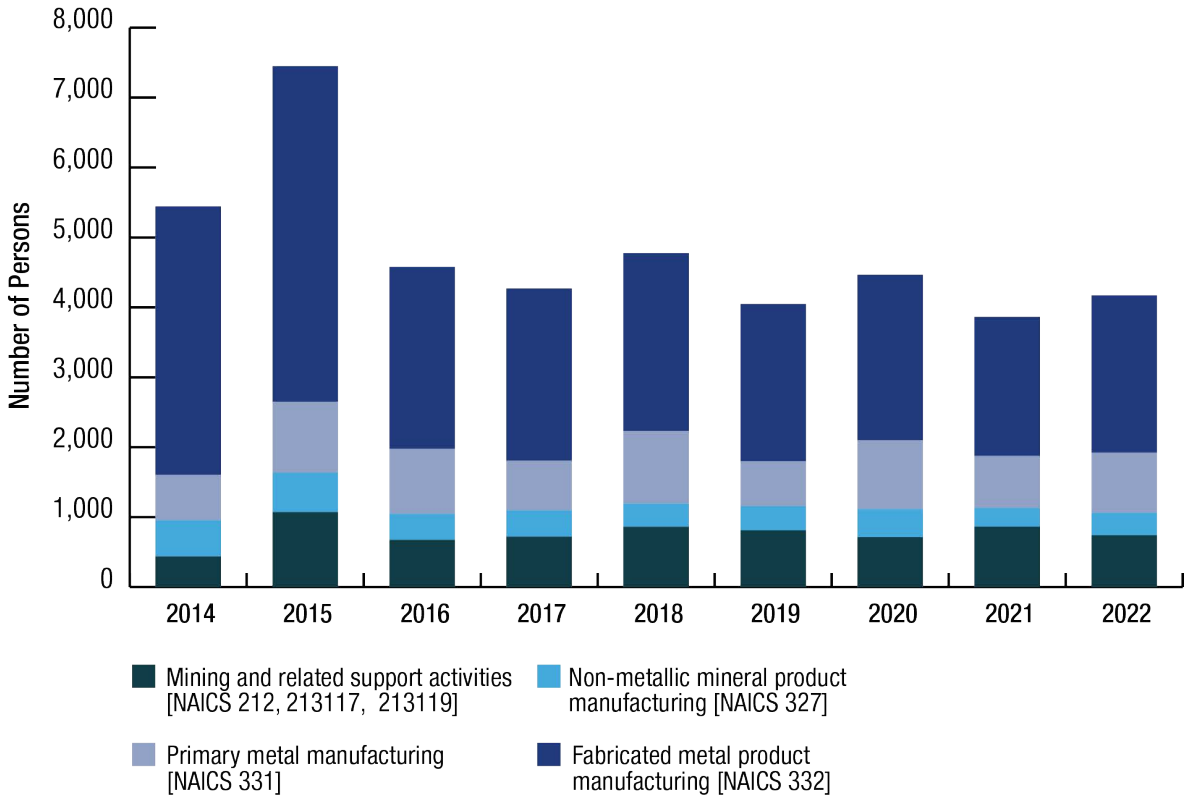
[78] Statistics Canada's dataset groups NAICS codes 212 (mining and quarrying, except oil and gas), 213117 (contract drilling, except oil and gas), and 213119 (other support activities for mining, including exploration, excluding surveying for oil and gas).

[79] Appendix A – Data Considerations

A total of 4,170 R&D personnel members were working in Canada's minerals sector in 2022, the most recent year for which data is available (Figure 18). There are several possible reasons that R&D personnel would be decreasing while overall R&D spending decreased. Generally, the trend suggests expenditures were made in areas other than hiring of additional employees (wage increases, equipment, overhead).

The fabricated metal product manufacturing subsector [NAICS 332] dominates the other three subsectors in terms of R&D personnel, contributing 57% on average to the total minerals sector over the same period.

Figure 18: Minerals sector research and development personnel, by subsector, 2014–2022



Source: Statistics Canada.

2.8 Government Revenues

Highlights

- Between 2013 and 2022, the minerals sector generated $16.4 billion in corporate provincial income tax revenue and $21.0 billion in total federal tax in constant 2023 Can$.
- The mineral extraction industry generated an additional $23.6 billion in mining royalties and taxes for Canadian governments between 2013–2014 and 2022–2023.
- Royalties and tax revenues paid to governments by the mineral extraction industry more than tripled from $1.4 billion to $4.6 billion in constant 2023 Can$ between 2013–2014 and 2022–2023.

Analysis

The minerals sector in Canada benefits from one of the most internationally competitive and attractive tax regimes for mining and mineral exploration. Canada has the lowest marginal effective tax rate among the G7 countries. Among global mining jurisdictions, Canada offers a competitive mining taxation regime including profit-based royalty systems, generous carry-forward and carry-back provisions, and unique mineral and exploration tax incentives such as the Mineral Exploration Tax Credit, the Critical Minerals Exploration Tax Credit, and flow-through shares (FTS). [80,81]

Government revenues from the minerals sector include corporate income taxes, mining taxes, and royalty payments to provincial and federal governments. Taxes and royalties paid to governments are a major part of the sector's contribution to the national economy and a way for present and future Canadians to share in the country's mineral wealth.

Generally, mining taxes and royalties in Canada are based on net income rather than revenue. However, six provinces[82] have a two-tier system in which a percentage of operating income is taxed before taxing the net income.

As shown in Table 11, between 2013 and 2022,[83] the Government of Canada, Saskatchewan, Manitoba, Ontario, Northwest Territories, and Nunavut made no changes to their corporate income tax rates for mining.[84] British Columbia, New Brunswick, and Newfoundland and Labrador increased their corporate income tax rates while Alberta, Nova Scotia, Quebec, and Yukon reduced their rates.

Table 11: Canadian federal and provincial/territorial corporate income tax rates, 2013 and 2022

Jurisdiction	Tax Year 2013	Tax Year 2022
Federal	15.00%	15.0%
Alberta	10.00%	8.00%
British Columbia	10.75%	12.00%
Manitoba	12.00%	12.00%
New Brunswick	11.00%	14.00%
Newfoundland and Labrador	14.00%	15.00%
Northwest Territories	11.50%	11.50%
Nova Scotia	16.00%	14.00%
Nunavut	12.00%	12.00%
Ontario	10.00%	10.00%
Prince Edward Island	16.00%	16.00%
Quebec	11.90%	11.50%
Saskatchewan	10.00%	10.00%
Yukon	15.00%	12.00%

Source: Natural Resources Canada.

[80] Glossary

[81] https://natural-resources.canada.ca/minerals-mining/mining-policy-taxation-industry/mining-taxation.

[82] Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, Nova Scotia, Quebec.

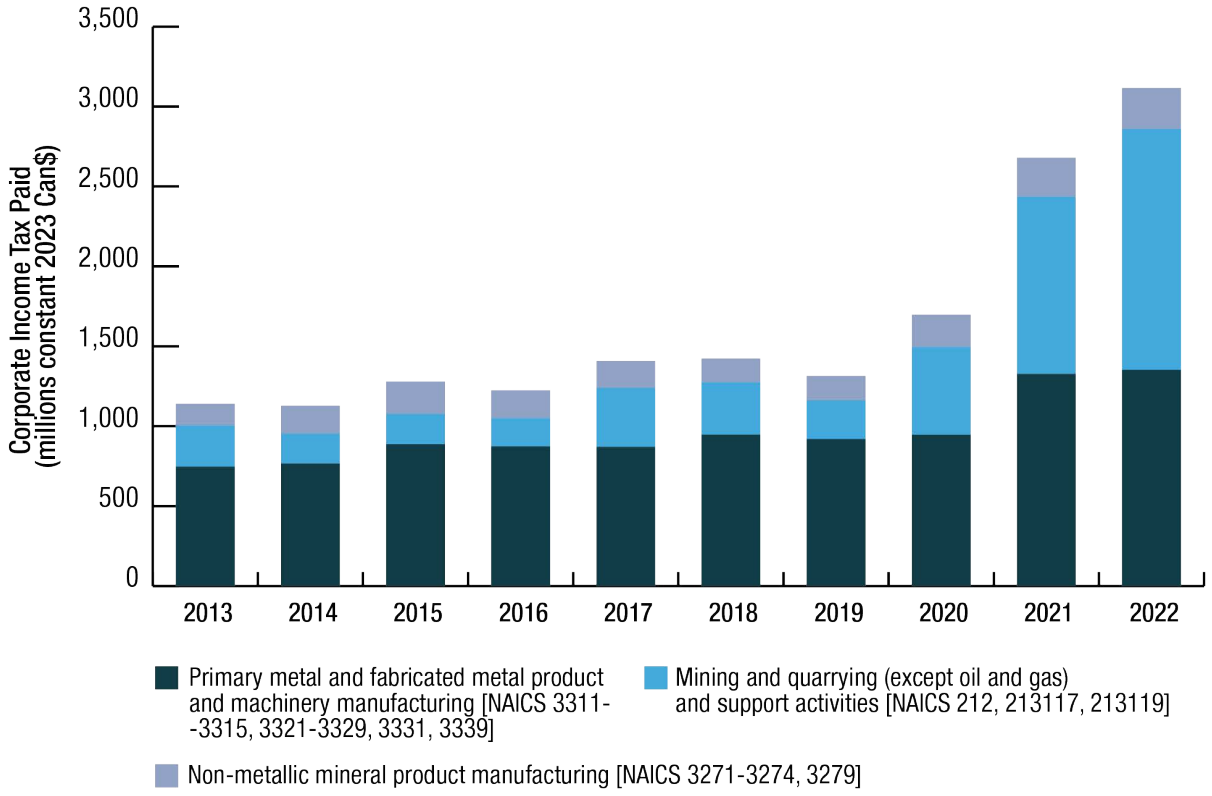
[83] A period of 2013 to 2022 was used for this section to present a 10-year range as 2023 data was not available from StatCan at the time of writing.

[84] Appendix A – Data Considerations

Corporate income tax paid to provincial governments by the minerals sector in Canada is shown below for 2013 to 2022 (the most recent year for which data were available) in Figure 19.[85] The overall trend is generally consistent with metal prices and the value of mineral production over the same period.

The increase between 2013 and 2022 was largely driven by the mining and quarrying (except oil and gas) and support activities subsector [NAICS 212, 213117, and 213119], which experienced an almost sixfold increase over the period and represented an average of 26% of total income taxes. The subsector's contribution to the total increased from 23% to 48% between 2013 and 2022.

Figure 19: Minerals sector corporate income tax paid to provincial and territorial governments, by subsector, 2013–2022

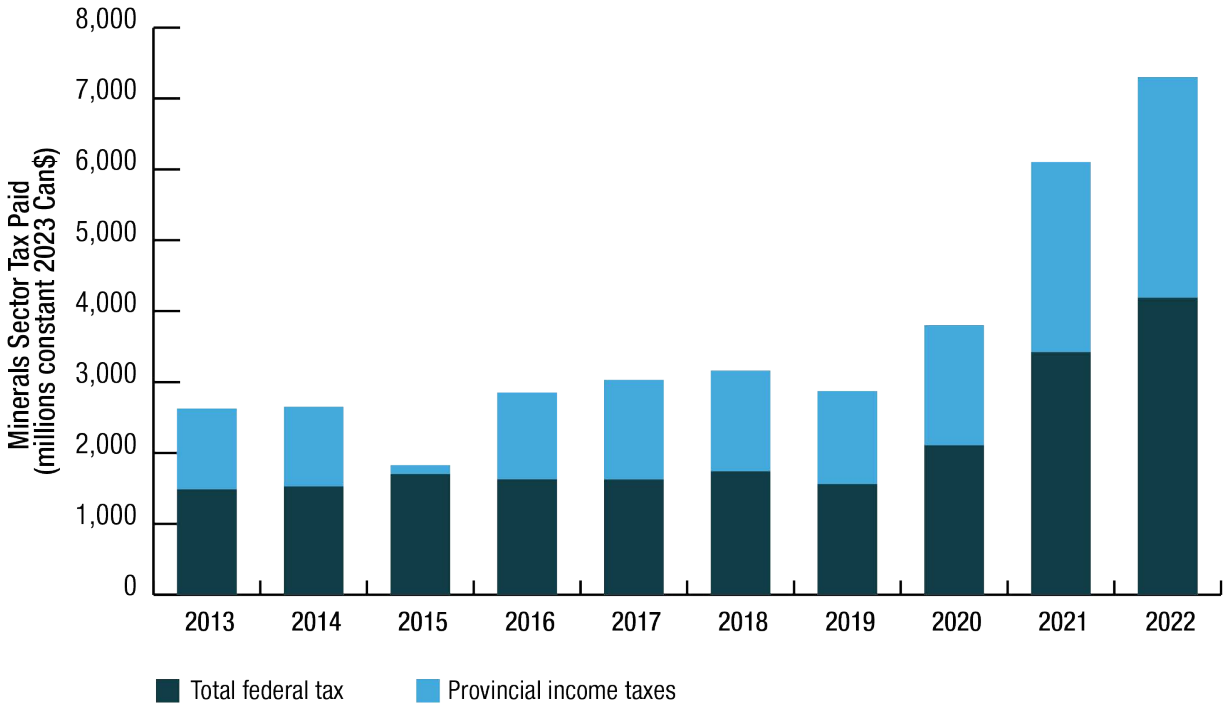


Source: Statistics Canada.

Between 2013 and 2022, the minerals sector generated a total of $37.4 billion in corporate income tax revenue for Canadian governments, with $21.0 billion going to the federal government and $16.4 billion to the provincial and territorial governments (Figure 20). Although some provinces and territories increased their corporate income tax rates and others reduced their rates over time, the revenue ratio between the federal and the provincial and territorial remains unchanged, with the federal amount accounting for 56% of the total and provinces and territories accounting for 44%.

[85] Data for NAICS 332 – fabricated metal product manufacturing are not available in a disaggregated form.

Figure 20: Minerals sector corporate income tax paid to federal and provincial governments, 2013–2022



Source: Statistics Canada.

Mining taxes and royalties paid to governments by the mineral extraction industry have experienced a more than three-fold increase between 2013–2014 and 2022–2023 (Table 12). Coal and potash[86] prices reached record levels in 2022, following Russia's invasion of Ukraine, which had a sizeable impact on mineral production values and royalties paid for that year.

[86] Included on Canada's critical minerals list.

Table 12: Royalties, mining taxes, and similar payments to provinces and territories, 2013–2014 to 2022–2023

	Payments (millions constant 2023 Can$)									
Province/Territory	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
Newfoundland and Labrador	202.2	121.3	88.4	73.8	112.9	279.6	101.2	130.3	197.4	180.2
Nova Scotia	1.8	1.4	1.7	1.6	3.0	5.2	5.5	5.5	5.0	4.9
New Brunswick	49.9	78.5	33.7	5.6	9.2	12.5	5.2	3.4	5.9	4.9
Quebec	71.6	139.9	220.9	121.9	201.2	346.5	364.2	671.9	1,090.8	613.7
Ontario	23.5	202.0	87.2	74.2	123.0	111.3	120.3	132.1	193.2	50.5
Manitoba	16.5	9.1	17.8	7.0	4.4	5.0	4.3	3.8	3.3	2.2
Saskatchewan	833.0	1,139.2	1,191.5	671.8	743.9	956.7	1,031.0	699.2	1,641.3	2,572.2
Alberta	20.2	20.3	17.7	32.2	14.5	202.6	214.6	142.1	165.3	335.0
British Columbia	134.3	113.9	130.0	318.2	585.0	482.3	295.4	83.1	670.0	817.2
Yukon	3.0	3.8	2.0	2.8	2.8	2.9	2.5	1.4	10.7	2.8
Northwest Territories and Nunavut	35.7	162.4	96.5	79.0	44.1	29.7	28.1	73.5	43.7	38.7
Canada	**1,391.5**	**1,991.8**	**1,887.3**	**1,388.0**	**1,844.2**	**2,434.4**	**2,173.0**	**1,923.0**	**3,915.3**	**4,622.3**

Source: Natural Resources Canada.

Section 3:
Social Performance

The industrial activities of the minerals sector can have a profound impact on local communities and Canadian society. The sector's outputs are key components in the production of a wide range of goods and services that benefit Canadians every day. Mineral exploration, development, and production contribute both directly and indirectly to economic and social well-being. This economic activity can enhance quality of life through job creation, education and training opportunities, improved access to infrastructure, and community development initiatives.

Mineral projects can also lead to changes in a community's identity and result in negative outcomes such as rising living costs.[87] Communities that become dependent on exploration and mining as the backbone of their local economy may be especially vulnerable to adverse effects once operations cease. Major social impacts following mine closures can include job and income loss, reduced tax revenues leading to cuts in infrastructure and social program funding, population decline, and a downturn in local economic activity, particularly those services that support the minerals sector and its workforce. Legacy environmental impacts following closures can also cause negative impacts to communities.

Outcomes and indicators in this section of the report were developed to help assess the minerals sector's social performance. Based on a review of various multi-stakeholder frameworks, the overall desired outcomes chosen to frame social performance are:

> *Develop Canada's mineral resources in order to provide tangible benefits for current and future generations, including local communities in the proximity of mineral activities such as prospecting and exploration, development, extraction, and closure and reclamation.*[88]

> *Conduct engagement processes to ensure local and affected communities have the opportunity to participate in the development of resources that could influence their future.*

The following strategic directions of the Canadian Minerals and Metals Plan were selected to further articulate the targets and outcomes for the social performance of the sector:[89]

- **Global leadership**
  - A sharpened competitive edge and increased global leadership for Canada.
- **Communities**
  - Communities welcome sustainable mineral development activities for the benefits they deliver.
- **Advancing the participation of Indigenous Peoples**
  - Increased economic opportunities for Indigenous Peoples and supporting the process of reconciliation.

The indicators[90] chosen to measure the sector's performance related to these outcomes are:

- **Employment** – Employment in the minerals sector offers income security, improved living standards, and transferable skills. Tracking employment levels helps assess the sector's key socio-economic contributions to communities across Canada, from urban centres to rural, northern, and remote areas.

[87] Natural Resources Canada, 2003, *The Social Dimension of Sustainable Development and the Mining Industry*, http://www.publications.gc.ca/site/eng/9.686723/publication.html.

[88] It is noted that while they are not discussed here, negative environmental impacts can also have social consequences such as effects on quality of life, life expectancy, and other factors.

[89] Refer to Section 1 for a full explanation of the alignment of the Canadian Minerals and Metals Plan and the Mining Sector Performance Report.

[90] The authors acknowledge that the indicators presented in the report are currently insufficient to measure all the positive and negative social impacts of the minerals sector. The search for relevant data and new indicators for subsequent editions of the report is an ongoing priority.

- **Indigenous employment** – Representation of Indigenous workers in the minerals sector is a key part of reconciliation. It helps ensure diverse perspectives are included, increases inclusivity, and strengthens community relationships. It also enables economic empowerment and preservation of cCultural and Traditional Knowledge, benefiting Indigenous communities and the broader society.
- **Skilled labour supply** – Crucial to the minerals sector as it ensures efficient operations, safety, and the effective use of advanced technologies. Strongly connected to the employment indicator above as the sector needs qualified personnel to staff those positions. It also helps maintain high productivity levels, enabling the industry to meet global demand and remain competitive, while offering skilled workers good salaries and long-term career opportunities.
- **Gender, diversity, and inclusion** – In this case refers to the measurable diversity of employees within the sector, including gender, immigrants, and visible minorities. It is an important indicator for assessing the effectiveness of industry efforts to remove unintended barriers that may prevent increased representation in the sector's labour force.
- **Government funding for public participation in impact assessments** – Impact assessments evaluate potential impacts of natural resource development, including cumulative effects, mitigation measures, and public feedback. Funding to support public and Indigenous participation in these assessments can indicate efforts to address concerns during regulatory processes.
- **Workplace health and safety** – Measured as the occupational injury rate, both fatal and non-fatal. Monitoring these rates helps determine the minerals sector's level of performance in ensuring safe practices and healthy work environments.
- **Mine openings and closures** – Mine openings and closures can result in significant socio-economic impacts, both positive and negative, including changes in employment, government revenues, population, and socio-economic activity in the local area.
- **Strikes and lockouts** – Strikes and lockouts are the result of friction between employees and the employer. Regardless of the reason for the labour disruption, they can have a negative impact on the industry, the workers, and the local community.

3.1 Employment

Highlights

- The number of people employed in mining, mining-related support activities, and mineral processing increased 7% from 375,670 to 401,435 employees between 2014 and 2023.
- The increase was largely driven by the mining and quarrying (except oil and gas) [NAICS 212] (21%) and mining-related support activities [NAICS 21311B] (17%) subsectors.
- Annual compensation increased between 2014 and 2023, reaching an average of $111,704 for the minerals sector compared to the national average of $76,208 for all industries.[91]

[91] The total annual compensation per job for the minerals sector is a weighted average of NAICS 212 – mining and quarrying (except oil and gas), NAICS 21311B – mining-related support activities, NAICS 327 – non-metallic mineral product manufacturing, NAICS 331 – primary metal manufacturing, and NAICS 332 – fabricated metal product manufacturing.

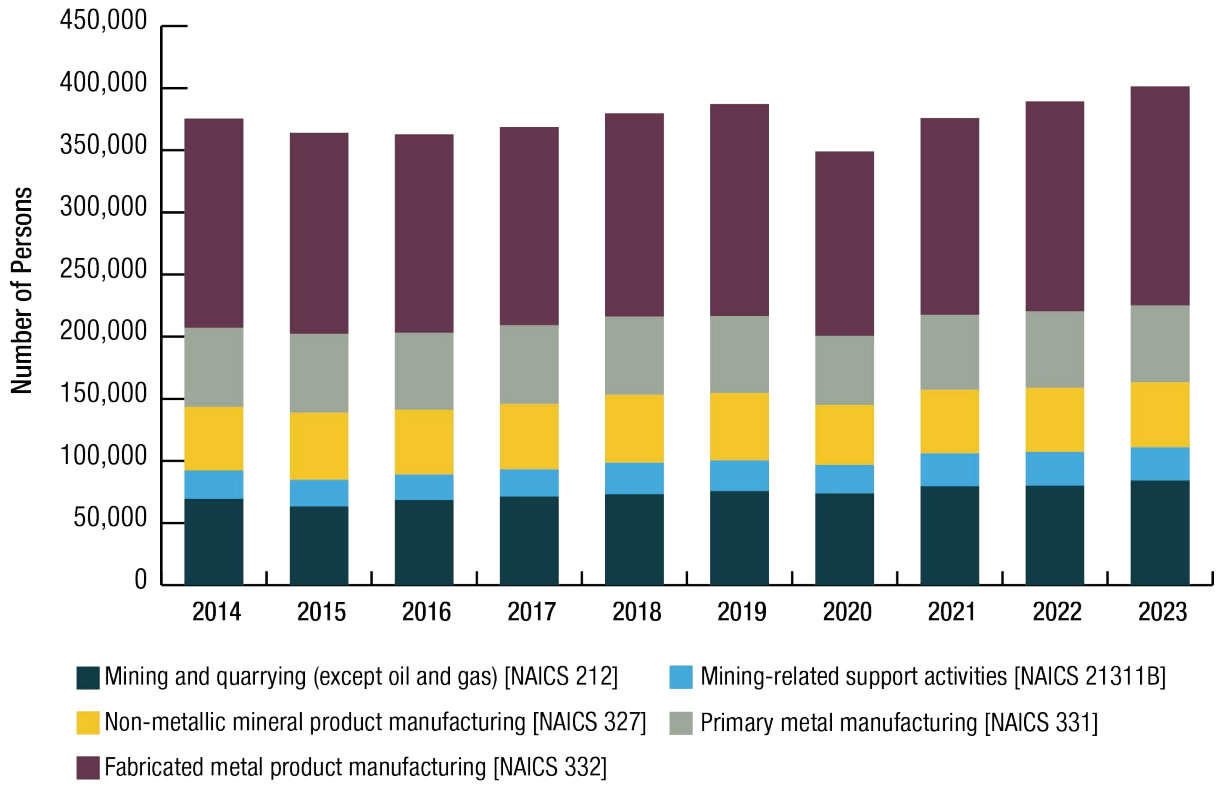
Analysis

Stable employment[92] provides income security that supports improved quality of life and the acquisition of transferable skills. In addition, employment leads to consumption and spending in the local community (usually in services and retail) where people live, which drives local economic development and improved quality of life, often resulting in better health.[93] There is a positive correlation between employment and gross domestic product (GDP) growth, which can lead to increased living standards.[94] Employment opportunities in the minerals sector encompass both traditional roles and emerging innovative skill sets.

In Canada, minerals sector jobs, including mining, mining-related support activities, and mineral processing, employed 401,435 people in 2023, representing a small but notable increase compared to 2014 (Figure 21).[95] The sector consistently contributed an average of 2% to total employment in Canada between 2014 and 2023.

The fabricated metal product manufacturing subsector [NAICS 332] was the largest employer among the minerals subsectors. While mining and quarrying (except oil and gas) [NAICS 212] and mining-related support activities [NAICS 21311B] experienced the largest positive trend over the 10-year period, these subsectors were relatively small in terms of employment within the larger sector and when compared to fabricated metal product manufacturing [NAICS 332].

Figure 21: Mining, mining-related support activities, and mineral processing employment, 2014–2023



Source: Statistics Canada

[92] Glossary

[93] https://www.canada.ca/en/public-health/services/publications/science-research-data/quality-life-framework-lessons-learned-multisectoral-action.html

[94] Daly, Mary C., et al., 2014, *Interpreting Deviations from Okun's Law*, Federal Reserve Bank of San Francisco: Economic Letters, http://www.frbsf.org/economic-research/publications/economic-letter/2014/april/okun-law-deviation-unemployment-recession/.

[95] Appendix A – Data Considerations

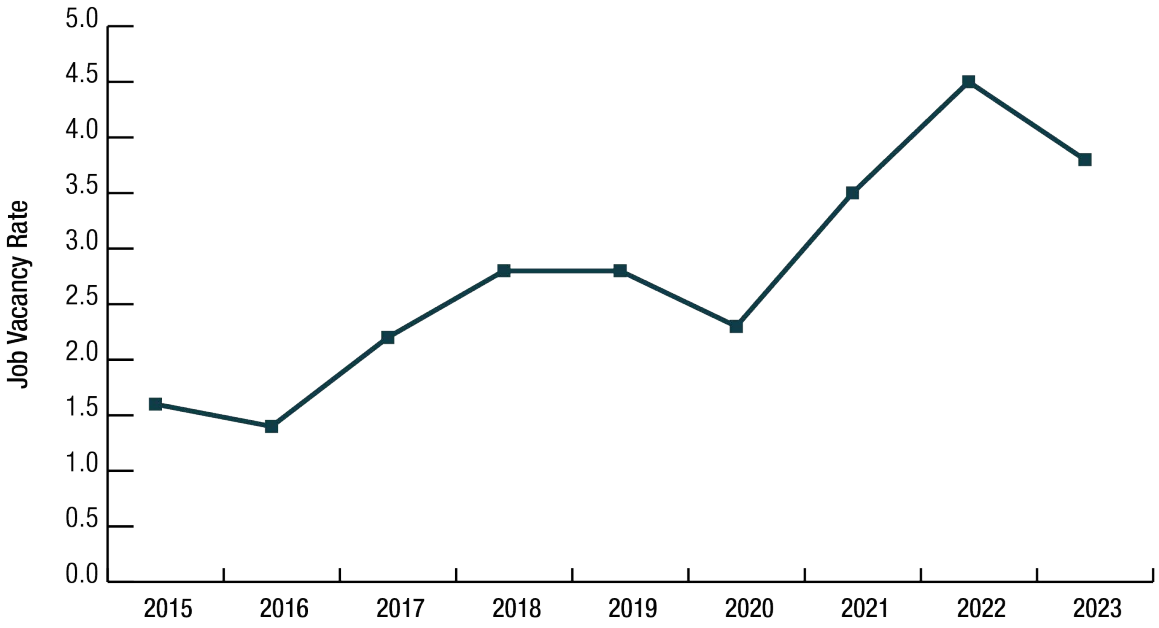
Fluctuations in sector employment generally result from factors influencing the mining and other associated sectors such as volatile commodity prices, market cycles, and global economic trends. These factors can lead to the opening and closing of mines and plants, which will have an influence on employment.

Compensation in the minerals sector remains among the most lucrative in the Canadian economy. The average annual salary for the minerals sector was $111,704 in 2023. The national average for all industries in Canada increased 31% from 2014 to 2023, but at $76,208, was only 68% of the average minerals sector salary.

The average annual job vacancy rate is shown below in Figure 22.[96,97] The overall trend shows the job vacancy rate in the Canadian minerals sector more than doubled from 2015 to 2023, leading to what is sometimes referred to as a "job-seeker's market."

The Canadian Mining Labour Market 10-year Outlook 2023 produced by the Mining Industry Human Resources Council (MiHR) considers the current Canadian minerals sector as a tight labour market post-2020. This situation is marked by several factors including low unemployment, high job vacancy rates, and strong employment growth. While this situation can benefit those seeking employment in the sector, it also suggests heightened labour market pressures for employers in the Canadian minerals sector.[98]

Figure 22: Average minerals sector job vacancy rate, 2015–2023



Source: Statistics Canada

[96] Source data was presented by quarter, and the calculated annual average ignores missing data points for Q1 2015, Q2 and Q3 2020, and Q3 2023. It is not expected that these missing data points affect the trend over the last decade in any meaningful way.

[97] The job vacancy rate is the number of job vacancies expressed as a percentage of labour demand; that is, all occupied and vacant jobs.

[98] Mining Industry Human Resources Council, 2023, *Canadian Mining Outlook 2023,* https://mihr.ca/wp-content/uploads/2023/03/Mihr-National-Outlook-EN-2023.pdf

3.2 Indigenous Employment

Highlights

- For the 2014–2023 period, Indigenous employment averaged 9% of employment in the mining industry, 4% in the broader minerals sector, and 3% in the total of all Canadian industries.
- In 2023, over half of Indigenous employment was concentrated in the mining and quarrying (except oil and gas) subsector [212] (58%), a significant increase from 42% in 2014.
- Census 2021 results were 30% higher in terms of Indigenous employment in the minerals sector compared to 2021 Labour Force data; most of the difference was due to the discrepancy between the mining and quarrying (except oil and gas) subsector [212] results between the two datasets.

Analysis

Indigenous participation in the minerals sector is important in many respects, including in terms of economic opportunities, knowledge sharing, and reconciliation. The Indigenous population in Canada is younger and growing at a faster rate than the general population. With many producing mines and exploration properties located in close proximity to Indigenous communities, Indigenous Peoples across the country are well positioned to access employment opportunities and other benefits in the sector (Box 9).

Major barriers to Indigenous workers entering and advancing in the mining workforce remain, including training, gaining experience, and familiarity with the industry as well as discrimination, productivity-fixated work culture, and the inability of employers to address specific needs and concerns.[99]

The Mining Industry Human Resources Council has found that, while mining in Canada is among the largest employers of Indigenous Peoples (9.8% of the mining workforce and growing compared to 3.9% across all industries), workers are largely concentrated in production and trades roles, and potential for increased Indigenous representation in areas such as finance, professional, and physical science occupations remains strong.

Providing training and transferable skills development for new workers is an important element of economic reconciliation and critical for the mining industry to grow the available labour pool in these occupations. The industry still has major opportunities to improve its competitiveness in attracting additional Indigenous workers in production and trades roles.

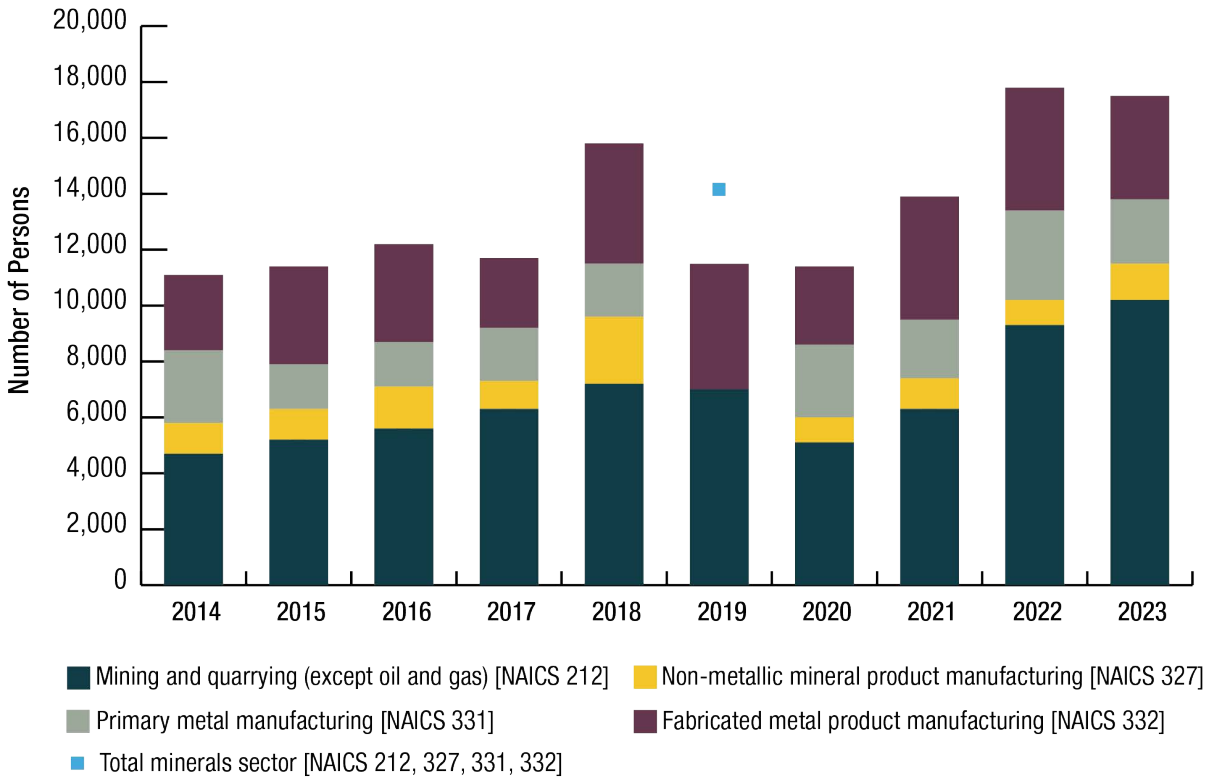
Indigenous employment in the minerals sector increased overall from 2014 to 2023 (Figure 23).[100] Total minerals sector employment in 2019 is represented by a single data point as data for the non-metallic mineral product manufacturing and primary metal manufacturing subsectors was suppressed by Statistics Canada for reasons of confidentiality.

The increase in the overall minerals sector was driven by the mining and quarrying (except oil and gas) subsector [NAICS 212], which both employs the most individuals among the subsectors and experienced consistent positive growth over the 10-year period. Indigenous employment in the other three subsectors was more variable over the same period.

[99] MiHR (2024), Equity Deserving Groups in Canada's Mining Industry.

[100] Appendix A – Data Considerations

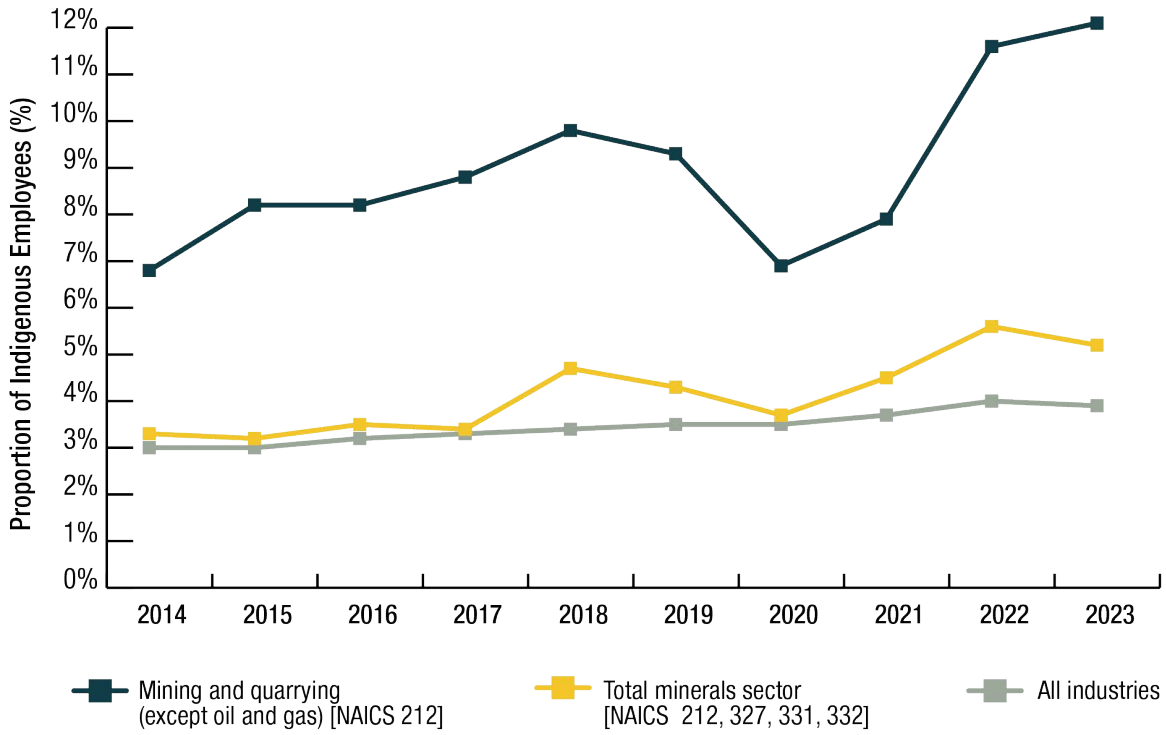
Figure 23: Minerals sector Indigenous employment, 2014–2023



Source: Statistics Canada.

The proportion of Indigenous People working in the minerals sector is shown below along with the proportion for the mining and quarrying (except oil and gas) subsector [NAICS 212] (Figure 24). The proportion increased for both the subsector and overall sector at a higher rate than for the total of all industries in Canada between 2014 and 2023.

Figure 24: Indigenous People as percent of total employees in the minerals sector and all industries, 2014–2023



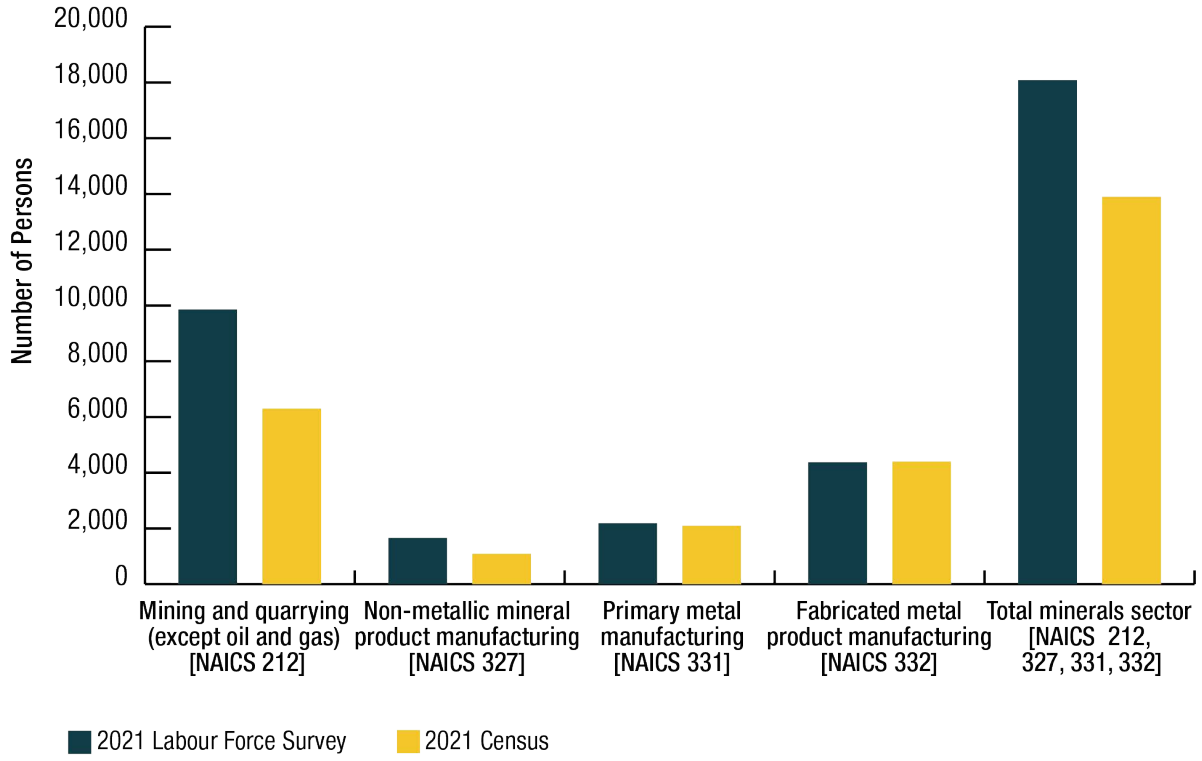
Source: Statistics Canada.

The release of data from Statistics Canada's Census 2021 allows a comparison of employment numbers to the Labour Force Survey (LFS). The Census data is considered more accurate than the LFS, and is available at higher levels of detail, but with the trade-off of less frequent publication of new data. The next Census will take place in 2026.

Census 2021 data on Indigenous employment in the minerals sector and related subsectors is shown below and compared to the LFS results for the same year (Figure 25). Census results are more favourable in terms of Indigenous employment in the subsectors compared to the LFS except for fabricated metal product manufacturing (where the difference is negligible).[101]

[101] Appendix A – Data Considerations

Figure 25: Comparison of census and LFS minerals sector Indigenous employment results, 2021



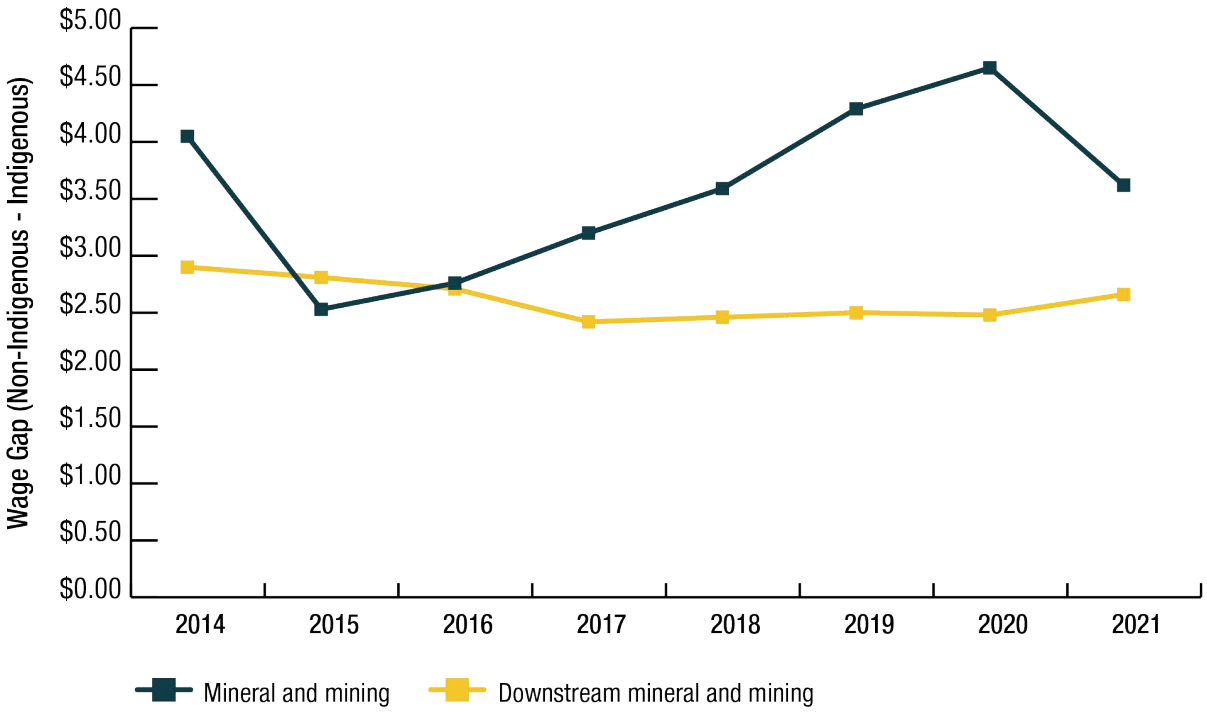
Source: Statistics Canada.

Figure 26 illustrates the minerals sector wage gap when average hourly wage of non-Indigenous employees is compared to that of Indigenous employees. The wage gap was calculated by subtracting the annual average hourly wage of employees who identify as Indigenous from that of employees who do not identify as Indigenous. The wage gap in the upstream "mineral and mining" subsector[102] has decreased overall by 7% between 2014 and 2021; however, data across the 10-year period shows substantial variability. In comparison, the wage gap in the downstream mineral and mining subsector[103] stayed relatively stable over the same period while decreasing 5% across the 10-year period.

[102] Appendix A – Data Considerations

[103] Appendix A – Data Considerations

Figure 26: Wage gap for Indigenous employees vs. non-Indigenous employees in the minerals sector



Source: Statistics Canada.

Box 9: Indigenous reconciliation through resource projects

Historical disadvantages mean Indigenous communities generally have fewer options to secure capital and make investments than other organizations, but this is changing. Recent efforts by companies and various levels of government are seeking to level the playing field, enhancing the ability of Indigenous governments to participate in the ownership of major projects and related businesses, including those in the minerals sector. Below are several examples of programs and partnerships that are reflective of these efforts.

Indigenous Loan Guarantee Program: Initially announced in Budget 2024, the Indigenous Loan Guarantee Program was formally launched on December 16, 2024, through the 2024 Fall Economic Statement. It will provide up to $5 billion in loan guarantees to unlock capital for Indigenous groups across the country and funding to support Indigenous groups conducting investment analysis and due diligence to assess equity ownership opportunities offered to them. Loan guarantees reduce the interest rates on loans by providing a guarantee that the debt will be repaid by the guarantor (the federal government) should the earnings from the borrower's (Indigenous groups) equity investment be unable to. Loan guarantees will enable Indigenous groups to overcome historic barriers to affordable capital, helping them become meaningful equity partners in natural resource and energy projects. Alberta, Ontario, and Saskatchewan have established Indigenous loan guarantee programs and British Columbia has announced its intent to develop a similar program.

Indigenous Procurement Guide: The Canadian Minerals and Metals Plan's Local Procurement Checklist to Support Indigenous Procurement in Mining sets out steps companies can take to increase opportunities for Indigenous businesses.[104] This includes advanced notification, price preferences, and unbundling larger contracts into smaller contracts, allowing local firms to successfully bid on them.

Met/Nuna partnership: A joint venture of Metcor, owned by the North Slave Métis Alliance and Inuit-owned Nuna Logistics, Met/Nuna signed a three-year, $110 million contract to be the primary contractor for the reclamation of De Beers Canada's Snap Lake diamond mine. By forming a joint venture, Indigenous Peoples in the Northwest Territories will benefit directly from the contract and from employment. "Taking it apart piece by piece, in a safe and environmentally friendly manner, is a far departure from the history of mine closure in the NWT," said Marc Whitford, Metcor President. "It is the way of the future." Active closure is expected to be completed in early 2025.

Nisga'a Royalty Model: In February 2024, the Nisga'a Nation started the first Indigenous royalty company, forming Nations Royalty Corporation. Listed on the TSX Venture Exchange in June, the company is focused on Indigenous-owned mining royalties, including project royalty revenues or lump sum payments contained in Impact and Benefit Agreements. Nations Royalty's portfolio includes its current royalty agreements with five mines in B.C.'s Golden Triangle, but it hopes to partner with other Indigenous groups on their royalties and to help them negotiate their Impact Benefit Agreements to ensure they're getting a fair transaction.

3.3 Skilled Labour Supply

Highlights

- Average hourly wages in the upstream mineral and mining sector increased 5% between 2014 and 2021, with the largest gains seen for workers holding trade certificates (7%) in constant 2023 Can$.
- Average hourly wages in the downstream mineral and mining sector increased 6% between 2014 and 2021, with the largest gains for those with a high school diploma or less (4%) in constant 2023 Can$. A notable decrease of 2% in hourly wage was experienced by workers holding university degrees or higher.
- Graduates from programs relevant to mining decreased 11% between 2014 and 2021, while total graduates from all programs increased 22%.

Analysis

Employment in the minerals sector covers an incredibly wide array of workers including prospectors and miners, but also manual labourers, office workers, engineers and scientists, equipment operators, and many others. Current and future success, productivity, and competitiveness of the minerals sector depends on a steady supply of labour providing all the skills needed in the mining and related manufacturing subsectors.

[104] https://www.minescanada.ca/sites/minescanada/files/2024-03/procurementchecklist-en.pdf

The breadth of skills needed to explore, develop, and operate a potential mine as well as process mineral ores and manufacture downstream products is immense. While this section focuses on workers and students with technical, engineering, and scientific backgrounds, it is important to remember there are other critical occupations in the minerals sector best served by workers with social sciences and humanities backgrounds, with roles in community development, sustainability, and human resources.

A previous section discussed employment numbers (see Section 3.1 Employment). This new section of the MSPR presents data tracking the available supply of skilled labour available to the minerals sector. It also includes programs and educational streams chosen by student graduates each year that are relevant to mining. Average hourly wages as a function of education level are also included.

Decreasing numbers of graduates of mining-relevant programs in the face of an industry experiencing growth would suggest a tight labour market that benefits workers in the short term but may have longer-term consequences in terms of success, efficiency, and growth of the industry. A forward-facing look at the minerals sector labour market is presented in Box 10.

Box 10: Mining Sector Labour Market Outlook

The Mining Industry Human Resources Council (MiHR) is an independent, non-profit organization that leads collaboration across Canada's mining industry to understand labour market trends, identify opportunities, and develop solutions.

MiHR's labour market research indicates that Canada's minerals and metals sector faces a people crisis. In 2023, the labour market tightness picture was clear: Canada's mining industry was facing acute labour shortages during a period of rapid growth, higher metals and minerals prices, and increasing capital expenditures. These developments were coupled with significant worldwide disruptive events, including the pandemic, the Russia-Ukraine war, and newfound concerns of inflation and monetary policy.

While the disruptions of the past few years have begun to level, the long-term stability of Canada's mining labour market remains a concern. Long-term forces will continue to undermine the ability of the labour supply to respond to periods of growth and help Canada transition to a clean economy, and MiHR continuously monitors a handful of labour market indicators to diagnose labour tightness, including industry sentiment, unemployment rate, job vacancy rate, unemployed-to-vacancies rate, employment growth, and wage growth:

- Among employers surveyed in *Mining, quarrying and oil and gas extraction* (NAICS 21), industry sentiment trended upward in 2023 regarding expectations for labour tightening factors.
- Since 2023, the mining unemployment rate has continued to exhibit acute labour market tightness with roughly 1% unemployment during low periods for *Mining and quarrying* [NAICS 212] and *Primary metal manufacturing* [NAICS 331].
- Job vacancy rates remain elevated compared to pre-pandemic levels with roughly 1% unemployment during the low periods for *Mining and quarrying and Primary metal manufacturing*.
- A low unemployed-to-vacancies ratio shows a prominent tightening trend in mining-related sectors. Notably, the ratio in *Mining and quarrying* has fallen dramatically since the pandemic, from 2.8 to less than one unemployed per job vacancy. This is markedly lower than pre-pandemic levels of roughly 1.5 on average. Other mining-related sectors display a similar trend with less than one unemployed per job vacancy as the new normal.

- Rapid employment growth is putting a strain on the expanding industry. For example, *Mining and quarrying* grew by roughly 50% in 2022, reaching eighty-five thousand workers in January 2023.
- Mining has relatively high wages compared to the average for all industries, and wage growth since 2018 shows mining wages grew by a 3.4% compound annual growth rate compared to 4.2% across all industries in Canada.

The first five of the above six indicators continue to signal labour market tightness compared to their historical benchmarks. With mining facing an aging workforce, rising retirement, and fewer young people entering the sector and post-secondary geoscience- and mining-related programs, it is apparent that the industry must address labour supply challenges to meet hiring needs. Improved awareness of the minerals and metals industry is imperative to its evolution. As the national organization that leads sectoral collaboration on labour market trends, MiHR is working to establish a pan-Canadian coalition of industry stakeholders to address the people crisis in mining.[105]

Geoscience is fundamental to solving many of society's current and future challenges. However, perceptions of the minerals sector (e.g., environmental impacts of mines) influences the enrollment and subsequent graduation of students from geoscience programs in Canada. The generally limited offerings of earth sciences courses at the university level also have an effect as students may not consider or are unable to take geoscience courses as they can for chemistry, biology, physics, and math.

A recent report prepared by MiHR for the Saskatchewan Mining Association differentiated between what are referred to as "prevalent" and "critical" occupations.[106] most prevalent minerals sector occupations based on worker numbers included trades, operators, and labourers. Critical occupations included engineers, geoscientists, and other physical scientists that are essential to the sector. Despite larger numbers of workers in the "prevalent" category, many of those jobs could be filled by workers from other sectors (e.g., construction, manufacturing). However, the specialized skills and qualifications of "critical" workers mean those types of jobs are not easily filled by workers from other sectors.

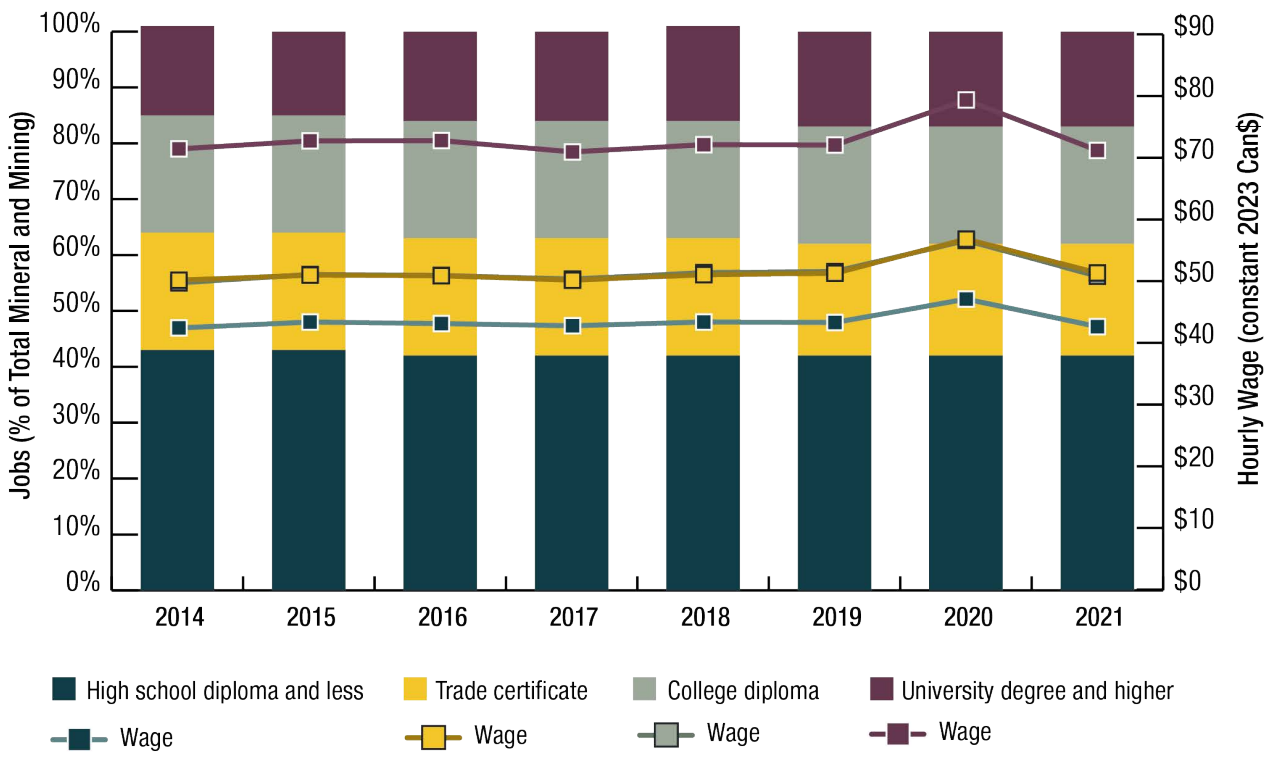
Figure 27 illustrates the educational levels and average hourly wages in the mineral and mining sector from 2014 to 2021, the most recent year for which data was available.[107] Throughout this period, all four educational categories exhibited similar year-over-year trends for average hourly wages. The distribution of jobs across these educational levels remained relatively stable, showing little change from 2014 to 2021.

[105] See MiHR.ca and the 2024 Canadian Mining Outlook (https://mihr.ca/wp-content/uploads/2024/04/Mihr-Outlook-2024-EN.pdf) to learn more.

[106] MiHR, 2024 Saskatchewan Mining Labour Market Analysis, http://saskmining.ca/ckfinder/userfiles/files/SK%20Mining%20Labour%20Market%20Analysis%20final%20resized%20for%20email.pdf

[107] Appendix A – Data Considerations

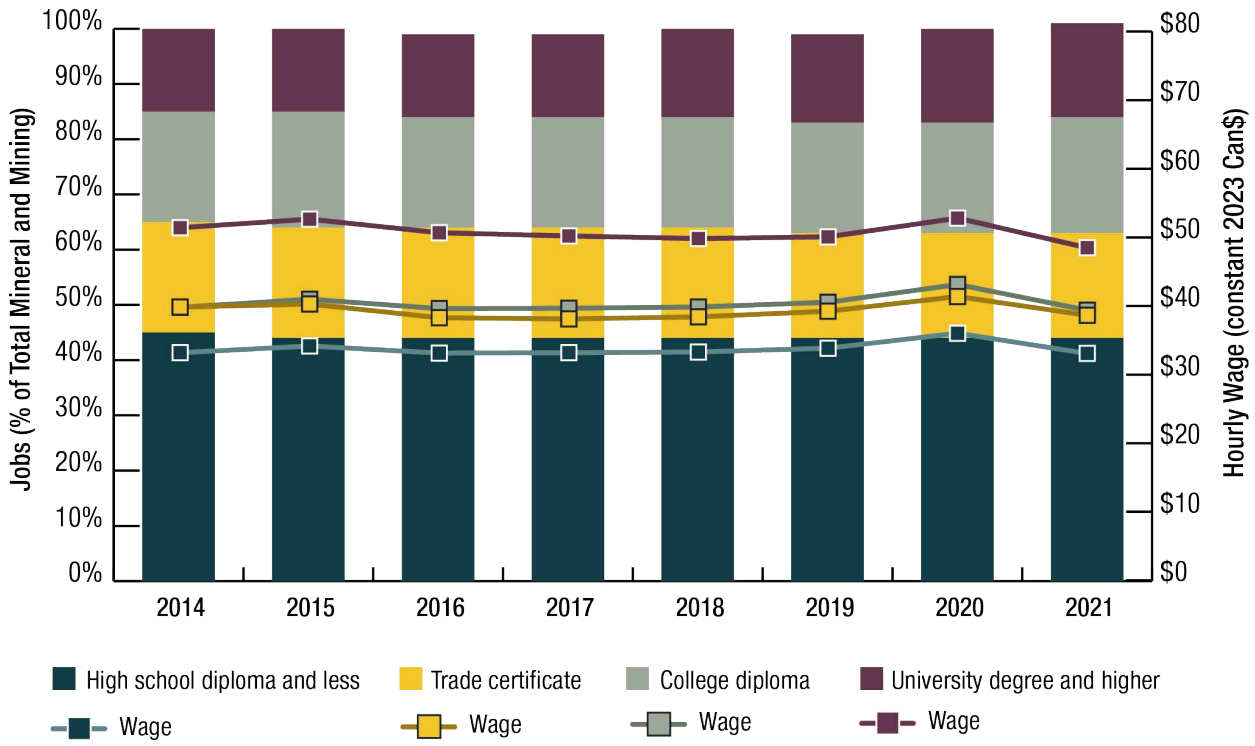
Figure 27: Education level and average hourly wages in constant 2023 Can$ in the mineral and mining sector, 2014–2021



Source: Statistics Canada

Similarly, all four educational levels in the more downstream mineral and mining sector (Figure 28) experienced comparable trends in average hourly wages from 2014 to 2021 and little change to the percentage of jobs distributed across the educational categories.

Figure 28: Education level and average hourly wages in constant 2023 Can$ in the downstream mineral and mining sector, 2014–2021

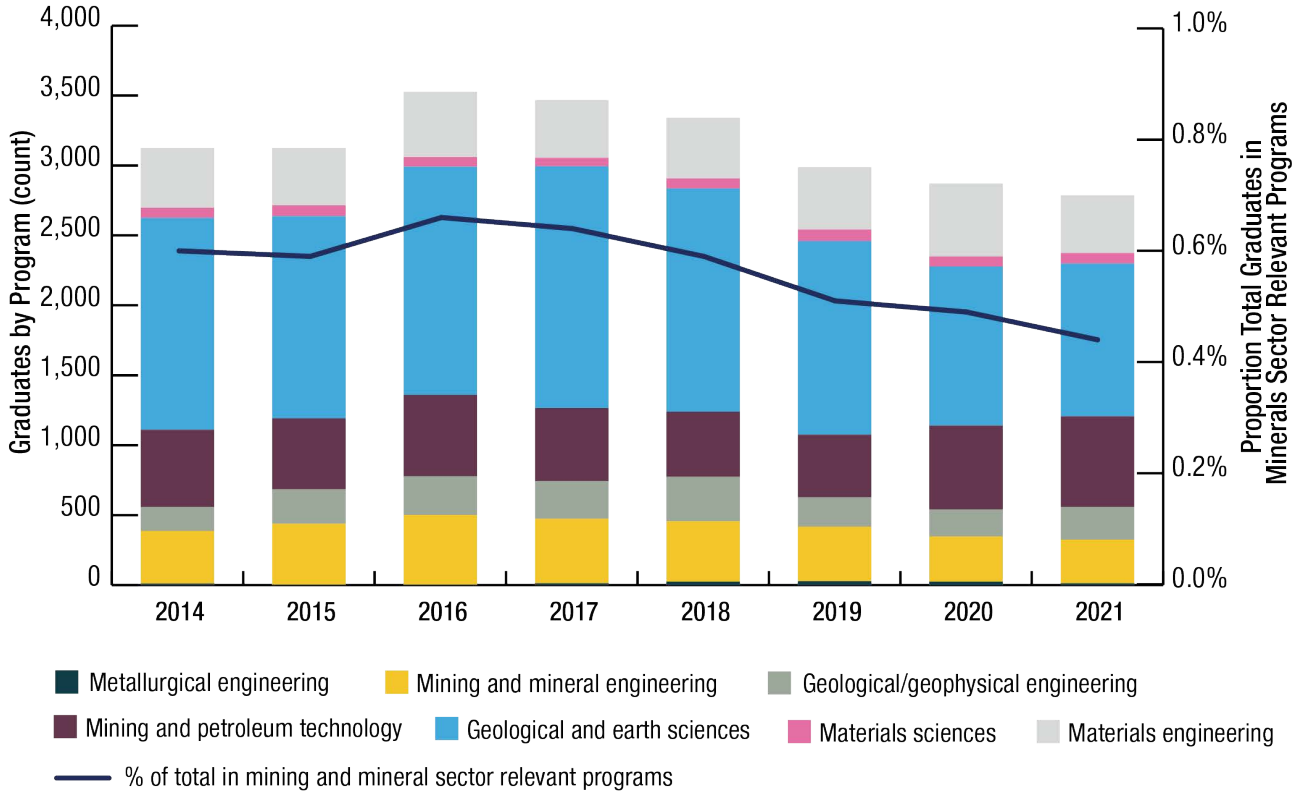


Source: Statistics Canada

There is a clear and overall decline in graduates from mining-relevant programs in Canada in absolute terms and when compared to graduates from all other programs (Figure 29). Graduates from geological and earth sciences programs represented the largest share of mining-relevant programs but experienced the largest decrease (28%) between 2014 and 2021. Strong growth in metallurgical engineering, mining and petroleum technology, and geological and geophysical engineering was not enough to offset this decrease.

A look at longer-term trends starting from 2009 confirmed the overall decline in the share of mining and minerals programs in the total for all programs from 0.6% (2009) to 0.4% (2021). The decline in Figure 29 between 2016 and 2021 reflects a smaller downward trend following a substantial increase in proportion of graduates of all programs coming from mining and minerals programs between 2011 and 2016. Notably, the number of graduates from those programs has increased over the longer term with totals appearing to be cyclical and following the Bank of Canada Metals and Minerals Price Index (see Section 2.1 Value of Mineral Production) with a three-to-five-year lag.

Figure 29: Graduates of mining-relevant programs compared to total graduates of all programs, 2014–2021



Source: Statistics Canada

Data published by the Council of Chairs of Canadian Earth Science Departments is used to track student enrollment and graduation from geoscience programs in Canada.[108] Data between 2014 and 2023 suggests a 4:1 ratio for enrollment versus graduation (i.e., one graduation for every four enrollments). However, undergraduate numbers do not include first-year students as many universities do not require that majors be declared until the second year. The actual enrollment-to-graduation ratio may be closer to 3:1.

The data also shows enrollment declining over the same period. As mentioned above, it can be expected that enrollment will begin to increase as exploration and mining activity for critical minerals and the Bank of Canada Metal and Minerals Commodity Price Index increase. At the same time, it is important to note that more student enrollment and graduates will be needed to meet future labour demand in the minerals sector.

[108] https://cccesd.acadiau.ca/

3.4 Gender, Diversity, and Inclusion

Highlights

- Female employees represented an average of 15% of the minerals sector workforce and earned 11% less than their male counterparts between 2014 and 2023. However, the average hourly wage of female workers increased 16% between 2014 and 2023, while those of male employees increased by 14%.
- The number of female employees in the sector increased 16% over the 10-year period, while the overall total of employees decreased by 1%.
- Visible minorities made up almost 17% of the mineral and mining sector between 2014 and 2021, while employees not identifying as visible minorities earned an average hourly wage that was 15% higher than that of visible minorities. Visible minorities represented just over 25% of the downstream mineral and mining sector workforce, while average wages were 15% higher for employees who do not identify as visible minorities.
- Immigrant employees made up almost 14% of the mineral and mining sector between 2014 and 2021, with average hourly wages 4% higher for workers not identifying as immigrants. Almost 30% of the downstream mineral and mining sector workforce self-identified as immigrants, while average wages were 5% higher for those not identifying as immigrants.
- Age distribution of employees in the total mineral and mining workforce showed an increase at the upper end of the age range (55 years old and over) between 2014 and 2021, while proportions of workers in the 15-to-24-year-old and 45-to-54-year-old groupings decreased. Other groupings remained relatively stable.
- Modest gains were seen in average hourly wages for workers of all age ranges in the mineral and mining sector between 2014 and 2021, except for 55-to-64-year-olds in downstream mineral and mining (0% change) and for 65-year-olds and over in both sectors (mineral and mining: 1% decrease, downstream mineral and mining: 11% decrease).

Analysis

Building on the scope of the *Gender Diversity*[109] indicator included in the 2022 edition of the MSPR, this newly expanded and retitled indicator section now presents a wider range of data relating to the broader topic of gender, diversity, and inclusion (GDI).[110]

While there is an ongoing push towards improved performance, the minerals sector continues to face a GDI challenge.[111,112,113] Aninclusive workforce means ensuring hiring practices are representative of all individuals regardless of race, ethnicity, gender, age, disability, or sexual orientation—from entry-level to management positions.

The authors acknowledge that Indigenous representation in the minerals sector is an important part of GDI and have included the topic as a standalone section (Section 3.2 Indigenous Employment).

[109] Glossary

[110] Glossary

[111] https://mining.ca/resources/press-releases/canadas-mining-sector-commits-to-world-leading-edi-standards/

[112] https://mihr.ca/inclusion-diversity/

[113] https://pdac.ca/driving-responsible-exploration/social-responsibility/gender-diversity-and-inclusion-guidance-document

GDI outcomes are directly linked to economic performance due to increased accountability, oversight, and the implementation of best governance practices. Organizations demonstrating more representative racial, ethnic, and gender diversity are more likely to have financial returns that outperform national industry medians. Companies with diverse workforces may also benefit from reduced debt, greater satisfaction among employees, and greater compliance with health and safety regulations leading to increased productivity.[114,115,116,117,118,119]

Recognizing these factors, the Mining Association of Canada (MAC) published a new T*SM Equitable, Diverse, and Inclusive Workplaces Protocol* in 2023 (also see Box 11). Members will be required to begin publicly reporting against the requirements of this protocol by 2026, and some members have already started reporting.

Box 11: Towards Sustainable Mining (TSM)

The evolving landscape of international standards for sustainable mining is shaped by environmental concerns, social expectations, and the need for responsible resource extraction. Frameworks like the UN Sustainable Development Goals (SDGs) and the Extractive Industries Transparency Initiative (EITI) guide mining companies in reducing environmental impact, ensuring ethical labour practices, and engaging with communities.

Within this context, the Mining Association of Canada's *Towards Sustainable Mining®* (TSM) initiative exemplifies industry leadership.

TSM is an international standard for responsible mining.[120] Originally developed by the Mining Association of Canada (MAC) and launched in 2004, the objective of TSM is to enable mining companies to meet society's needs for minerals, metals, and energy products in the most socially and environmentally responsible way. Implementation of TSM is a condition of membership for MAC members.

TSM provides companies with a set of protocols[121] that are used to measure, report, and improve performance related to:

- Tailings management
- Water stewardship
- Biodiversity conservation management
- Climate change
- Indigenous and community relationships
- Crisis management and communications planning
- Safe, healthy, and respectful workplaces
- Equitable, diverse, and inclusive workplaces
- Prevention of child and forced labour

[114] Unleashing the Power of Inclusion: Attracting and Engaging the Evolving Workforce. Deloitte, 2017.

[115] Welcoming to Women: An Action Plan for Canada's Mining Employers. Women in Mining Canada, 2016.

[116] Diversity Matters, McKinsey & Company, 2014.

[117] Credit Suisse Research Institute, 2012.

[118] Welcoming to Women: An Action Plan for Canada's Mining Employers. Women in Mining Canada, 2016.

[119] https://www.deloitte.com/content/dam/assets-shared/legacy/docs/gx-the-diversity-equity-and-inclusion-imperative-in-mining-and-metals.pdf

[120] https://tsminitiative.com/

[121] https://mining.ca/towards-sustainable-mining/protocols-guides/

The TSM standard has several strengths:

- Companies implementing TSM measure and report their performance annually. Every three years, results must be verified by an external, independent party. Company and auditor reports are posted on MAC's website.[122]
- Performance is measured primarily at the site level, where mining activity takes place. The results provide local communities with a meaningful view of how a nearby mine is faring.
- TSM performance protocols are reviewed and updated on a regular basis to ensure that they continue to reflect industry best practice.

TSM is jointly governed by MAC's board of directors (which includes executives from major global and Canadian mining companies) and a multi-stakeholder Community of Interest (COI) Advisory Panel.[123] This panel includes 12 to 15 people from Indigenous groups, communities where the industry is active, environmental and social NGOs, and labour and financial organizations. In addition to its decision-making role, the panel plays an important role in the external verification of the TSM reporting of companies through the post-verification review process. It meets regularly with senior mining representatives to provide support and advice for TSM, identify emerging issues for the sector, and encourage the mining industry to raise the bar in corporate responsibility.

TSM is helping to build capacity within the global mining industry and is freely shared with mining associations in other countries that are seeking tools to improve the environmental and social performance of their mining industries. TSM has been adopted by industry associations in Finland, Argentina, Botswana, the Philippines, Brazil, Norway, Australia, Colombia, Guatemala, Panama, Mexico, and Mongolia. More than 250 mining companies are implementing TSM worldwide.

Figure 30 shows employment trends by gender for the total minerals sector [NAICS 212, 327, 331, 332] from 2014 to 2023.[124,125] Female employees represented 15% of the sector's workforce on average and earned $3.94 less per hour than their male counterparts over the 10-year period. There was substantial variability in the wage gap[126] between 2014 and 2023, ranging from $6.23 in 2016 to $1.12 in 2018. The average magnitude of the wage gap for female workers in the minerals sector over the period was 12% smaller than that for all Canadian industries, where female employees represented 47% of the overall workforce.

The mining and quarrying (except oil and gas) [NAICS 212] subsector showed a noteworthy change where numbers of female employees increased 58% over the 10-year period while the total number of employees increased by only 11%.[127]

[122] https://mining.ca/towards-sustainable-mining/tsm-progress-report/

[123] https://mining.ca/towards-sustainable-mining/community-of-interest-advisory-panel/

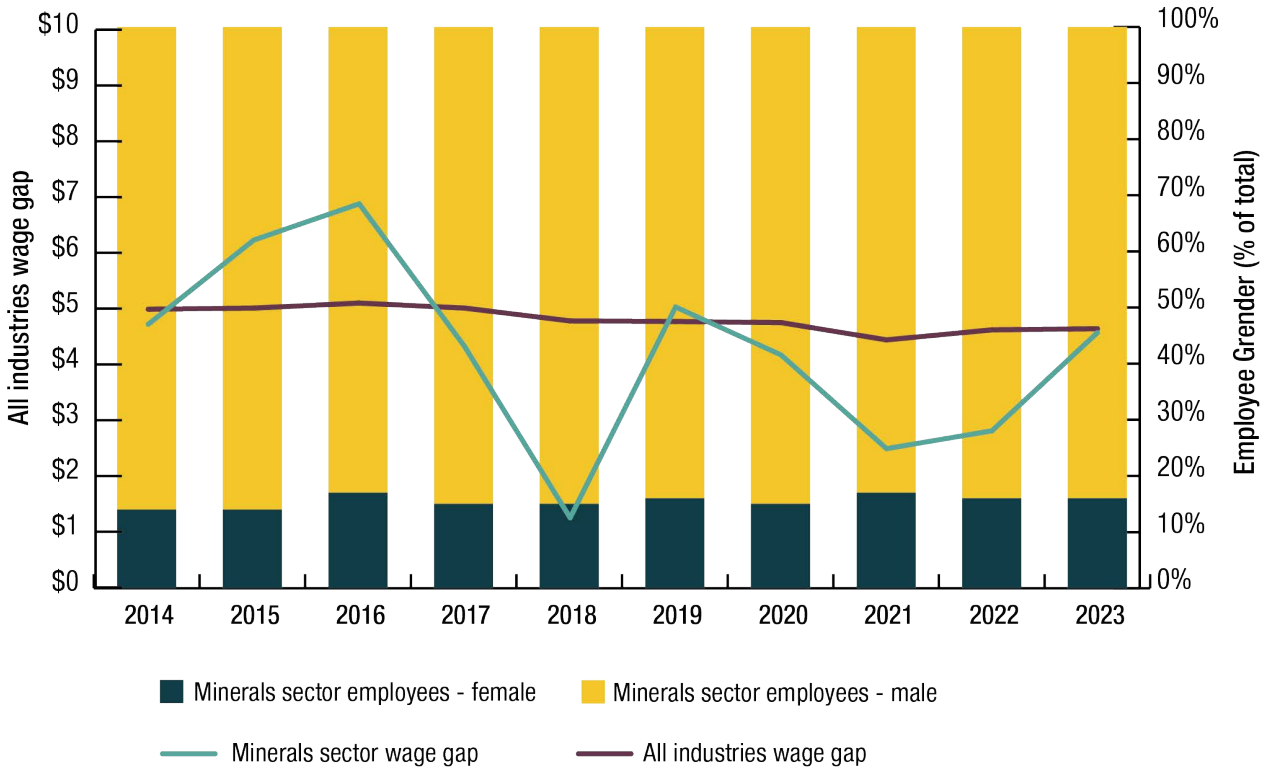
[124] Appendix A – Data Considerations

[125] Subsector employees by gender data is included in Appendix B - Additional Information

[126] Glossary

[127] Appendix B - Additional Information

Figure 30: Minerals sector employment and wage gap (in constant 2023 Can$), by gender, 2014–2023



Source: Statistics Canada.

The wage gap for employees identifying as visible minorities and immigrants in the mineral and mining and downstream mineral and mining sectors[128] compared to those not identifying as being within those groups is shown below in Figure 31.

Workers identifying as visible minorities made up an average of 16.6% (±0.7%) of the mineral and mining sector workforce between 2014 and 2021, and 25.2% (±1.0%) of the downstream mineral and mining sector. This difference may be due to mines being in relatively remote and rural areas, which have lower population levels of immigrant and visible minority employees compared to larger towns and cities where downstream processing generally occurs.

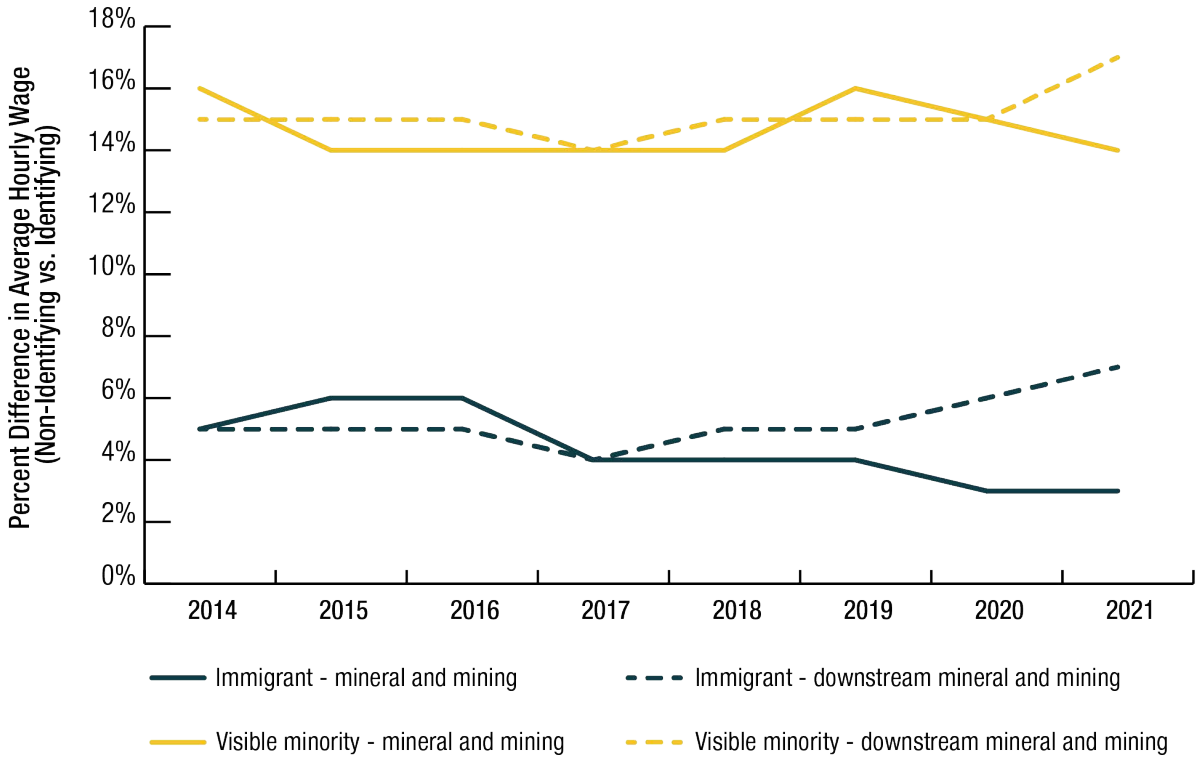
Employees not identifying as visible minorities earned 14% more than those identifying as visible minorities in 2021, compared to 16% more in 2014 in the mineral and mining sector. In the downstream mineral and mining sector, employees not identifying as visible minorities earned 17% more than those identifying as visible minorities in 2021, compared to 15% more in 2014.

Employees who self-identified as immigrants made up 13.7% (±0.4%) of the mineral and mining sector between 2014 and 2021 and 29.7% (±0.7%) of the downstream mineral and mining sector.

Workers not identifying as immigrant employees earned 3% more than those identifying as immigrant employees in 2021, compared to 5% in 2014 in the mineral and mining sector. In the downstream mineral and mining sector, workers not identifying as immigrant employees earned 7% more than those identifying as immigrant employees in 2021, compared to 5% in 2014.

[128] Appendix A – Data Considerations

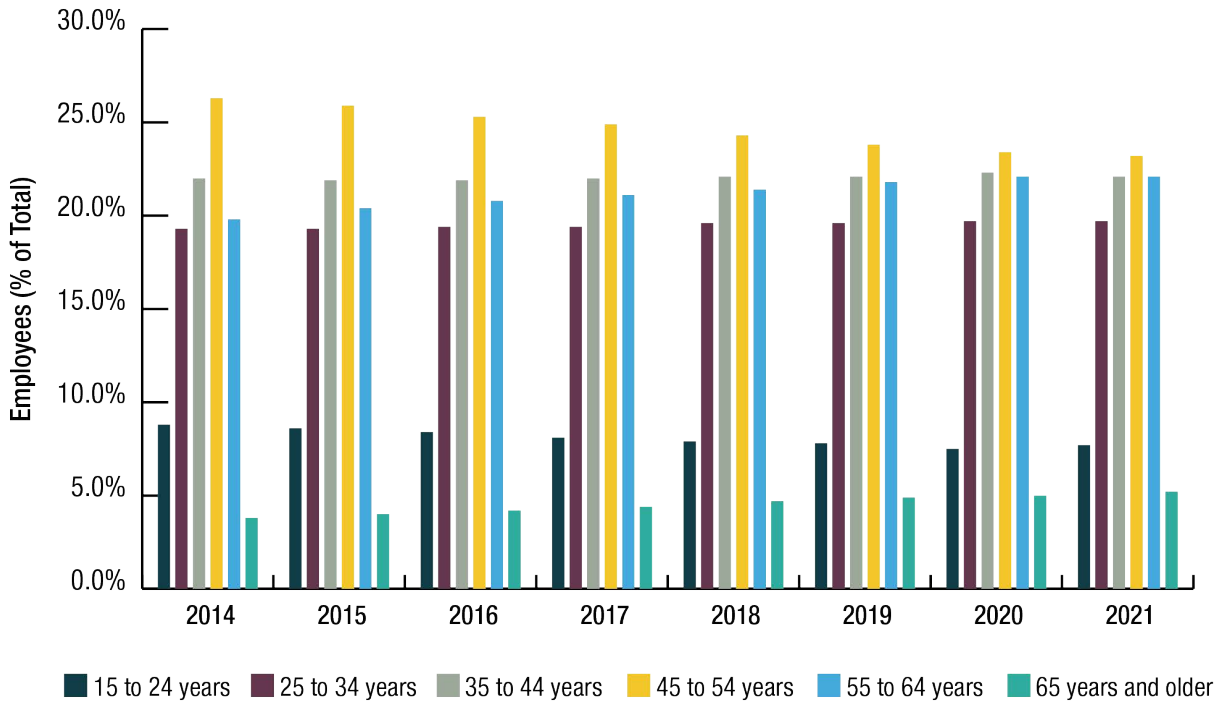
Figure 31: Wage gap between non-immigrant vs. immigrant and non-visible minority vs. visible minority employees in the mineral and mining sector, 2014–2021



Source: Statistics Canada.

A breakdown of the age of employees in the total mineral and mining sector workforces is shown below in Figure 32. Trends in both the mineral and mining and downstream mineral and mining sectors were similar. There was a gradual increase in the proportion of employees at the upper end of the age range (55 to 64 and 65 years old and over) between 2014 and 2021 while proportions of 15-to-24-year-old and 45-to-54-year-old workers decreased. Little change was seen in the 25-to-34-year-old and 35-to-44-year-old groupings over the same period.

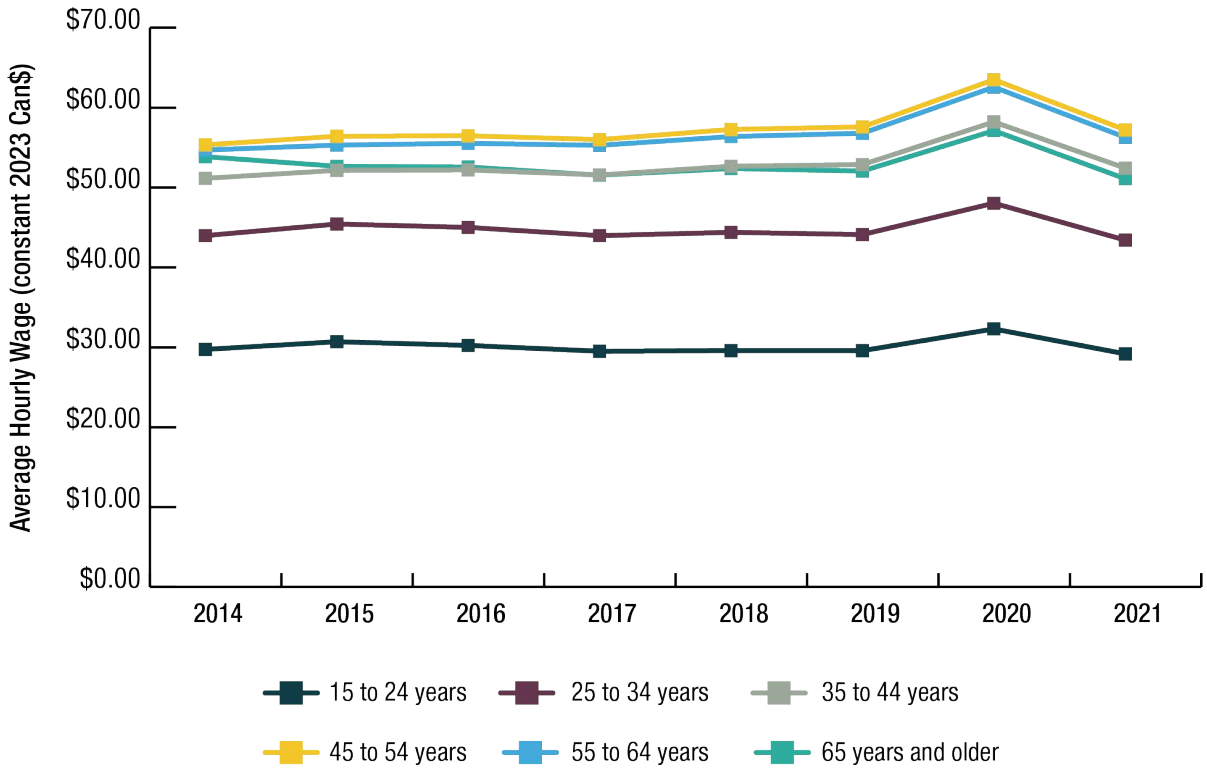
Figure 32: Proportion of total mineral and mining sector employees by age, 2014–2021



Source: Statistics Canada

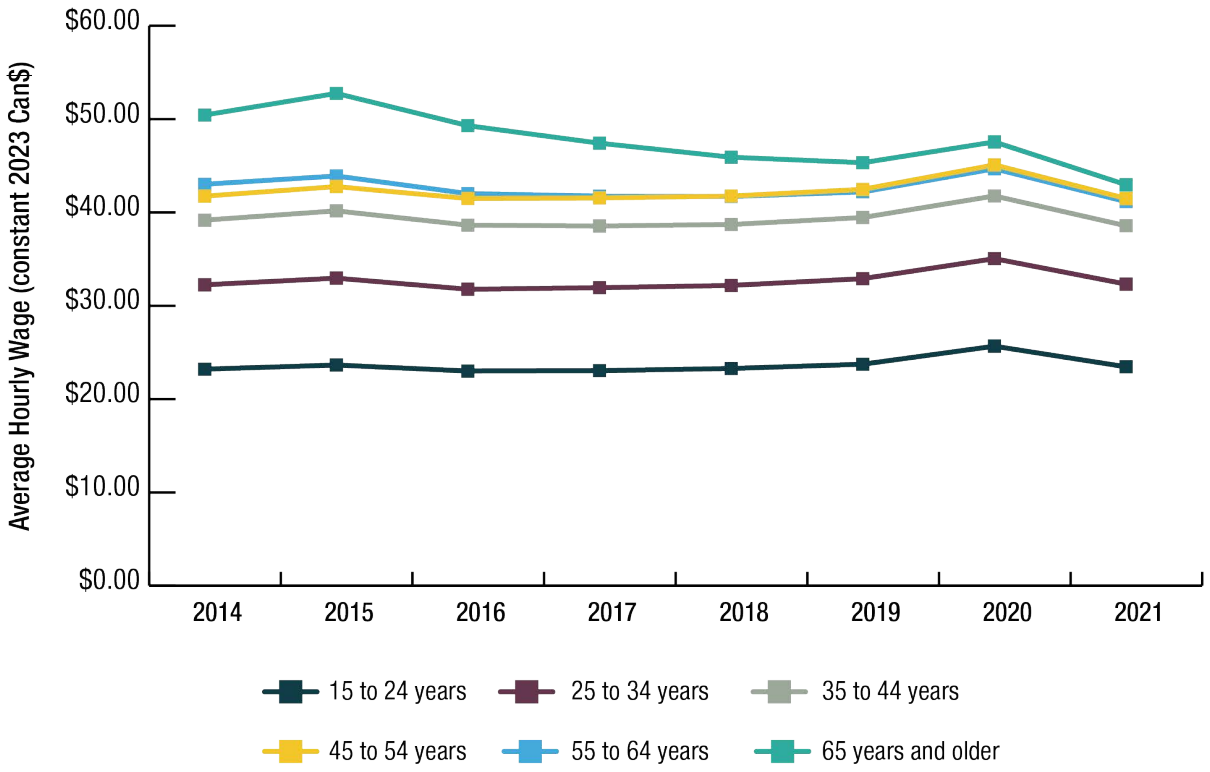
Average hourly wages in the mineral and mining and downstream mineral and mining sectors by employee age are shown below in Figure 33 and Figure 34. Wages were higher on average in the mineral and mining sector compared to the downstream sector, with the largest differential seen for 45-to-54-year-olds. Modest gains in average hourly wages between 2014 and 2021 were seen for all age groups except 55-to-64-year-olds in the downstream mineral and mining sector (0% change) and for 65-year-olds and over in both the mineral and mining sector (1% decrease) and downstream mineral and mining sector (11% decrease).

Figure 33: Average hourly wage of mineral and mining sector employees, by age, 2014–2021



Source: Statistics Canada

Figure 34: Average hourly wage of downstream mineral and mining sector employees, by age, 2014–2021



Source: Statistics Canada

3.5 Funding for Public Participation in Environmental Review Processes

Highlights

- In 2022–2023, the Impact Assessment Agency of Canada's (IAAC) Participant Funding Program (PFP) disbursed a total of $6,276,094.
- A total of $609,922 was disbursed in contributions to six unique recipients to support their participation in six impact assessment processes. A total of $499,185 was disbursed in contributions to 24 unique recipients to support their participation in four regional assessment processes.
- A total of $3,459,700 was disbursed in contributions to 51 unique recipients to support their participation in 14 environmental assessment processes.

- Participant Funding Program disbursed funding through 259 grant agreements worth $1,707,287 to support the participation of Indigenous groups, the public, and stakeholders in assessment processes:
  - $929,647 was disbursed to 111 recipients for their participation in 39 project assessment-related activities;
  - $422,640 was disbursed to 24 unique recipients to facilitate their participation in three regional assessment-related activities; and,
  - $355,000 was disbursed to 71 unique recipients on behalf of the Canada Energy Regulator (CER) to facilitate their participation in the Indigenous Oversight Forum Leadership Meetings with the CER for the Nova Gas Transmission Ltd.

Analysis

Public participation in the Impact Assessment (IA) process[129] helps ensure the views of Canadians are meaningfully considered in the planning of natural resource development projects. It increases the inclusion of Local and Traditional Indigenous Knowledge in assessments and improves knowledge and understanding of the public's concerns and potential issues. Section 75 of the *Impact Assessment Act*, 2019 (IAA) requires that a funding program be established to facilitate the public's participation in consultation activities.[130] On June 20, 2024, the *Budget Implementation Act*, 2024, received Royal Assent and brought into force amendments to the *Impact Assessment Act* (IAA). These changes were made in response to the Supreme Court of Canada's decision on the constitutionality of the IAA.[131]

Funding for public participation in IAs supports an open and balanced assessment process and strengthens the quality and credibility of federal assessments.

The number of assessments and groups requesting funding is influenced by how much funding is provided each year and does not necessarily reflect industry performance. However, overall benefits of consultation, funding, and public participation in assessments are a positive for the minerals sector.

The Participant Funding Program (PFP) consists of two funding components: Regular Funding (RF) and Indigenous Funding (IF). RF provides financial assistance to individuals and not-for-profit organizations to participate in public participation opportunities. IF is meant specifically for Indigenous groups, which triggers the Government of Canada's duty to consult for IF participation and provides funding to prepare for and participate in Indigenous consultation and participation activities.

In 2022–2023, the Agency's PFP disbursed a total of $6,276,094 and averaged $3.2 million per year since 2013–2014 in constant 2023 dollars (Table 13).[132] Note that data in the table relate to impact assessments only and omit other funds included in the $6,276,984.

Indigenous and mining funding saw 180% and 262% increases over the last decade, respectively, while regular funding increased 51%. The large jump in Indigenous funding between 2021–2022 and 2022–2023 is due to a substantial transfer associated with one large-scale project.

[129] Glossary

[130] https://laws.justice.gc.ca/eng/acts/I-2.75/index.html

[131] https://www.canada.ca/en/impact-assessment-agency/corporate/acts-regulations.html

[132] Appendix A – Data Considerations

Table 13: CEAA/IAAC funding for public participation in the Impact Assessment process, 2013–2014 to 2022–2023*

	Regular Funding**			Indigenous Funding**			Mining-Related	
Fiscal Year	Constant 2023 Can$	Projects	Recipients	Constant 2023 Can$	Projects	Recipients	Constant 2023 Can$	Projects
2013-14	$652,247	22	51	$2,521,460	27	91	n.a.	n.a.
2014-15	$207,105	14	32	$2,027,294	27	74	942,179	18
2015-16	$157,535	13	30	$1,518,608	25	59	755,397	19
2016-17	$284,270	13	38	$2,179,324	20	59	858,057	10
2017-18	$170,127	12	22	$1,566,084	21	47	772,492	12
2018-19	$201,159	13	22	$3,177,537	31	77	870,190	17
2019-20	$257,622	17	33	$3,293,783	35	132	453,665	10
2020-21	$575,079	19	50	$3,647,686	38	173	881,514	14
2021-22	$617,605	18	73	$3,055,643	38	155	934,754	12
2022-23	$285,004	18	38	$5,166,090	43	198	3,100,108	16

* Source: Impact Assessment Agency of Canada
** These values represent all projects funded through the IAAC, e.g., mining, hydro, oil and gas, marine.
NB: Data in the table relate to impact assessments and may not include other funds (e.g., environmental assessments, regional assessments, and the Impact Assessment Agency administering funds on behalf of the Canada Energy Regulator); hence, there are some discrepancies between the table and descriptive text above.

While the IAAC leads the review of major projects, it works collaboratively with the Canadian Nuclear Safety Commission (CNSC) to review any projects also subject to regulation under the Nuclear Safety and Control Act. Once an IA decision is made for an applicable project, the CNSC becomes the lead for Crown consultation activities. CNSC works with IAAC on all public participation and Indigenous consultation activities and IAAC provides and administers participant funding until issuance of an IA decision.[133]

Other Jurisdictions

The eventual goal of IAs can be summarized as "one project, one assessment" to reduce duplication and increase efficiency and certainty. In working towards that goal, The IAAC promotes collaboration with other jurisdictions to support a single IA process for major projects. The IAAC leads each IA and coordinates with provinces and territories to determine the best approach. This approach is laid out in a Cooperation Plan that is shared with the project proponent and posted publicly.[134]

In addition, regional assessments are carried out under the IAA to better understand the regional context of projects and provide more comprehensive analyses that can inform future project IAs. Regional assessments are undertaken cooperatively with the provincial, territorial, and Indigenous jurisdictions that have responsibilities within the region.[135] In one example, the regional assessment for the Ring of Fire mineral deposits in northern Ontario was entering the public review and feedback on the draft Terms of Reference as of October 2024.[136] It should be noted that, to date, application of regional assessments is not yet widespread and only a few have been initiated since the Act came into force.

[133] https://nuclearsafety.gc.ca/eng/resources/environmental-protection/impact-assessment-act-presentation.cfm

[134] https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/impact-assessments-canada-faq.html

[135] https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/requesting-regional-strategic-assessment-iaa.html

[136] https://iaac-aeic.gc.ca/050/evaluations/proj/80468

Mineral companies are important facilitators in enabling public participation in the review of their projects. Fostering participation is a critical step towards achieving public confidence in a given project as it enables a better understanding of concerns and issues related to the project and allows for the opportunity to take those issues into account in developing a more environmentally and socially responsible project.

3.6 Workplace Health and Safety

Highlights

- The fatal injury rate in the mining and quarrying (except oil and gas) [NAICS 212] subsector fluctuated between 2014 and 2022 but demonstrated an overall 58% decline, from 5.9 to 2.5 fatal incidents per 10,000 workers.
- Non-fatal incidents in the mining and quarrying (except oil and gas) [NAICS 212] subsector increased 22% between 2014 and 2022, from 147 to 189 incidents per 10,000 workers.

Analysis

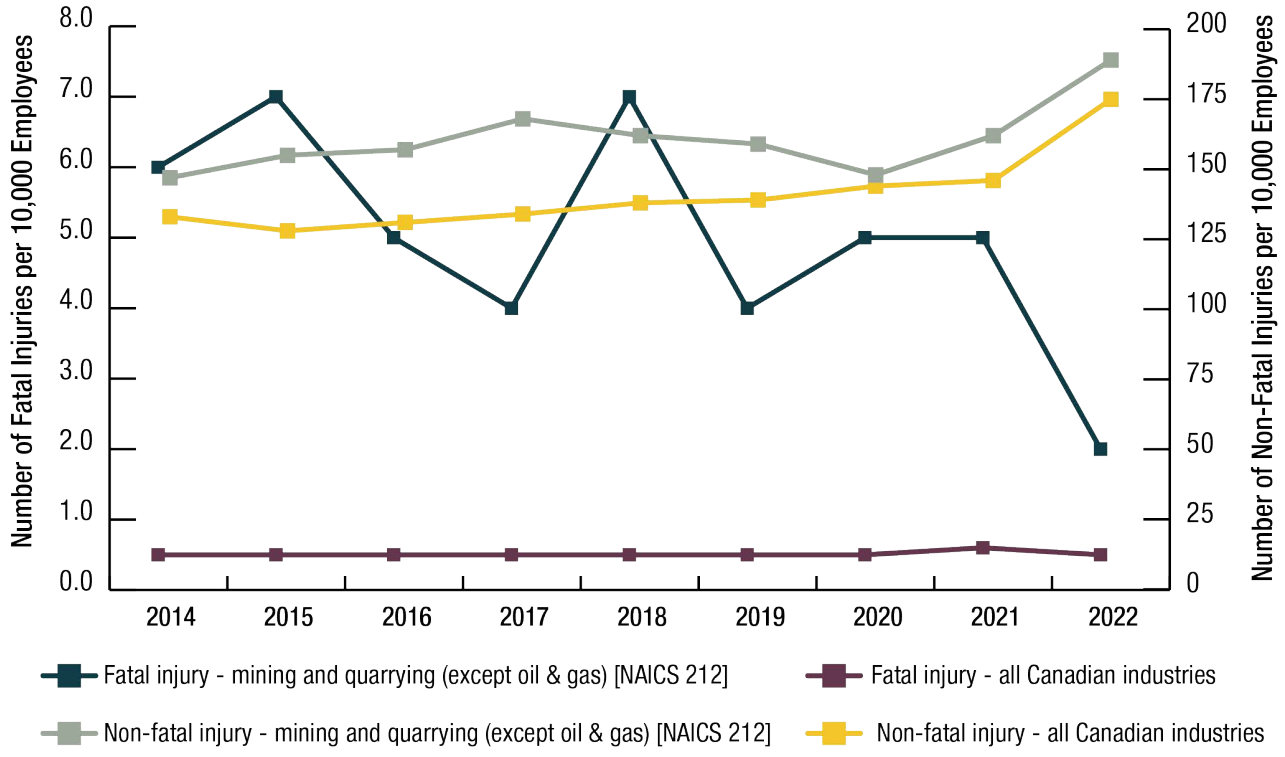
A safe and healthy work environment is among the most important social issues for workers and local communities.

Organizations operating within the mining and quarrying (except oil and gas) [NAICS 212] subsector in Canada have worked to improve performance in providing safe work environments. Figure 35 shows the resulting 58% decrease in rates of fatal injury between 2014 and 2022 (the most recent year for which data was available at the time of writing) even as the total number of jobs increased.[137] Data suppression for reasons of confidentiality meant that a similar calculation could not be done for the overall minerals sector. The overall rate for all industries in Canada averaged 0.51 incidents per 10,000 workers over the same period (±0.03 incidents per 10,000 workers).

The rate of non-fatal injuries was relatively stable, with only a slight increase followed by a decreasing trend from 2014 to 2020, before rapidly increasing by 28% towards the end of the period. The all-industry average rate of non-fatal injuries in Canada between 2014 and 2022 was 141 incidents per 10,000 workers, compared to 161 incidents per 10,000 workers for the mining and quarrying (except oil and gas) [NAICS 212] subsector.

[137] Appendix A – Data Considerations

Figure 35: Total compensated fatal and non-fatal injury rate in the minerals sector, 2014–2022



Sources: Natural Resources Canada; Association of Workers' Compensation Boards of Canada; Statistics Canada.

Labour unions, industry associations, and various levels of government all play an important role in improving worker health and safety by encouraging the sharing of best practices, developing industry standards, and providing third-party auditing and external verification.

Examples include the Prospectors and Developers Association of Canada's (PDAC) relaunch of e3Plus as Driving Responsible Exploration, which includes a health and safety toolkit and pocket guide. PDAC has continued to develop their convention short course to include new content on psychological safety and mental wellness.

The Mining Association of Canada's Towards Sustainable Mining (TSM, Box 11) program has included requirements for health and safety since 2009, and in 2023 the scope was expanded to include psychological safety and respectful behaviour. Members will be required to begin publicly reporting against the requirements of the new *TSM Safe, Healthy, and Respectful Workplaces Protocol* by 2026.

3.7 Mine Openings and Closures

Highlights

- From the beginning of 2014 to year-end 2023, 39 mines opened and 30 reopened in Canada.[138]
- During this same period, 38 mines closed and 58 operations were suspended.

Analysis

Mine closure, opening, suspension, reopening, and the related process of mine reclamation[139] can result in major socio-economic impacts, both positive and negative, including changes in employment, government revenues, population, and economic activity in the local area. Monitoring the status of Canadian mines is important given the potential for significant impacts on local communities. See Box 12 for a discussion of the legacy of orphaned and abandoned mines.

The dynamic nature of the mining industry results in fluctuating numbers of mines opening and closing each year. Mines may close at the end of their planned mine life based on the availability of the resource and they may reopen, suspend, or close prematurely based on commodity price fluctuations or for a variety of other factors (e.g., input costs or natural disasters including wildfires).

It should also be noted that this section presents a count of mines opening and closing without consideration for the scale of each operation—a large mine with hundreds of employees, extensive infrastructure, and fleets of heavy equipment and a smaller operation with a few dozen employees and relying on higher degrees of manual labour would be considered equal in the count of openings or closures.

Between 2014 and 2023, 38 mines closed and 58 operations were suspended, while 39 new mines opened and 30 reopened (Figure 36, Table 14).[140] The sum of closures and suspensions outweighed that of openings and re-openings across all three categories: precious metals, base metals, and other minerals or metals.[141]

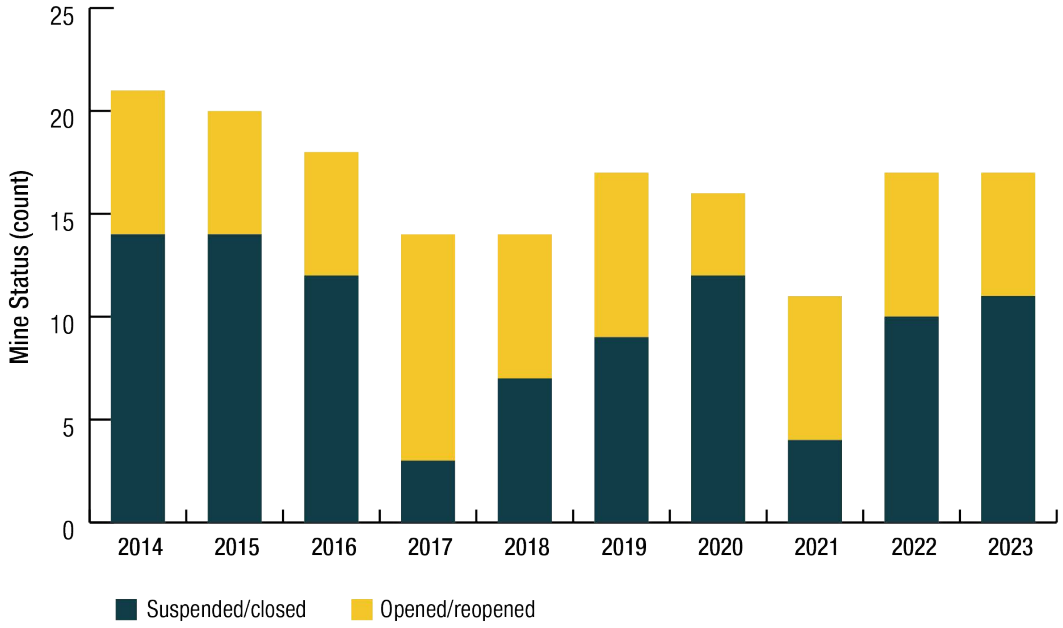
[138] In the context of this section, mine openings, closures, re-openings, and suspensions are a count of status changes of operations. If a single mine facility closed and then reopened five times between 2014 and 2023, then each of those five closures and five re-openings would be included in their respective totals. Similarly, no distinction between scales of operations is made (i.e., the closure of a mine of any scale is counted as "1").

[139] Glossary

[140] Natural Resources Canada. Note: These figures are additive and do not exclude operations that may have re-opened in later years.

[141] Additional data on openings, re-openings, suspensions, and closures in Canada by type of operation and jurisdiction is included in Appendix B - Additional Information

Figure 36: Mine openings and closings in Canada, 2014–2023



Source: Natural Resources Canada.

Table 14: Mine openings and closings in Canada, 2014–2023

	Precious Metals				Base Metals				Other Minerals or Metals			
Year	Opening	Reopening	Suspension	Closing	Opening	Reopening	Suspension	Closing	Opening	Reopening	Suspension	Closing
2014	1	0	3	3	5	0	1	0	1	0	7	0
2015	2	0	5	2	1	1	2	2	1	1	3	0
2016	1	2	1	0	1	0	2	0	1	1	3	6
2017	5	0	0	1	0	0	2	0	3	3	0	0
2018	3	0	0	3	0	0	1	1	2	2	2	0
2019	5	0	0	3	0	1	1	0	1	1	2	3
2020	0	1	0	3	0	1	1	1	1	1	6	1
2021	1	0	1	0	0	1	0	0	1	4	0	3
2022	1	1	3	0	0	2	1	2	0	3	3	1
2023	1	1	1	2	0	0	4	0	1	3	3	1
Total	**20**	**5**	**14**	**17**	**7**	**6**	**15**	**6**	**12**	**19**	**29**	**15**

Source: Natural Resources Canada.

Box 12: Orphaned and Abandoned Mines

Mining has a long history in Canada, and historic activity has left behind thousands of orphaned and abandoned mines (OAM). OAM sites include legacy mines for which the owner cannot be found or for which the owner is financially unable or unwilling to carry out remediation of the site.

OAM sites pose environmental, health, safety, and economic risks to local communities, the mining industry, and governments. They also represent a significant liability to the Crown.

Canadians expect that exploration, extraction, processing, and other mining-related activities include measures to avoid, minimize, and mitigate adverse impacts. They also expect that land once used for mining will be restored to a more natural state or be used for alternate development activities.

Demonstrating respect for nature and communities in meeting these expectations will contribute towards building public trust and social licence to continue developing natural resources.

Jurisdictional Measures

OAM sites exist within all mining jurisdictions in Canada. Many are legacy sites that pose little risk, but thousands of sites across the country are considered liabilities requiring varying degrees of maintenance and remediation.

Provinces and territories administer their respective acts and regulations to ensure reclamation and closure of mining projects are planned and implemented. The exception is Nunavut where mining is still federally supported through Crown-Indigenous Relations and Northern Affairs (CIRNAC). CIRNAC also manages the remediation of dozens of abandoned mines and mineral exploration sites in the Yukon and Northwest Territories through its Northern Abandoned Mine Reclamation Program and the Northern Contaminated Sites Program.

Mining legislation in all Canadian jurisdictions requires mine closure, decommissioning, and reclamation plans and financial assurance as part of the permitting process. While standards and requirements of closure plans vary across jurisdictions, they all describe how the site will be rehabilitated throughout its life cycle and how it will be decommissioned when mining activities end, and they also include financial assurance of compliance. Financial assurance allows a jurisdiction to implement the identified rehabilitation measures if the proponent fails or refuses to do so.

Jurisdictions have also implemented programs and initiatives, through which they allocate millions of dollars annually to remediate and reclaim orphaned and abandoned mines and other contaminated sites. These actions aim to mitigate public health, safety, and environmental risks posed by OAM sites. Hundreds of remediation and reclamation projects at OAM sites have been completed or are ongoing, and many more are in the planning stages. Canada is also a global leader in research and development to address environmental issues caused by legacy mine sites.

Multi-Stakeholder Activities

Multi-stakeholder collaboration and information-sharing are crucial to ensure that best practices inform decision-making, cost-effective planning, transparency, and sustainable reclamation. Key initiatives include:

Annual Orphaned and Abandoned Mines Workshop

The annual OAM workshop replaced the National Orphaned/Abandoned Mines Initiative after its dissolution in 2022.[142] It is co-hosted in the fall by the Canadian Minerals and Metals Plan Secretariat and the Task Team on Environment under the Mines Intergovernmental Working Group. The multi-day working-level workshop provides an important opportunity to facilitate information-sharing, diverse and inclusive engagement, and broad collaboration among federal, provincial, and territorial governments, the mining industry, Indigenous Peoples, non-government organizations, academia, and other stakeholders to advance the remediation of OAM and prevent new ones across Canada.

National OAM Inventory

While many mining jurisdictions maintain their own inventories of OAM sites, in 2024, Natural Resources Canada in partnership with the provinces and territories launched the web-based National Orphaned and Abandoned Mines Inventory and interactive map on the Open Science Data Platform.[143] It builds on the national inventory developed in 2012 through the National Orphaned/Abandoned Mines Initiative and continues to inform the closure and reclamation work at legacy mine sites across Canada.

Challenges and Opportunities

Significant challenges require ongoing attention. Securing adequate funding remains the biggest challenge for all jurisdictions. Another important challenge relates to meaningful engagement with Indigenous communities and other stakeholders in the planning and remediation of OAM sites. Other challenges include regulatory barriers to reclamation and innovation, prioritizing sites in resource-constrained settings, and climate-related risks, particularly in northern settings.

However, numerous opportunities also exist. These include the potential for partnerships among governments, Indigenous Peoples, industry, and other stakeholders on land use and economic opportunities. Waste valorization and the reprocessing of mine tailings are another potential opportunity that governments and mining companies are exploring, which could have immense economic and environmental benefit.

Implications of Remediation

Remediating OAM sites is critical for addressing the long-term environmental, social, and economic impacts of historical mining activities and plays an important role in the environmental sustainability of the mining industry, including the restoration of land, water, ecosystems, and biodiversity. Collaboration between governments, industry, and Indigenous Peoples has improved transparency and accountability in remediation efforts and represents tangible contributions to advance reconciliation. OAM remediation benefits from advances in technologies that showcase Canada's leadership in innovation and contributes to mine tailings management and the potential to source critical minerals.

Through collaborative dialogue on the best way to accomplish desired outcomes and targeted initiatives for the remediation of OAM sites nationally, Canada will continue to be a world leader in a sustainable, responsible, competitive, and inclusive mining sector.

[142] https://www.minescanada.ca/en/historical-national-orphanedabandoned-mines-initiative

[143] https://osdp-psdo.canada.ca/dp/en/search/metadata/NRCAN-FGP-1-330ec960-cc52-47d9-840b-d93470347ab4

3.8 Strikes and Lockouts

Highlights

- There was little change in the total number of strikes and lockouts when comparing 2014 (eight strikes and lockouts) to 2023 (seven strikes and lockouts). However, substantial variation is seen from year to year within the 10-year period.
- The number of person-days not worked due to strikes or lockouts also changed little between 2014 and 2023, decreasing only 3% from 56,470 days to 54,910 days.
- Average number of strikes and lockouts was similar across the minerals subsectors while peaks in the number of person-days not worked between 2014 and 2023 were largely driven by the primary metal manufacturing subsector.

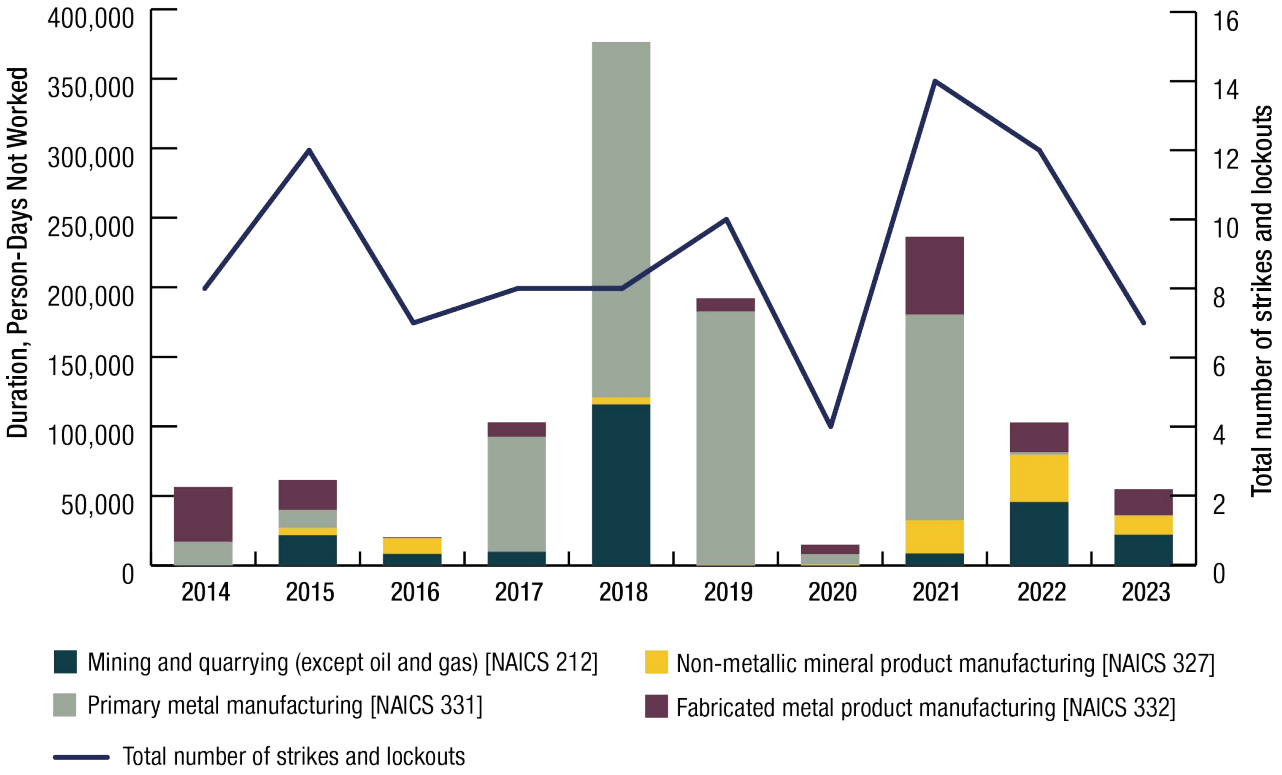
Analysis

Strikes and lockouts[144] can occur for a variety of reasons, including disagreements over wages, benefits, social programs, or work conditions. Regardless of the reason for the strike or lockout, it has an impact on the industry, workers, and the local community. Strikes and lockouts threaten the stability of the relationship between labour and industry and have the potential to affect both investment and employee decisions to remain in the sector. As well, they may have an impact on the public image of the company and industry.

The number of strikes and lockouts in the minerals sector and resulting person-days not worked is shown below (Figure 37). There was substantial variation in the total over the 10-year period, but little overall change when comparing 2014 to 2023. A similar trend across the period, or lack thereof, was also seen in person-days not worked. Prominent peaks in the "person-days not worked" values in 2017–2019 and 2021 were driven by the primary metal manufacturing subsector. A 10-year low in 2020 coincided with shutdowns due to the global COVID-19 pandemic.

[144] Glossary

Figure 37: Minerals sector labour stoppages, 2014–2023



Source: Employment and Social Development Canada, Labour Program, Collective Bargaining Information.

Section 4: Environmental Performance

Previous chapters of this report highlighted how the minerals sector contributes to Canada's well-being through economic and social performance. Key benefits included GDP growth, jobs and opportunities for Indigenous communities, as well as access to minerals and metals which are required inputs into countless value chains, including many which support the energy transition.

These economic and social benefits are balanced by challenges, particularly in terms of environmental impacts of mineral operations. From exploration to closure, mining activities can affect local ecosystems and biodiversity (Box 15). The sector's public image is closely tied to its environmental performance, with concerns over abandoned mines, water, air quality, waste, and greenhouse gas emissions growing among the public. Minimizing environmental risks remains a priority for the minerals sector.

Sustainability is critical for companies worldwide, including in Canada, where the mining industry must comply with various environmental regulations at federal, provincial, and territorial levels. Initiatives like the Mining Association of Canada's Towards Sustainable Mining® (TSM®, Box 11), launched in 2004, set standards for responsible environmental practices across the sector. Similarly, the Prospectors and Developers Association of Canada's e3 Plus framework guides exploration companies towards better environmental stewardship.

These and other efforts showcase the sector's commitment to sustainability, aiming to lead by example in responsible development and environmental protection. With some of the world's lowest greenhouse gas emissions, due to a clean energy grid and high-quality ores, Canada's minerals sector continues to invest in clean technology, contributing to global environmental progress.

This chapter will examine a set of indicators and outcomes to better understand and quantify the sector's performance in addressing these environmental challenges.[145] An examination of the various multi-stakeholder frameworks used in developing this report led to the following statement of desired environmental performance outcomes:

> *Practise responsible mineral exploration, development, and operations, and support public policies that are predicated on maintaining a healthy environment and, upon closure, ensuring that mine sites remain safe and physically and chemically stable in the long term, and positioning them for a post-closure land use determined with communities (e.g., returning them to viable, self-sustaining ecosystems, converting them to some other industrial or economic activity).*
>
> *Ensure institutional governance frameworks are in place to provide certainty and confidence that mechanisms exist for governments, industry, communities, and residents to avoid or mitigate adverse environmental effects.*

The following strategic directions of the Canadian Minerals and Metals Plan were selected to further articulate the targets and outcomes for the environmental performance of the sector:[146]

- **Global leadership**
  - A sharpened competitive edge and increased global leadership for Canada.
- **Communities**
  - Communities welcome sustainable mineral development activities for the benefits they deliver.

[145] It is important to differentiate between mineral exploration impacts, which tend to be less invasive, and those of mineral development, extraction, and processing activities, which are typically more substantial. The indicators within this section are weighted towards mining activities due to 1) the less intrusive nature of mineral exploration activities, and 2) data availability. Guidance such as the Prospectors and Developers Association of Canada's e3 Plus has been developed to assist mineral exploration companies minimize their environmental footprint and impact on the environments in which they operate.

[146] Refer to Section 1 for a full explanation of the alignment of the Canadian Minerals and Metals Plan and the Mining Sector Performance Report.

- **The environment**
  - The protection of Canada's natural environment underpins a responsible, competitive industry. Canada is a leader in building public trust, developing tomorrow's low-footprint mines, and managing the legacy of past activities.
- **Science, technology, and innovation**
  - A modern and innovative industry supported by world-leading science and technology—across all phases of the mineral development cycle.

The indicators chosen to measure the sector's performance as it relates to this statement are:

- **Waste rock and tailings disposal** – Mineral extraction and processing generates significant waste that must be carefully managed to minimize physical risks (e.g., tailings facility failures) and chemical risks (e.g., contaminated drainage). Proper waste rock and tailings management is crucial for protecting local ecosystems and ensuring long-term environmental safety.
- **Mine effluent and releases to surface water** – Water on mine sites can become contaminated through contact with mine waste, the processing of chemicals, or disturbed areas like open pits and underground workings. It should be carefully managed and treated before being released to protect aquatic environments. Contaminant releases may occur due to spills, extreme weather, or treatment system and other failures (e.g., tailings dam breaches). Monitoring these releases helps assess the sector's impact on local aquatic ecosystems. This indicator tracks performance using the *Metal and Diamond Mining Effluent Regulations* (MDMER) and the National Pollutant Release Inventory (NPRI).
- **Air emissions** – Mining, smelting, and refining can release pollutants like nitrogen oxides (NO_x), sulphur oxides (SO_x), and particulate matter (PM_{10}, $PM_{2.5}$), impacting ecosystems, air quality, and health. Tracking air emissions trends shows the sector's progress in reducing pollution.
- **Energy consumption and efficiency** – Energy costs have a strong influence on business performance and global competitiveness in the energy-intensive minerals sector. There are economic, social, and environmental incentives to improve energy efficiency, lower energy-related operating costs, and reduce environmental impacts, including greenhouse gas (GHG) emissions and other contributors to climate change.
- **Greenhouse gas emissions** – GHGs emissions trap heat in the atmosphere, driving climate change, which brings risks like flooding and forest fires, as well as opportunities like reduced snow and ice in exploration areas. Monitoring GHG emissions management shows the sector's efforts to mitigate climate change impacts.
- **Environmental expenditures** – Measuring the level of environmental expenditures in the minerals sector gives an indication of the level of capital that has been committed to complying with Canadian or international environmental regulations, agreements, and voluntary commitments.

4.1 Waste Rock and Tailings Disposal

Highlights

- The quantity of National Pollutant Release Inventory (NPRI) substances in tailings and waste rock reported by mining facilities in 2023 was 32% higher than in 2014, increasing from 738,912 tonnes to 972,465 tonnes with a 10-year high of 1,240,379 tonnes in 2020. This excludes unconsolidated overburden, stable/inert constituents of tailings, and inert waste rock.
- Manganese and its compounds were the most abundant substances measured in tailings and waste rock, comprising an average of 49% of all measured substances between 2014 and 2023. Averages between 2014 and 2023 of other substances that could be considered more toxic than manganese included arsenic (6%), cyanides (0.1%), lead (2%), and selenium (0.1%).
- The number of facilities reporting substances to NPRI decreased 6% from 101 to 95 between 2014 and 2023.

Analysis

Mineral extraction and processing generate significant volumes of tailings and waste rock.[147] Tailings pose physical risks if the structures built to contain them (e.g., dams) fail and release large volumes of tailings, other solid materials, and water. This type of physical risk is exemplified by the failure of a tailings management facility at the Mount Polley Mine in British Columbia that occurred in 2014. Tailings and waste rock also pose chemicals risks–water in contact with these wastes can become acidic or contaminated with metals and other elements (e.g., arsenic, selenium, cyanide, ammonia) due to chemical interactions with minerals in the tailings or waste rock.

Tailings and waste rock are subject to guidelines, regulations, and monitoring, and are carefully managed to eliminate or reduce the above risks (Box 14).[148] Water use by the mining industry is a separate topic and is presented in Box 13.

Box 13: Water Use in the Canadian Mining Industry

Water usage in Canadian mining operations is a critical consideration due to the environmental and regulatory pressures accompanying water management. More efficient use of all inputs to production, including water, is of ever-increasing importance in terms of sustainability of the industry and especially in the face of climate change. The mining industry primarily uses water for processing and other activities, such as dust suppression and vehicle washing. Water for on-site potable and sanitary uses, while also important, is proportionally much smaller.

Key definitions:

- Intake water is added to the establishment's water system to replace water discharged or consumed during production.
- Recirculated/recycled water is used more than once in an industrial establishment (mainly for cooling and processing activities).

[147] Glossary

[148] Appendix B – Additional Information

- Discharge water is returned to the environment, either treated or untreated, usually in a location close to the establishment.
- Gross water use is equal to the sum of intake water and recirculated water.
- Water consumption is the amount of water lost through the production process (mostly as evaporation).

According to the 2021 Industrial Water Survey released by Statistics Canada,[149] the mining industry[150] accounted for 1.5% of total industrial water intake, representing approximately 411 million cubic metres. The mining industry was responsible for 3.1% of total industrial water recirculation, with approximately 412 million cubic metres of water being reused within mining operations. Mining operations contributed to 2.1% of total industrial water discharge, amounting to about 540 million cubic metres. Water discharge exceeds water intake due to the need for many mining operations to pump out groundwater from open pit and underground mine workings (dewatering) to facilitate mining activities.[151]

The mining sector has seen a gradual decrease in both intake and discharge volumes since 2017, although this is mainly due to mine closures.[152] In 2021, recirculation volumes remained steady and exceeded intake volumes in metal ore mining operations (and were nearly on par in non-metallic mineral mining operations), reflecting the industry's ongoing efforts to improve water efficiency and put sustainable practices at the forefront of operations.

The National Pollutant Release Inventory (NPRI) collects information on the quantities of 236 substances and substance groups in tailings and waste rock produced each year. This analysis includes mineral, metal, and diamond mines as well as coal. Oil and gas extraction is excluded.[153]

It is important to emphasize that National Pollutant Release Inventory (NPRI) data on the quantities of substances in tailings and waste rock presented in this section do not provide a measure of the release of these substances to the environment (releases of substances from tailings and waste rock must be reported but are not reported separately from other releases reported by the facilities, and so cannot be analyzed independently of other sources at the facilities). Also worth noting is different substances present very different potential hazards. Tailings and waste rock are managed on site at mine facilities and are not released unless a failure occurs.

In addition, these data do not provide a meaningful indication of the risk of release of these substances to the environment. This is because NPRI data do not provide:

- Information needed to assess risk on a site-specific basis, such as the physical characteristics and chemical or mineralogical composition of the tailings or waste rock, including chemical or mineral forms in which NPRI substances occur; and
- Information regarding how tailings, waste rock, and associated water are managed to prevent or control any releases from tailings and waste rock to the air, in the form of dust, or to surface water.

[149] https://www150.statcan.gc.ca/n1/daily-quotidien/240318/dq240318d-eng.htm

[150] Mining industry in this case includes locations primarily involved in coal mining, metal ore mining, and non-metallic mineral mining (excluding sand and gravel quarrying).

[151] Statistics Canada. (2005). *Industrial Water Use* (catalogue no. 16-401-X).

[152] https://www150.statcan.gc.ca/n1/daily-quotidien/240318/dq240318d-eng.htm

[153] Additional information on tailings and waste rock disposal and the National Pollutant Release Inventory is included in Appendix B - Additional Information

The number of facilities reporting waste rock and tailings to NPRI decreased 6% between 2014 and 2023, while total quantity of waste rock and tailings increased 32%, with some fluctuations over the same period (Table 15, Figure 38).[154] Tailings contributed between 61% and 90% of total quantity of NPRI substances in the waste rock and tailings category over the 10-year period. This analysis does not include facilities that reported zero tonnes of waste rock and tailings.

The large increase in waste rock seen between 2018 and 2019 in Figure 38 is largely attributable to one operation. Of the 62 different operations reporting for those two years, that operation accounted for 71% of total waste rock in 2018 and 50% in 2019, with a year-over-year increase of 88% in its quantity of waste rock.

Table 15: Quantities of NPRI substances (tonnes) reported in minerals sector tailings and waste rock [NAICS 212, 327, 331, 332], 2014–2023

Year	Tailings Onsite*	Tailings Offsite**	Tailings Total	Waste Rock Onsite*	Waste Rock Offsite**	Waste Rock Total	Total Quantity of NPRI Substances in Tailings and Waste Rock	Number of Reporting Facilities
2014	634,434	2,231	636,666	102,230	16.6	102,247	738,912	101
2015	702,293	1,786	704,079	79,612	35.1	79,647	783,727	94
2016	749,033	1,644	750,677	128,718	13.2	128,731	879,408	87
2017	817,043	1,916	818,959	168,650	35.0	168,685	987,643	96
2018	757,369	1,595	758,963	163,387	7.1	163,394	922,358	104
2019	762,549	1,384	763,933	436,874	2.6	436,877	1,200,810	104
2020	753,677	1,292	754,969	485,404	6.1	485,410	1,240,379	102
2021	717,945	1,420	719,364	388,860	8.0	388,868	1,108,232	98
2022	736,624	2,524	739,149	266,131	3.9	266,135	1,005,283	95
2023	712,715	3,714	716,429	256,035	0.6	256,036	972,465	95

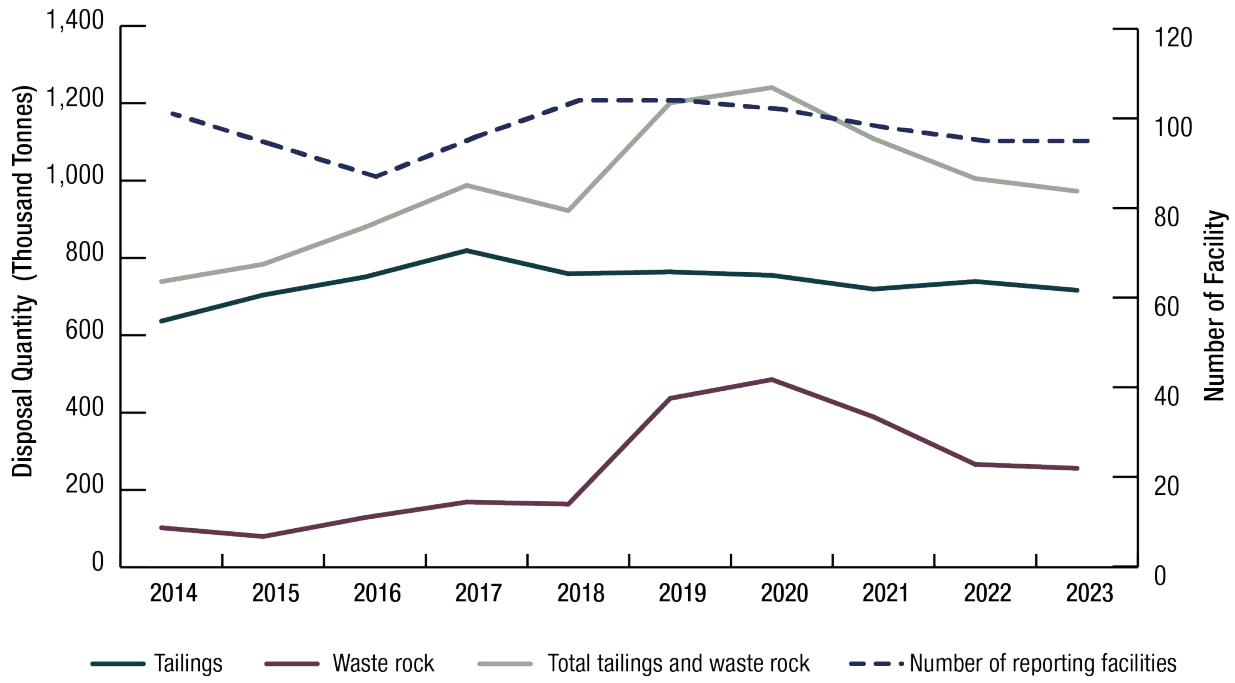
Source: National Pollutant Release Inventory

* On-site disposal means movement into an area where tailings or waste rock are discarded or stored and further managed to reduce or prevent releases to air, water, or land on the facility site. The disposal of a substance is different from a direct release to air, water, or land. Facilities must report net quantities of substances that are moved into an on-site area where tailings or waste rock are discarded or stored and further managed to reduce or prevent releases. (ECCC Guide for reporting to the National Pollutant Release Inventory 2022–2024, p. 76)

** Includes total quantities transferred off the facility site for final disposal (ECCC, *Guide for Reporting to the National Pollutant Release Inventory 2022-2024*).

[154] Appendix A – Data Considerations

Figure 38: Quantities of NPRI substances (tonnes) in minerals sector tailings and waste rock [NAICS 212, 327, 331, 332], 2014–2023



Source: National Pollutant Release Inventory

Metal ore mining accounted for between 90% and 95% of total reported quantities of NPRI substances in tailings and waste rock between 2014 and 2023 (Table 16). Tailings and waste rock from copper,[155] nickel,[156] lead, and zinc[157] mines were the greatest contributors to reported NPRI substances over the 10-year period (28-35%), followed by tailings and waste rock from gold and silver (22-45%), iron[158] (16-25%), and coal (1-3%).

[155] Included on Canada's critical minerals list.

[156] Included on Canada's critical minerals list.

[157] Included on Canada's critical minerals list.

[158] High-purity iron is included on Canada's critical minerals list.

Table 16: Reporting quantities (tonnes) of NPRI substances in tailings and waste rock by mineral and metal category, 2014–2023

Year	Coal [NAICS 2121]	Iron* [NAICS 21221]	Gold and silver [NAICS 21222]	Copper*, nickel*, lead and zinc* [NAICS 21223]	Other metal [NAICS 21229]	Total Metal [NAICS 2122]	Non-metallic mineral mining and quarrying [NAICS 2123]	Total Quantity of NPRI Substances in Tailings and Waste Rock
2014	19,648	170,483	159,896	218,597	119,233	668,210	23,202	738,912
2015	15,317	195,662	169,798	268,969	86,154	720,583	20,687	783,727
2016	18,157	213,533	213,005	273,070	111,774	811,382	22,302	879,408
2017	21,803	203,096	286,149	273,135	144,013	906,394	30,598	987,643
2018	16,493	152,542	287,806	294,921	105,596	840,867	34,636	922,358
2019	17,521	187,028	476,529	417,090	43,630	1,124,276	29,965	1,200,810
2020	15,766	206,081	554,384	383,743	34,694	1,178,902	17,789	1,240,379
2021	19,857	178,059	450,860	361,348	39,094	1,029,362	22,797	1,108,232
2022	23,606	175,008	378,294	332,958	39,900	926,159	22,970	1,005,283
2023	24,763	180,469	331,579	286,759	93,358	892,166	23,408	972,465

Source: National Pollutant Release Inventory
* Included on Canada's critical minerals list. Note that high-purity iron is included on the list.

Between 2014 and 2023, there was a 30% increase in total selected reported NPRI substances in tailings and waste rock (Table 17). It is important to understand that these are absolute quantities and highly dependent on changes in mining tonnages and ore types year to year, as explained above and elsewhere.[159] These substances exhibit a wide range of potential hazards and potential for environmental release. In some cases, concentration values of the substances are less important unless there is an exposure pathway. The most common pathways are through water or inhalation or ingestion of dust.

Manganese[160] and its compounds were the most abundant reported substances every year between 2014 and 2023, averaging 48% of total reported quantity of NPRI substances.

The total reported quantity of many substances increased between 2014 and 2023, generally mirroring production volumes for many metals over the same period. Of note is thallium, which increased more than 10-fold over the 10-year period. The large increase in reported quantities of cobalt[161] after 2015 (65% change) resulted from the substance moving from Group 1A to Group 1B of NPRI reporting, with the reporting threshold dropping from 10 tonnes to 50 kg. In contrast, cadmium, cyanide, lead, and selenium all experienced decreases over the 10-year period.

[159] Appendix A – Data Considerations, Appendix B – Additional Information

[160] Included on Canada's critical minerals list.

[161] Included on Canada's critical minerals list.

Table 17: Total reported mass (in tonnes) of selected NPRI substances in minerals sector tailings and waste rock [NAICS 212, 327, 331, 332], 2014–2023

Substance	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Antimony	131	92	162	237	226	444	555	512	397	396
Arsenic	19,535	23,845	22,482	23,521	31,329	55,170	65,965	71,028	64,035	54,926
Cadmium	331	314	293	313	423	422	367	440	291	297
Chromium*	23,325	26,752	30,451	45,570	34,896	141,574	62,327	76,577	40,149	41,395
Cobalt*	5,959	5,436	8,945	9,989	9,472	10,296	10,221	10,870	10,433	9,941
Copper*	98,452	90,475	107,001	133,130	125,141	148,421	147,922	151,778	139,560	136,821
Cyanides	768	840	1,009	1,157	628	614	577	579	507	578
Lead	11,096	13,047	17,434	17,760	16,655	30,593	16,165	11,727	10,865	9,778
Manganese*	297,897	332,961	356,473	380,397	329,788	422,600	448,051	428,248	379,773	366,498
Mercury	31	11	14	13	24	40	52	36	35	49
Nickel*	53,668	51,330	53,978	59,248	53,446	52,585	58,035	65,339	78,133	58,210
Selenium	1,081	988	1,057	1,221	1,090	839	772	750	737	619
Thallium	42	103	98	132	132	161	158	336	330	456
Vanadium*	21,923	21,747	29,890	26,200	25,021	26,360	25,283	24,032	27,219	26,430
Zinc*	53,046	58,279	64,551	69,625	76,266	126,241	86,593	85,064	62,156	58,889
Total	**587,284**	**626,221**	**693,839**	**768,514**	**704,539**	**1,016,361**	**923,043**	**927,313**	**814,620**	**765,283**

Source: National Pollutant Release Inventory
* Included on Canada's critical minerals list.

There are two international standards in use that are helping to drive continual improvement in the management of risks associated with tailings. These standards go beyond the scope of regulatory requirements and describe performance expectations regarding both governance and technical aspects of tailings management (Box 14). One is a homegrown standard—the tailings management component of the *Towards Sustainable Mining®* (TSM, Box 11) program developed by the Mining Association of Canada (MAC).[162] As of 2023, TSM was being applied in Canada and 11 other countries around the world. The other—the *Global Industry Standard on Tailings Management*—is closely aligned with the TSM requirements and was developed with input from MAC.[163] It is being implemented by members of the International Council on Mining and Metals and some other mining companies.

[162] https://mining.ca/towards-sustainable-mining/protocols-guides/tailings-management-protocol/

[163] https://globaltailingsreview.org/global-industry-standard/

Box 14: International Standards for Tailings Management

The management of mine tailings presents a complex set of risks, including both physical and chemical hazards. Physical risks, such as the catastrophic failure of a tailings facility, and chemical risks, such as the long-term leaching of contaminants into the environment, can have severe consequences. If these risks materialize, they can lead to a range of impacts, from human fatalities to significant damage to downstream ecosystems. Additionally, the costs of recovery are often immense—and can even bankrupt companies leaving governments to cover the costs—affecting communities, industries, governments, and society at large.

Standards and enforcement are essential for reducing these risks and effectively managing those that remain. They establish expectations for care and provide a way to measure and report performance. In countries like Canada, where there are strong legal requirements, standards complement legal frameworks by driving improvements in areas that may not be fully addressed by law.

Two key international standards currently guide tailings management:

- The tailings management component of the *Towards Sustainable Mining* (TSM, Box 11) program, introduced in 2004 by the Mining Association of Canada (MAC).
- The Global Industry Standard on Tailings Management (GISTM), introduced in 2020.

TSM is a comprehensive standard that covers a broad range of environmental and social issues, including tailings management. In contrast, the GISTM focuses specifically on tailings management. Despite their different scopes, both standards share many similarities, from their objectives to the governance and technical topics they address. While both standards have areas of improvement, effective implementation of either can help tailings owners enhance their practices and minimize harm.

Canada is recognized as a global leader in developing and implementing standards for responsible tailings management. Guidance documents from MAC and the Canadian Dam Association (CDA) are not only widely used across Canada but have also influenced international standards. Due to this leadership, MAC was invited to join the advisory group of the expert panel that developed the GISTM. MAC also contributed to the creation of the Tailings Management: Good Practice Guide, published by the International Council on Mining and Metals in 2021. Additionally, several CDA members played a key role in shaping guidance from the International Commission on Large Dams.

4.2 Mine Effluent and Discharges to Surface Water

Highlights

- The number of mines subject to the Metal and Diamond Mining Effluent Regulations (MDMER) increased 21% between 2014 and 2023 from 125 to 151 mines.
- The MDMER status report (2023)[164] found that:
  - Compared to 2022, the "percentage of mining operations meeting regulatory standards for lead, nickel,[165] un-ionized ammonia, pH low, and fish and invertebrate non-toxicity increased in 2023."
  - In 2023, for "deleterious substances, compliance was 99% or higher for 7 substances and above 97% for the remaining substances."
- Excluding discharges from the Mount Polley mine disaster in 2014, surface water releases of 14 metals by mine facilities reporting to the National Pollutant Release Inventory (NPRI) decreased 3% over the 2014 to 2023 period.

Analysis

Mining often involves managing substantial volumes of water, including rain and snow that falls on mine sites as well as groundwater pumped from surface and underground workings. Some fresh water is drawn for use in ore processing, although this is minimized through recycling of water used in processing. This water can become contaminated during ore processing or by contact with mine workings, mine waste (e.g., tailings and waste rock), on-site roads, and other mine site infrastructure.

Contact with mine waste can pose a particular challenge as the water in contact with the waste can become acidic or be contaminated by metals or other substances (e.g., cyanide from ore processing, ammonia from explosives). If released without proper treatment, this water could directly and indirectly affect water quality and the health of aquatic ecosystems.

Water and mine wastes can be carefully managed to limit the potential for water to become contaminated. For example, tailings that could generate acid can be kept saturated with water to limit their exposure to oxygen, an essential ingredient in chemical reactions causing acidity and release of metals to water.

Ore processing facilities that use cyanide to recover gold often use treatment processes to destroy the cyanide before tailings are transferred to management facilities. In addition, clean water including runoff from nearby slopes is diverted away from mine sites to prevent it from becoming contaminated.

Water from mine sites that is to be released to the environment is required to be treated as needed to reduce concentrations of all contaminants to safe levels.

The Environmental Code of Practice for Metal Mines recommends environmental management practices to mitigate identified environmental concerns, including potential impacts on groundwater resources.[166] Risks can be minimized by implementing measures to prevent pollution, such as environmental management planning and implementation of management programs for water quality, tailings, and waste rock.

[164] https://www.canada.ca/en/environment-climate-change/services/managing-pollution/sources-industry/mining-effluent/metal-diamond-mining-effluent/status-report-performance-mines-regulations-2023.html

[165] Included on Canada's critical minerals list.

[166] Environmental Code of Practice for Metal Mines, Environment Canada, 2009.

There is no known or reliable data source detailing releases to groundwater, which remains a gap. This can be a concern in areas where local communities rely on groundwater sources of drinking water. The lack of information also risks the erroneous impression that activity within industries including the minerals sector is having no impact on groundwater resources. Other wastes and residues can also be relevant (e.g., roasted ore, slag, heap leach residue). Requiring the measurement, monitoring, and reporting of discharges to groundwater and these other waste categories would address this gap.

Data collected and published under the Metal and Diamond Mining Effluent Regulations (MDMER)[167] are indispensable to the analysis contained in the section below. Additional data and annual reports prepared by Environment and Climate Change Canada under MDMER are also available and the authors of the report can be contacted via MDMER-REMMMD@ec.gc.ca.[168]

A list of mines subject to MDMER and other information is available on the Government of Canada's Open Data Portal.[169]

According to the status report on the performance of mines, subject to the Metal and Diamond Mining Effluent Regulations in 2023,[170,171] Table 18 below

> "shows the percentage of regulatory data within authorized limits for 2014 to 2023. Compared to 2022, the percentage of mining operations meeting regulatory standards for lead, nickel, un-ionized ammonia, pH low, and fish and invertebrate non-toxicity increased in 2023. For deleterious substances, compliance was 99% or higher for 7 substances and above 97% for the remaining substances."

Table 18: Percentage of MDMER regulatory data within authorized limits, 2014–2023

Substance/Parameter	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Arsenic	99.9%	100.0%	100.0%	100.0%	100.0%	99.9%	100.0%	99.9%	99.8%	99.8%
Copper*	99.7%	99.9%	99.9%	100.0%	100.0%	99.9%	99.9%	99.9%	100.0%	99.7%
Cyanide	99.8%	99.8%	100.0%	100.0%	99.8%	99.7%	100.0%	100.0%	100.0%	100.0%
Lead	100.0%	100.0%	100.0%	100.0%	100.0%	99.9%	99.9%	99.8%	99.9%	100.0%
Nickel*	99.3%	99.8%	99.9%	99.9%	99.5%	98.2%	98.9%	98.7%	99.1%	99.5%
Radium 226	99.5%	99.4%	99.3%	99.8%	100.0%	99.6%	99.6%	99.8%	100.0%	100.0%
Zinc*	99.6%	100.0%	99.9%	99.9%	99.4%	98.5%	99.1%	99.0%	99.3%	98.9%
Total Suspended Solids	97.6%	98.0%	98.0%	98.0%	97.8%	97.0%	98.1%	98.3%	97.8%	97.7%
Un-Ionized Ammonia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	99.0%	99.2%	99.6%
pH Low	99.3%	99.3%	99.3%	99.8%	97.7%	96.7%	99.2%	98.8%	98.9%	99.6%
pH High	99.8%	99.9%	99.9%	100.0%	100.0%	99.0%	100.0%	100.0%	100.0%	99.9%
Fish Non-Toxicity	99.0%	99.6%	95.7%	98.6%	91.6%	100.0%	99.4%	99.4%	97.9%	97.9%
Invertebrate Non-Toxicity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	94.0%	84.7%	95.9%

Source: Environment and Climate Change Canada, status report on the performance of mines subject to the Metal and Diamond Mining Effluent Regulations in 2023.
* Included on Canada's critical minerals list.

[167] Glossary

[168] https://www.canada.ca/en/environment-climate-change/services/managing-pollution/sources-industry/mining-effluent/metal-diamond-mining-effluent/data-annual-reports.html

[169] https://open.canada.ca/data/en/dataset/6ceba940-efaa-4994-bee7-3ea1930bedad

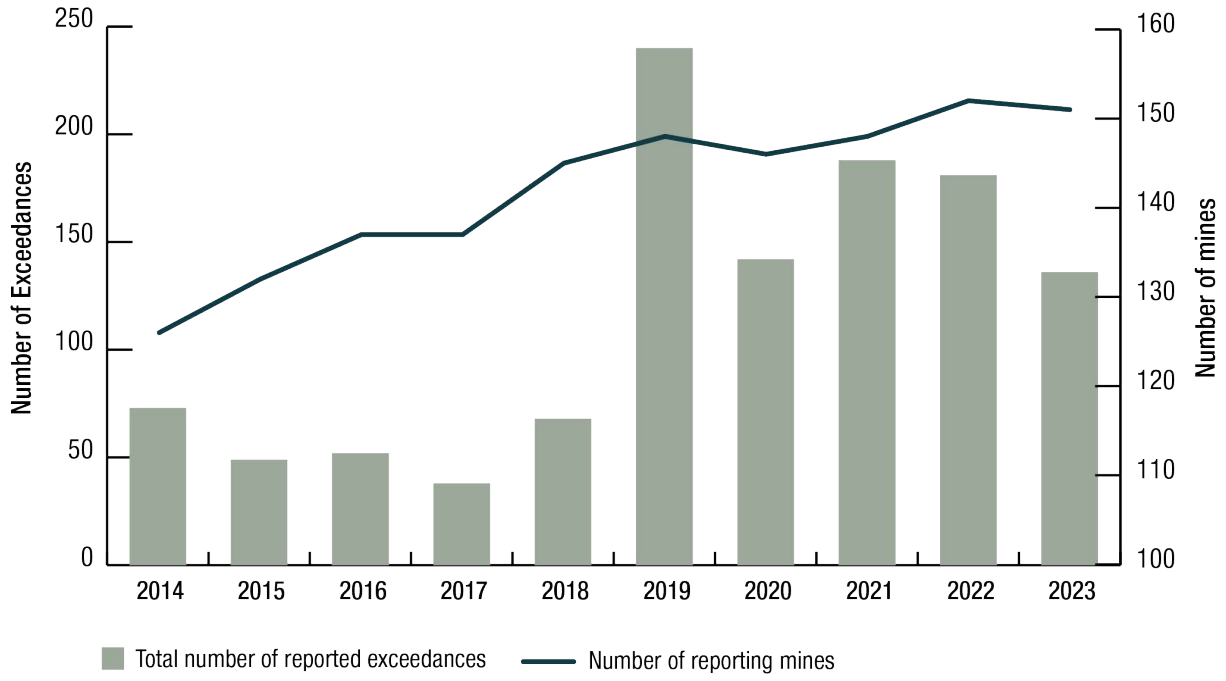
[170] https://www.canada.ca/en/environment-climate-change/services/managing-pollution/sources-industry/mining-effluent/metal-diamond-mining-effluent/status-report-performance-mines-regulations-2023.html

[171] Appendix A – Data Considerations

Figure 39 below "shows the total number of exceedances for deleterious substances and pH against the number of mines subject to the [MDMER] regulations from 2014 to 2023."[172] There were 147 metal mines and four diamond mines subject to MDMER in 2023. This is a 20% increase compared to 126 reporting metal mines in 2014 (diamond mines were not yet subject to the regulations in 2014).

Diamond mines were added to the set of mines that were subject to MDMER on June 1, 2018. In addition, there were changes to the authorized limits of prescribed deleterious substances under MDMER that came into effect in 2021.[173]

Figure 39: Total number of exceedances for deleterious substances and pH, against number of reporting mines, 2014–2023



Source: Environment and Climate Change Canada, status report on the performance of mines subject to the Metal and Diamond Mining Effluent Regulations in 2023.
Note the scaling of the secondary vertical axis between 100 and 160 reporting mines.

[172] https://www.canada.ca/en/environment-climate-change/services/managing-pollution/sources-industry/mining-effluent/metal-diamond-mining-effluent/status-report-performance-mines-regulations-2023.html

[173] https://www.canada.ca/en/environment-climate-change/services/managing-pollution/sources-industry/mining-effluent/metal-diamond-mining-effluent/overview.html#toc4

Table 19 below displays the numbers of reporting facilities by location between 2014 and 2023. Ontario and Quebec host just over half of mines reporting to MDMER with an average of 58% of the total over the 10-year period.

Table 19: Number of reporting facilities by jurisdiction, 2014–2023

Year	BC	YK	SK	MB	NT	NU	ON	QC	NB	NL	NS	Total
2014	12	3	9	10	3	2	40	33	3	10	1	126
2015	11	3	8	10	3	3	45	34	3	11	1	132
2016	13	3	8	10	3	4	46	35	3	11	1	137
2017	13	3	8	10	3	4	46	35	3	11	1	137
2018	13	3	8	10	6	5	48	37	2	11	2	145
2019	14	4	8	10	6	6	49	37	2	10	2	148
2020	14	5	9	10	6	6	48	34	2	10	2	146
2021	14	5	9	10	5	6	51	34	2	10	2	148
2022	17	5	9	10	5	6	51	35	2	10	2	152
2023	17	5	9	10	5	5	50	36	2	10	2	151

Source: Environment and Climate Change Canada, status report on the performance of mines subject to the Metal and Diamond Mining Effluent Regulations in 2023.

Table 20 presents National Pollutant Release Inventory data on minerals sector releases to surface water by substance in tonnes from 2014 to 2023.[174] The most singular result for the 10-year period was due to the breach of a tailings dam at the Mount Polley mine in 2014. Data for 2014 is shown with the Mount Polley release separated from other sources that year. In 2017, over 1 tonne or 46% of total cobalt originated from only three facilities.

Table 20: Minerals sector releases to surface water by substance (tonnes) [NAICS 212, 327, 331, 332], 2014–2023

Year	Arsenic (and its compounds)	Cadmium (and its compounds)	Lead (and its compounds)	Nickel** (and its compounds)	Selenium (and its compounds)	Other Metals (and compounds)*
2014	264.0	4.4	138.6	253.3	52.3	40,524.2
Mount Polley	*259.1*	*3.8*	*134.2*	*223.7*	*33.0*	*40,386.4*
All Others	*4.9*	*0.6*	*4.3*	*29.6*	*19.4*	*137.8*
2015	3.2	0.4	3.3	28.7	14.4	155.0
2016	4.2	0.5	3.3	25.1	13.6	103.0
2017	3.9	0.6	2.9	23.3	18.6	150.5
2018	3.3	0.7	2.7	19.7	15.5	213.2
2019	3.8	0.5	2.4	21.4	15.5	208.3
2020	3.0	0.4	2.1	25.2	15.7	181.8
2021	2.2	0.3	1.9	22.6	16.1	151.0
2022	2.4	0.3	1.9	23.4	16.7	166.8
2023	2.8	0.4	2.4	21.6	12.6	151.3

Source: Environment and Climate Change Canada, National Pollutant Release Inventory.
*Includes: antimony**, chromium**, cobalt**, copper**, manganese**, mercury, thallium, vanadium**, and zinc**.
** Included on Canada's critical minerals list.

[174] https://www.canada.ca/en/services/environment/pollution-waste-management/national-pollutant-release-inventory.html

Box 15: Biodiversity and Conservation Initiatives in Mining

Conserving biodiversity through all stages of the mining life cycle is an industry and government priority. Halting of biodiversity loss is also a part of the 15th of the UN's 17 Sustainable Development Goals.[175]

Canada's mining industry recognizes that land access and a company's social licence to operate depend on responsible social, environmental, and economic practices and a strong business case for biodiversity conservation. Exploration and mining companies are supporting global efforts to protect biodiversity by integrating conservation and land-use planning considerations into their processes and rehabilitating sites affected by their activities through progressive initiatives to restore ecosystems.

Canada's mining industry is committed to sustainability, as demonstrated by the application of leading standards and guidance. The Mining Association of Canada's Towards Sustainable Mining initiative includes specific criteria related to biodiversity conservation, which seek to confirm that mining projects are committed to managing biodiversity at their sites, are implementing action plans for protecting biodiversity, and conservation reporting systems are informing decision-making. Additionally, TSM includes requirements related to water stewardship, responsible tailings management, and Indigenous and community relationships, all of which complement the TSM Biodiversity Conservation Management Protocol. Further, the Prospectors and Developers Association of Canada's e3 Plus framework provides the exploration sector with a suite of tools for responsible exploration.

The Government of Canada promotes biodiversity in the mining industry through a comprehensive approach integrating environmental stewardship into mining practices. Through partnerships with Indigenous communities, environmental organizations, rights holders, and industry stakeholders, Canada is advancing restoration of ecosystems affected by mining activities and fostering responsible resource extraction. Financial incentives and funding programs encourage research and innovation in sustainable mining technology and practices. A range of government departments are collaborating to offer support and expertise:

- **Species at Risk** – The Government of Canada plays a role protecting and conserving federally listed species at risk. This includes ongoing collaboration with the mining sector on recovery strategies, conservation agreements, and other tools like emergency orders. Additionally, the mining sector actively participates in several multi-interest initiatives that support the federal government's efforts under the Species at Risk Act (SARA), such as the Boreal Caribou Knowledge Consortium and the Nature Advisory Committee.
- **Nunavut Land Use Planning** – As a signatory to the Nunavut Agreement, the Government of Canada is playing a key role in the development of the Nunavut Land Use Plan. Once complete, the plan will establish acceptable land uses within 3.3 million square kilometres of Nunavut's land and marine areas, including areas designated for mining and conservation.
- **Parks Conservation** – Protected areas under Parks Canada contribute to global targets of protecting 25% of lands and waters by 2025, and 30% by 2030. The Canadian Wildlife Service is collaborating with various governments and Indigenous communities to recognize Other Effective Area-based Measures (OECMs) that support biodiversity outside traditional parks. This helps arrest and reverse biodiversity loss and addresses climate change.

[175] https://sdgs.un.org/topics/biodiversity-and-ecosystems#:~:text=The%20Sustainable%20Development%20Goal%2015,degradation%20and%20halt%20biodiversity%20loss%E2%80%9D.

- **Marine Conservation Analysis** – Canada is providing economic analysis to assess impacts on the minerals sector of various proposed new national marine protected areas. These areas are intended to safeguard important marine ecosystems, enhance biodiversity, and support sustainable fisheries management, contributing to Canada's goal of conserving 30% of marine areas by 2030.

Through partnerships with Indigenous communities, environmental organizations, and industry stakeholders, Canada is working to designate and manage protected areas within an integrated approach across government and private sector stakeholders, ensuring biodiversity and economic development in the mining sector are each given equal measure.

4.3 Air Emissions

Highlights

- Minerals sector total emissions of sulphur dioxide (SO_2) in tonnes decreased by a substantial 66% between 2014 and 2023.
- Emissions of NO_x and $PM_{2.5}$ were relatively stable with 2% and 3% increases between 2014 and 2023, respectively.
- Emissions of PM_{10} increased by 20% between 2014 and 2023.
- When tonnes of emissions per reporting facility are considered, sulphur dioxide decreased by 61%, NO_x decreased by 1%, $PM_{2.5}$ increased by 0.1%, and PM_{10} increased by 17.7% between 2014 and 2023.

Analysis

Air pollution problems result from pollutants released by human activities, natural processes, and interactions between pollutants. Air pollutant concentrations in the environment are influenced in part by the quantity of pollutants released, distance from sources, and weather. Some pollutants can affect air quality hundreds to thousands of kilometres from sources.

Air pollution can affect the health of Canadians and the environment. Emissions of sulphur oxides (SO_x), including sulphur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter with a diameter less than 10 micrometres (PM_{10}), and particulate matter with a diameter less than 2.5 micrometres ($PM_{2.5}$) can all contribute to air pollution.

Exposure to SO_x and NO_x can reduce lung function and increase susceptibility to allergens in people with asthma. SO_x and NO_x are precursors of fine particulate matter ($PM_{2.5}$) and contribute to formation of acid rain and smog. Exposure to particulates including $PM_{2.5}$ and PM_{10} can lead to health issues such as cancer, cardiovascular problems, and respiratory conditions, as well as environmental impacts like poor air quality, ecosystem damage, and soil contamination.

The minerals sector is a source of these air emissions. Other sources include electricity generating plants and generators, refineries, and paper and pulp facilities.[176] NO_x is generated by fuel combustion in industrial processes and transportation equipment. Sources of direct PM_{10} and $PM_{2.5}$ emissions include crushing and fragmentation processes and transportation. $PM_{2.5}$ can be transported over long distances, while effects of coarser particles, including most PM_{10}, are local.

Variations in emissions for the mining and quarrying subsector (i.e., mine sites not associated with smelters) may be due to factors including changes in mining method, ore grade, waste volumes, new equipment, improved engines, and pollution controls, as well as weather conditions that can affect surface mining PM as wet roads decrease road dust and high winds can disperse it. Emissions of NO_x from the mining industry are generally from off-grid mines that generate their own electricity; therefore, opening and closing of off-grid mines would influence NO_x emissions for the sector.

Base metal smelters process sulphide mineral concentrates and are major sources of domestic SO_x emissions including sulphur dioxide. Reductions in SO_x (including sulphur dioxide, SO_2) and NO_x emissions at primary processing sites, which include base metal smelters, stem in part from federal, provincial, and territorial government regulatory initiatives, including the implementation of Environmental Performance Agreements for base metals smelting and refining with the objective of implementing the base level industrial emissions requirements (BLIERs) for emissions of sulphur dioxide and particulate matter.[177] There were also several smelter closures in Canada during the 2014–2023 period, which contributes to observed reductions in emissions.

Sulphur dioxide emissions from the minerals sector and related subsectors showed a substantial decline between 2014 and 2023 (Figure 40 and Figure 44).[178] The largest declines were seen for the mining and quarrying (except oil and gas) [NAICS 212] and fabricated metal product manufacturing [NAICS 332] subsectors at 93.9% and 99.9%, respectively.

The large reductions seen for NAICS 212 are attributed to a single smelter that ramped down production in 2015–2016 and closed in 2018 (Thompson Operations). Since the smelter was located on a mine site, its emissions were reported under NAICS 212 rather than 331.

Over the longer term, an even more dramatic decrease in SO_x is apparent and worth noting here. There has been a 78% reduction in SO_x from all sectors between 1990 and 2022 (3,000 kilotonnes to 650 kilotonnes).[179] This includes a reduction from 1500 kilotonnes to 167 kilotonnes from the minerals sector.

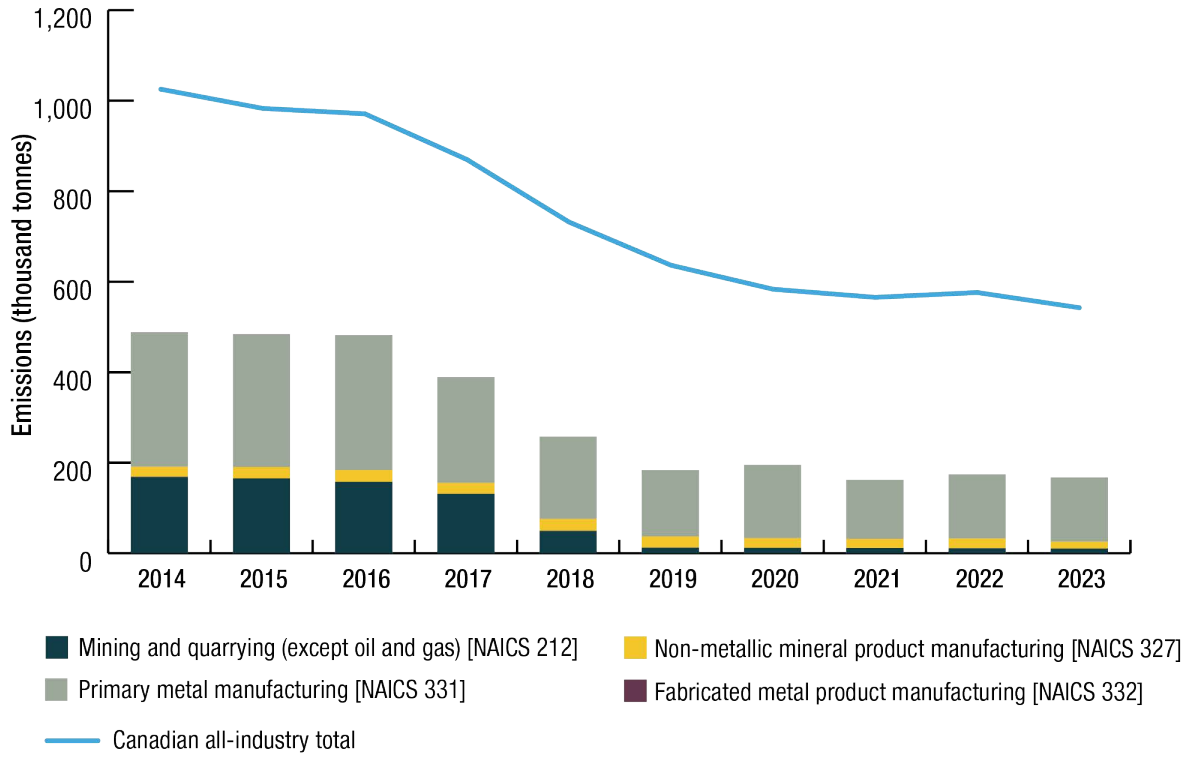
[176] The Conference Board of Canada, 2016, *Sulphur Oxides Emissions*, https://www.conferenceboard.ca/hcp/provincial/environment/sox.aspx?AspxAutoDetectCookieSupport=1

[177] https://www.canada.ca/en/environment-climate-change/services/environmental-performance-agreements/base-metal-smelters-overview.html

[178] Appendix A – Data Considerations

[179] https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-pollutant-emissions.html

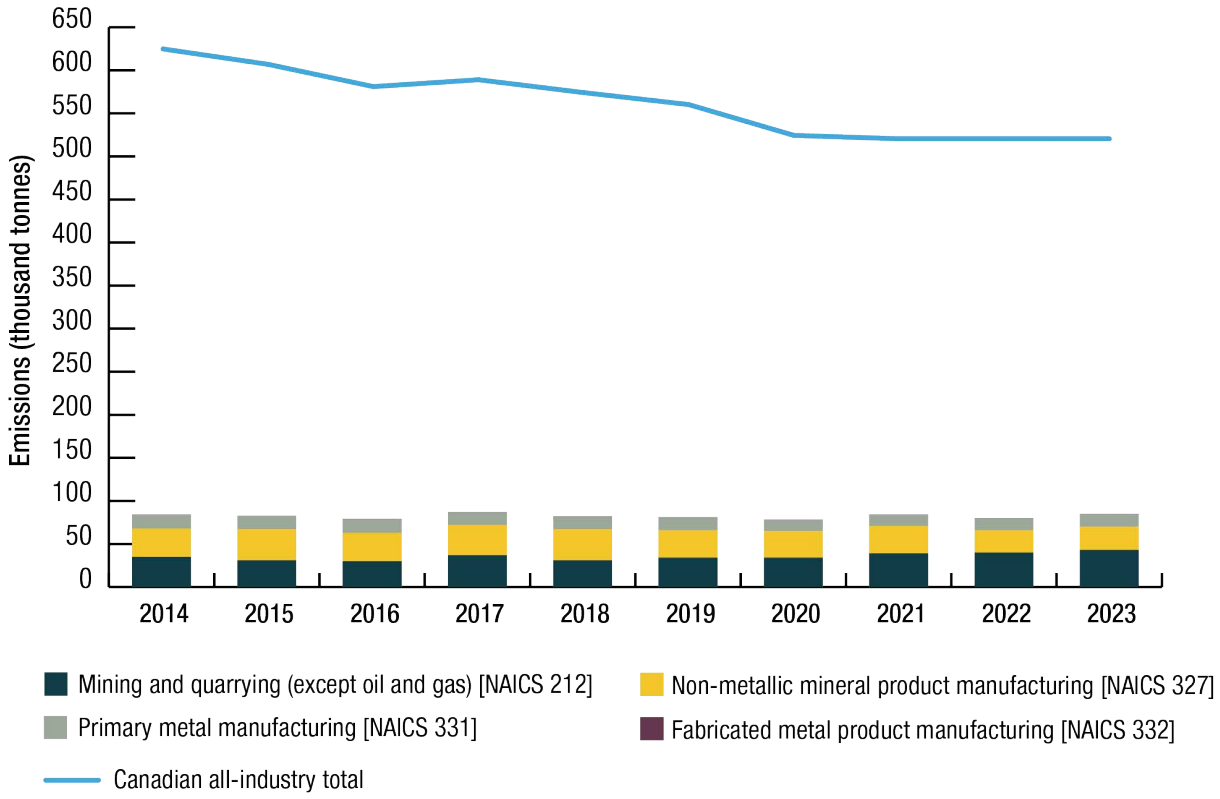
Figure 40: Sulphur dioxide emissions (thousands of tonnes), 2014–2023



Source: Environment and Climate Change Canada, National Pollutant Release Inventory.

Emissions of NO_x from the minerals sector stayed relatively stable, increasing by 2% between 2014 and 2023, while Canadian all-industry total emissions declined by almost 17%. A 17% decrease in emissions from the non-metallic mineral product manufacturing subsector [NAICS 327] was offset by a 24% increase in the mining and quarrying (except oil and gas) subsector [NAICS 212].

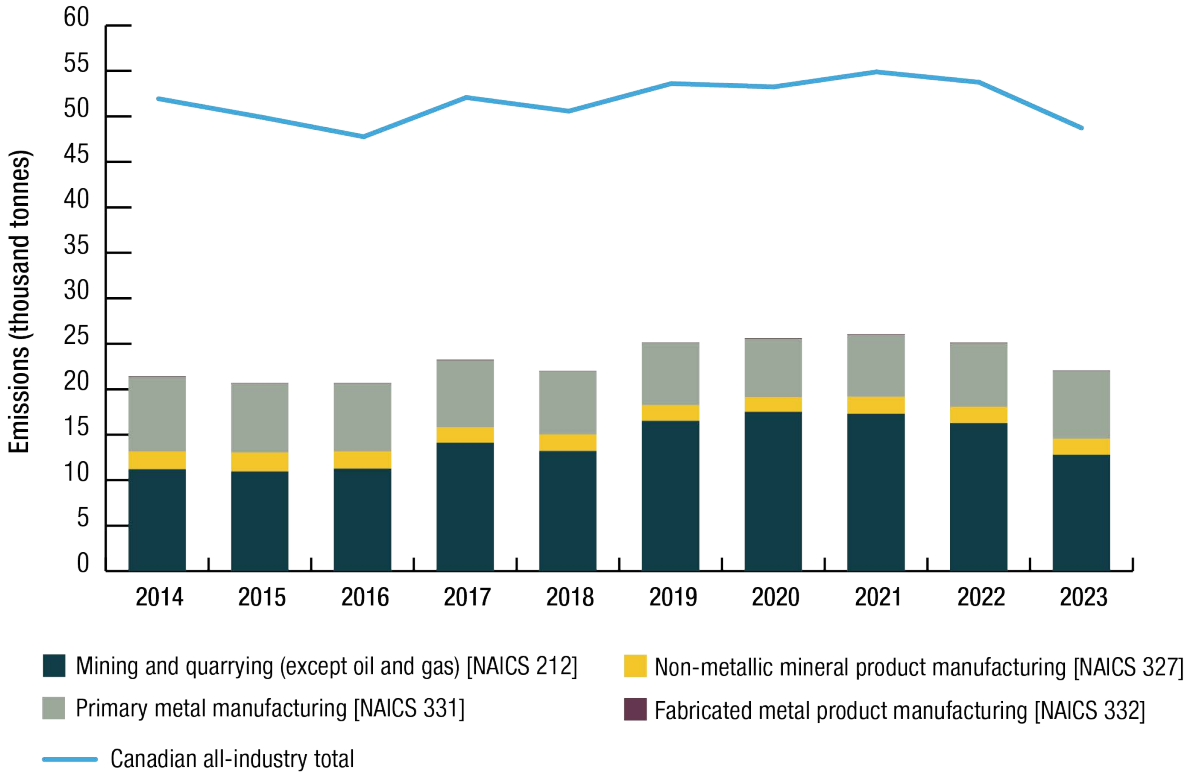
Figure 41: Minerals sector emissions of NO_x (thousands of tonnes), 2014–2023



Source: Environment and Climate Change Canada, National Pollutant Release Inventory.

Direct $PM_{2.5}$ emissions are shown below in Figure 42. The total minerals sector and Canadian all-industry totals showed little change between 2014 and 2023, increasing 3% and decreasing 6%, respectively. Emissions decreases of 11% from non-metallic mineral product manufacturing [NAICS 327] and 9% from primary metal manufacturing [NAICS 331] were offset by a 14% increase from mining and quarrying (except oil and gas) [NAICS 212].

Figure 42: Minerals sector emissions of $PM_{2.5}$ (thousands of tonnes), 2014–2023

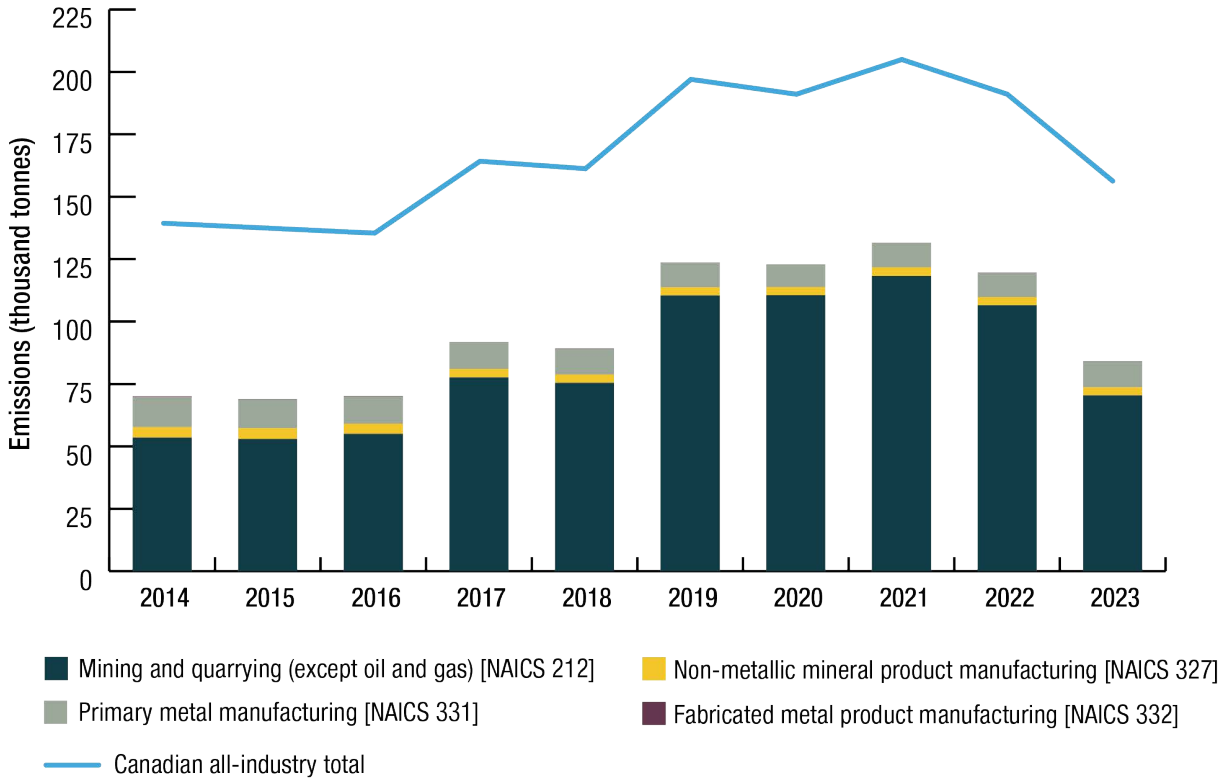


Source: Environment and Climate Change Canada, National Pollutant Release Inventory.

Figure 43 shows minerals sector and related subsector emissions of PM_{10} compared to the Canadian all-industry total. Minerals sector emissions increased 20% between 2014 and 2023 while the all-industry total increased 13%. The minerals sector's overall increase was driven by a 32% increase in emissions from the mining and quarrying (except oil and gas) subsector [NAICS 212] while emissions from the other three subsectors showed decreases between 15% and 50%. A 10-year peak in 2021 represented a 121% increase in NAICS 212 emissions relative to 2014, while the other three subsectors showed decreases of 17% to 34%. The main contributors to PM_{10} data from the mining and quarrying (except oil and gas) subsector [NAICS 212] were coal mines.

No plausible explanation could be found for why the minerals sector, and more specifically the mining and quarrying (except oil and gas) subsector [NAICS 212], would experience an increase in PM_{10} emissions from 2014 to 2023 while all other sectors experienced a similar magnitude of decrease. It is possible that this represents a reporting artifact in the NPRI data (e.g., changes in reporting requirements capturing additional facilities, additional facilities reporting, or changes to measurement or modelling of emissions).

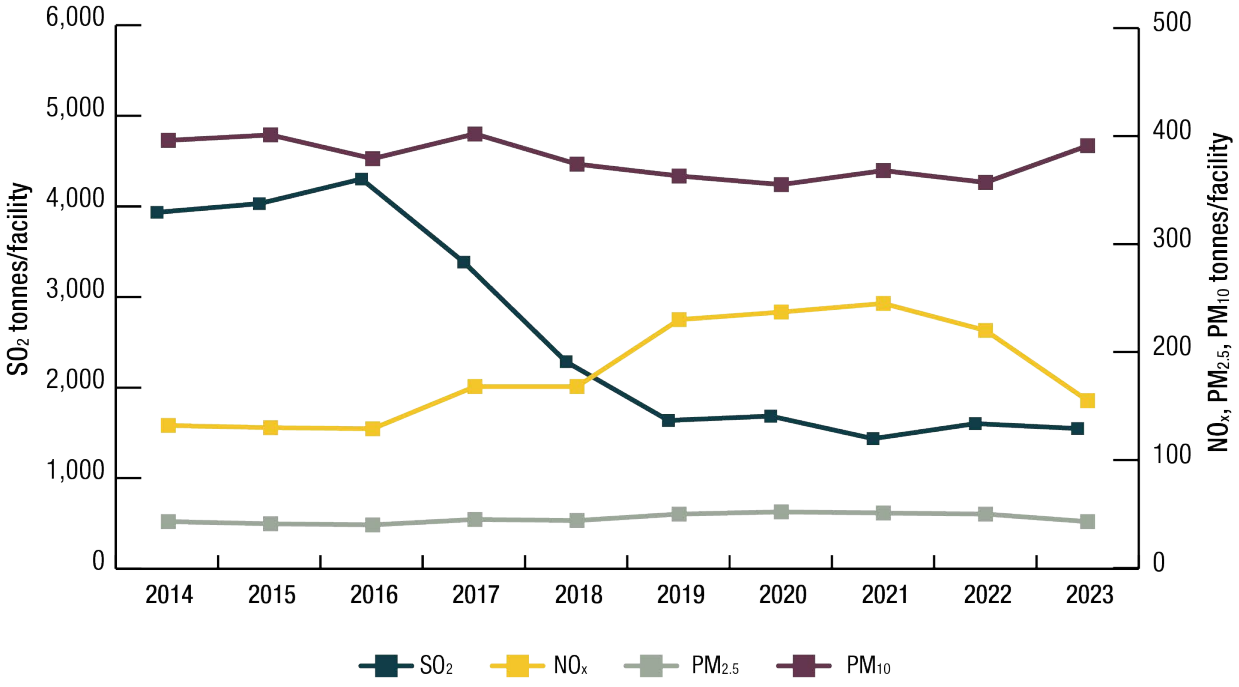
Figure 43: Minerals sector emissions of PM_{10} (thousands of tonnes), 2014–2023



Source: Environment and Climate Change Canada, National Pollutant Release Inventory.

Emissions of the select substances described above are also presented below on a per-facility basis in Figure 44. Increased PM_{10} emissions between 2019 and 2022 were due to increased tonnes of emissions, with the total number of facilities staying relatively stable. Emissions of $PM_{2.5}$ between 2019 and 2022 followed a similar, though more subtle, trend. The PM_{10} and $PM_{2.5}$ trend could result from expansion of operations, increased emissions from individual mine facilities, or outside influences such as climatic or wildfire conditions, or it may be an artifact in the measurement of the parameters. A specific and reliable explanation could not be determined from the data at the time of writing.

Figure 44: Minerals sector sulphur dioxide, NO_x, $PM_{2.5}$, and PM_{10} emissions per reporting facility [NAICS 212, 327, 331, 332], 2014–2023



Source: Environment and Climate Change Canada, National Pollutant Release Inventory.

4.4 Greenhouse Gas Emissions

Highlights

- The minerals sector emitted an average of 50 million tonnes (Mt) of greenhouse gas (GHG) per year between 2014 and 2022 before decreasing to 37 Mt by 2023 (-28%).
- Between 2014 and 2022, the minerals sector contributed an average of 6% of Canada's total GHG emissions per year.
- GHG intensity for the minerals sector decreased by 25% between 2014 and 2023.
  - GHG intensities increased by 29% in the mining and quarrying (except oil and gas) [NAICS 212] subsector and by 6% in the fabricated metal product manufacturing [NAICS 332] subsector between 2014 and 2023.
  - GHG intensities decreased by 68% in the non-metallic mineral product manufacturing [NAICS 327] subsector and by 19% in the primary metal manufacturing [NAICS 331] subsector between 2014 and 2023.

Analysis

Climate change due to greenhouse gas (GHG)[180] accumulation in the atmosphere is a domestic and international issue. GHGs trap heat in the earth's atmosphere and contribute to climate change. Major sources include fossil fuel combustion and process emissions. Fuel combustion emits gaseous carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Process emissions of CO_2 and other gases arise from decomposition of carbonate minerals, use of reducing agents to produce metals from oxides, transformation of iron into steel, and other manufacturing processes.

Environmental, economic, and social impacts resulting from GHGs and climate change occur in Canada and at a global scale. Businesses are vulnerable to climate change impacts on transportation, communication, infrastructure, operations, and long-term reclamation.[181] Temperature shifts present risks (e.g., flooding, droughts, forest fires, less reliable ice roads) and opportunities (e.g., access to markets via new shipping routes), now and in the future. The minerals sector must assess, plan for, and adapt to changes in climate. Monitoring the management of GHG emissions is an important component in assessing efforts to mitigate current and future impacts.

GHG emissions result mainly from fossil fuel use in heavy equipment (Box 16), heat and power generation in remote regions, and industrial processes. Changes in quantity of emissions over time reflect changes in output, product mix, and development of new mines in remote regions where electricity is not available. Box 17 presents emissions intensity for Canadian production of selected metal commodities, which is compared to global averages.

Box 16: Alternative Energy Technology in Mining Vehicles

Use of diesel fuel for powering vehicles is among the major sources of greenhouse gas (GHG) in the Canadian mining industry. Alternative technologies for displacing diesel use include Battery Electric Vehicles (BEV), tethered electric vehicles, hydrogen fuel cells, Hydrogen Internal Combustion Engines (HICE), and trolley-assisted electric haul trucks powered by overhead pantographs, similar to those of electric trains and Light-Rail Transit systems.

While the mining industry is currently transitioning towards BEVs, alternatives including HICE or other innovative green technologies could become viable alternatives in the future as the industry moves towards mine decarbonization.

A Railveyor system is now operational at Agnico Eagle's Goldex mine as an electric haulage solution for removing bulk material from the mine. The system consists of cars connected like a train and powered by electric drive stations along the route. The system hauled over 10 million tonnes of ore between 2018 and 2002, consistently exceeding the 6,000 t/d haul capacity of its initial design.[182,183]

Copper Mountain Mining's trolley assist project in British Columbia is a major step towards reducing carbon emissions and advancing the company's sustainability goals. The project uses trolley assist technology to reduce diesel fuel consumption by providing additional power to haul trucks. This system not only cuts fuel use but also lowers carbon dioxide emissions, supporting the company's target of

[180] Glossary

[181] Warren, F.J. and Lemmen, D.S. (eds.), 2014, *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptations*, https://ostrnrcan-dostrncan.canada.ca/bitstreams/918e5d4a-5eca-416b-a887-148793c1b033/download.

[182] https://www.canadianminingjournal.com/news/railveyor-hauls-over-10m-tonnes-at-agnicos-goldex/

[183] https://www.railveyor.com/wp-content/uploads/2024/08/240821_AEM-PDF1-3.pdf

net-zero greenhouse gas emissions by 2035. Initially applied to a few trucks, the technology will expand across the fleet. Powered by clean hydroelectric energy, the project is a key milestone in transitioning to more sustainable mining practices.[184,185,186,187]

There are challenges and risks for any industry adopting new technologies. For example, battery handling is an often-overlooked aspect of BEV adoption and is important in reducing the likelihood of battery damage, which may lead to equipment failure or fire in the worst case. In the case of fuel cells or HICE, hydrogen gas can pose an explosion hazard. It is therefore critical for users to properly understand the technology and disseminate knowledge to manage and reduce the risks.

A recent study, funded by the Clean Growth Program and with the participation of Vale, Glencore, FVT, Kovatera, CanmetENERGY, and CanmetMINING, compared BEV and diesel vehicles in a simulated mine environment. BEVs are advantageous due to reduced noise in operation and their zero local emissions and lower heat output potentially requiring less ventilation—another significant source of energy use for underground mines. However, BEVs have a limited driving range and can require long charging times; however, they can generate and store energy when they travel downhill. Both vehicle types were found to be capable of meeting demand for a specific scenario even when including battery charge time, meaning that BEVs could replace diesel vehicles without any impact on productivity. However, this must be evaluated on a case-by-case basis since performance is impacted by the proportion of travel on flat, uphill, and downhill routes. BEVs are already being adopted at other mining projects across Canada, including BEVs manufactured by Canadian companies such as Miller Technology, Rokion, and MacLean Engineering. In one example, MacLean BEVs were selected by Glencore to serve some of its underground fleet needs on its Onaping Depth nickel project northwest of Sudbury.[188]

Meanwhile, use of diesel-powered vehicles in mining is still far from being eliminated. Work is underway to support and improve diesel technology via engine certification and clean diesel research. Improved standards and guidelines can also help facilitate adoption of new technologies and work that focuses on safety risks is being done according to Canadian Safety Association standards and guidelines for diesel vehicles, BEVs, and HICEs.

CanmetMINING at NRCan is working to address the challenges and risks of green technology adoption by the Canadian mining industry through research, lab, and field work. It also organizes the annual Mining Vehicle Powertrain Conference where advancements relating to diesel, electric, and hydrogen technologies are showcased. The knowledge gained is disseminated to other researchers and users within the mining industry through conference presentations and journal publications.

[184] https://www.mining.com/copper-mountain-commissions-trolley-assist-project-for-cutting-carbon-emissions/

[185] https://new.abb.com/mining/reference-stories/open-pit-mining/trolley-assist-solution-to-meet-copper-mountain-mining-sustainable-development-goals-in-canada

[186] https://www.bchydro.com/news/conservation/2022/mining-trolley-trucks.html

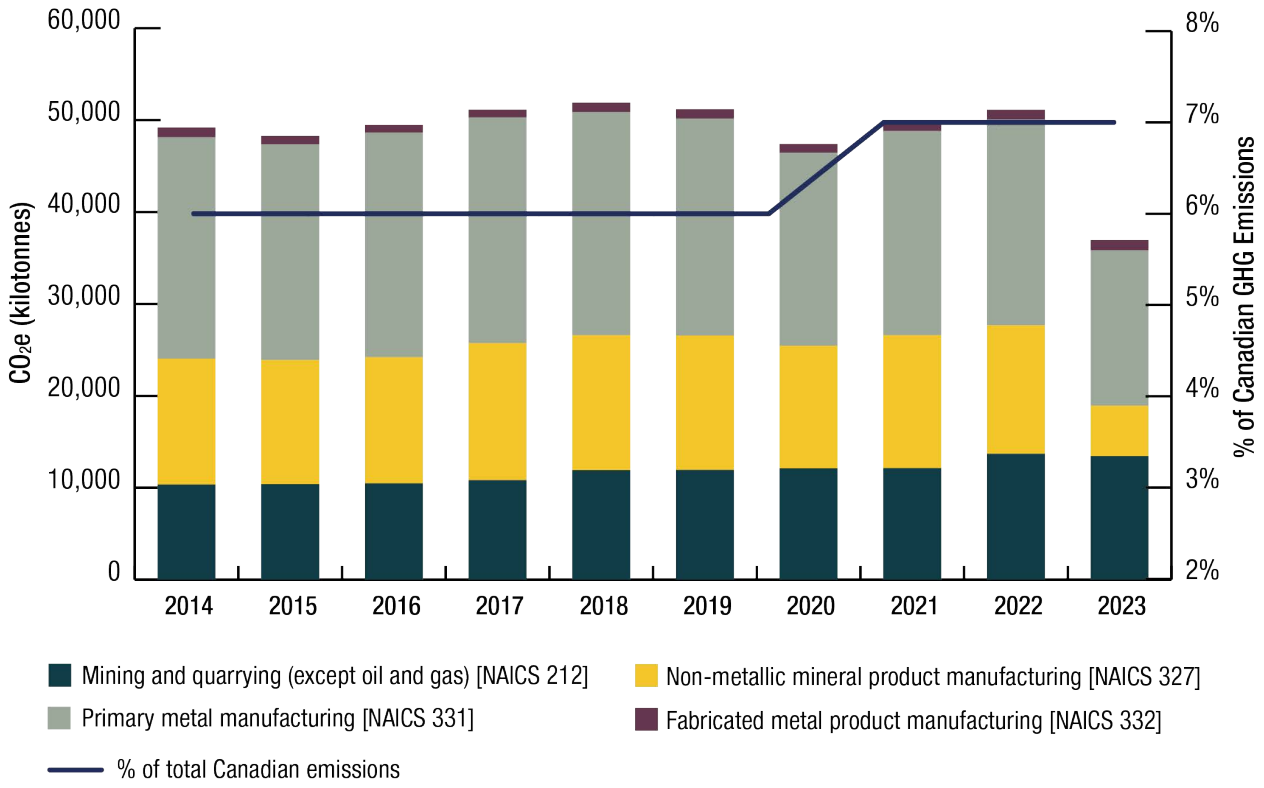
[187] https://im-mining.com/2022/09/23/copper-mountain-increases-scope-of-trolley-assist-haulage-project/

[188] https://www.northernontariobusiness.com/top-stories/the-drift-glencore-makes-battery-vehicle-order-from-maclean-engineering-5478345

In general, GHG emissions from the minerals sector changed little between 2014 and 2022 (Figure 45).[189] However, the sector's contribution to total Canadian emissions increased from 6% to 7% over the same period, while total Canadian emissions decreased by 7%. A substantial drop from 51 Mt to 37 Mt between 2022 and 2023 was driven by the non-metallic mineral product manufacturing [NAICS 327] and primary metal manufacturing [NAICS 331] subsectors. The non-metallic mineral product manufacturing subsector includes cement plants which may be significant contributors to the drop seen here because of programs, commitments, and technology including *Roadmap to Net-Zero Carbon Concrete by 2050*, the Cement Association of Canada's *Concrete Zero*, and new production processes with lower carbon emissions.[190,191,192]

Statistics Canada data for total Canadian emissions in 2023 was not available at the time of writing and is not shown in Figure 45. However, data from the Canadian Climate Institute suggests the minerals sector's share of total emissions dropped to 5% in that year.[193]

Figure 45: Minerals sector GHG emissions, 2014–2023



Sources: Canadian Energy and Emissions Data Centre; Statistics Canada.

[189] Appendix A – Data Considerations

[190] https://ised-isde.canada.ca/site/clean-growth-hub/en/cement-and-concrete-canada/roadmap-net-zero-carbon-concrete-2050

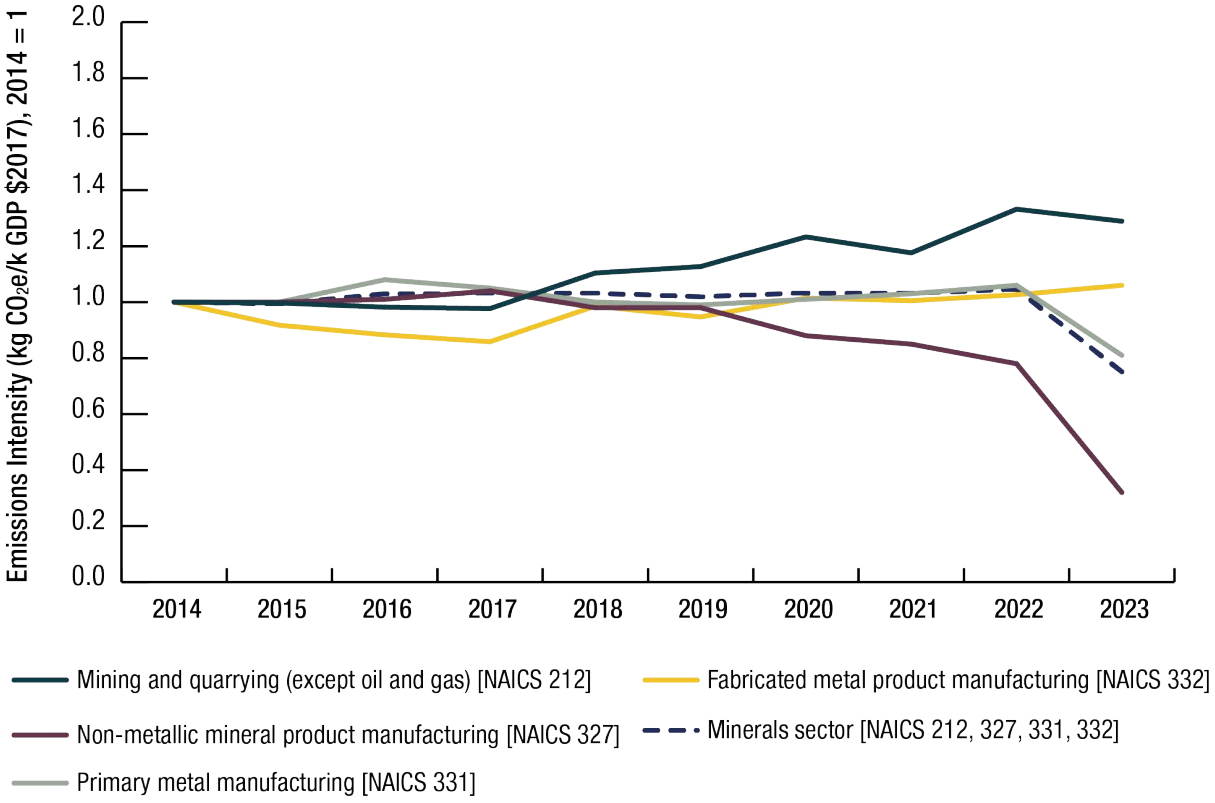
[191] https://cement.ca/sustainability/concrete-zero/

[192] https://www.lafarge.ca/en/how-canada-leading-way-low-carbon-cement-production

[193] https://climateinstitute.ca/news/experts-estimate-modest-drop-in-2023-emissions/

GHG emissions intensity for the minerals sector showed a slight increase between 2014 and 2022 (5%) before decreasing by 28% in 2023 (Figure 46). As the larger contributors to the sector's GHG emissions (Figure 45), the non-metallic mineral product manufacturing [NAICS 327] (-68%) and primary metal manufacturing [NAIC 331] (-19%) subsectors drove the decrease in intensity seen towards the end of the 10-year period. Non-metallic mineral product manufacturing [NAICS 327] GHG emissions intensity decreased by 68% while primary metal manufacturing [NAIC 331] decreased by 19%.

Figure 46: Minerals sector GHG emission intensity (GHG/GDP), 2014–2023 (2014 = 1)



Source: Canadian Energy and Emissions Data Centre. Statistics Canada

Since its launch in 2004, the Mining Association of Canada's (MAC) *Towards Sustainable Mining* (TSM) standard has included an *Energy and GHG Emissions Management Protocol* that, among other requirements, includes criteria to establish and meet facility-level energy and GHG targets. In 2020, TSM replaced this standard with a revised version of the Climate Change Protocol that takes a comprehensive approach to climate change including mitigation and adaptation measures. MAC's 2023 Annual Report notes, "MAC members reported high levels of performance on Indicator 1 (corporate climate change management), with nearly 90% of facilities reporting a Level A or higher – 70% at Level AAA. At the facility level, at least 70% of facilities reported Level A or higher on the two performance indicators."[194]

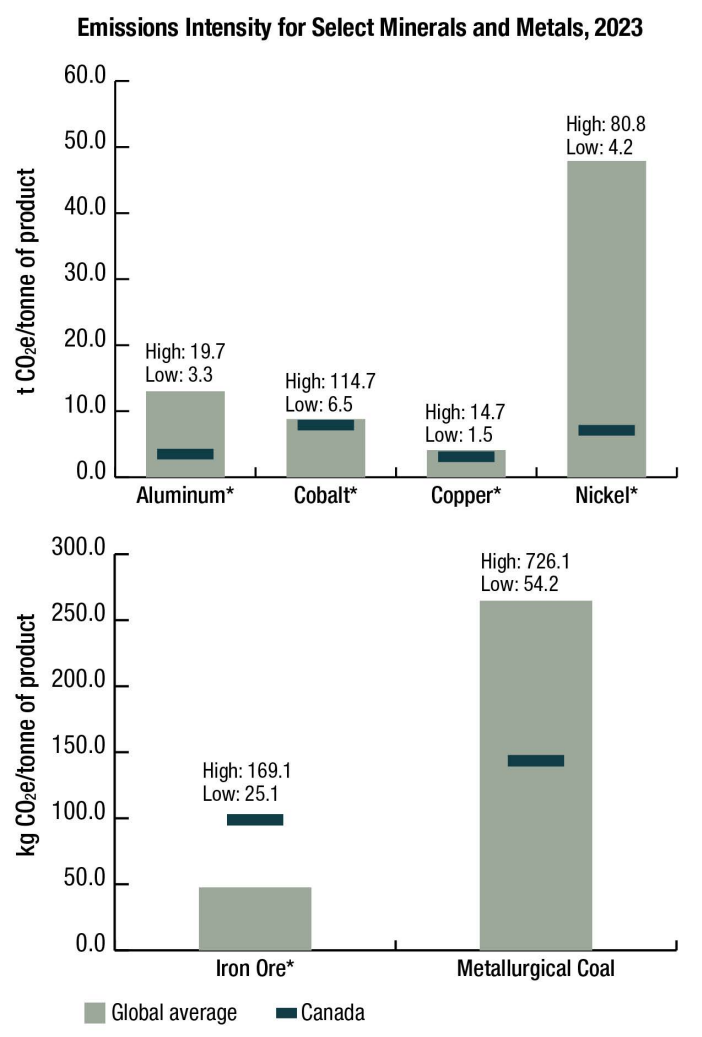
[194] https://mining.ca/resources/reports/annual-report-2023/

Box 17: Emissions Intensity for Selected Metals, 2023

The Canadian Minerals Sector's Low-Carbon Advantage

Mines in Canada produce relatively low intensities of greenhouse gas emissions.[195] Canada's edge in carbon competitiveness is driven by numerous factors, such as its abundant clean energy resources and substantial investments in the research, development, and implementation of green technologies. The emissions intensity of producing select commodities in Canada is compared to global ranges in the figure below.

Canadian mines and processing plants continue to make progress in emissions reduction by electrifying their equipment and vehicle fleets, as well as by embracing innovative technologies. These efforts include mines in isolated areas where operations are off grid and alternative energy options are few. In these locations, some companies have turned to wind turbines and solar panels to lessen their reliance on diesel fuel.



Source: Skarn Associates Limited.
Note: includes select minerals and metals for which data were available. Emissions are categorized as E1 and include emissions from mining activities, ore processing, transport, and downstream distribution up to first-use entry point.

* Included on Canada's critical minerals list. High-purity iron is included on the list.

[195] https://natural-resources.canada.ca/minerals-mining/mining-data-statistics-analysis/minerals-economy#green

4.5 Energy Consumption and Efficiency

Highlights

- In 2023, minerals sector energy consumption was 918 petajoules (PJ)[196] which was 142 PJ (18%) higher than 2014 levels.
  - Generally, sector energy derived from coke decreased while that derived from electricity and natural gas increased over the 10-year period. Those three energy sources accounted for an average of 90% of total energy derived from all sources.
- A 10-year low of 764 PJ in 2015 was followed by a steady increase towards a 10-year high in 2023, with a brief interruption in 2020 when levels dropped to 806 PJ from 851 PJ in 2019.
- The minerals sector accounted for an average of 10% of total Canadian energy use each year between 2014 and 2023.
- Energy intensity of the minerals sector increased 15% between 2014 and 2023, compared to a 1% increase for total industrial sectors, including mining but excluding electrical power generation.

Analysis

Minerals sector activities are energy-intensive, and energy cost is an important determinant of business performance and global competitiveness. Improving energy efficiency reduces operating costs and environmental stressors and impacts, including the direct and indirect greenhouse gas (GHG) emissions that contribute to climate change.

Fuel options differ among products, processes, and locations. Electricity is preferred where available, affordable, and appropriate (e.g., when heat as a by-product of energy generation for a given process is not needed or desirable). In primary metal manufacturing [NAICS 331], electricity is the dominant fuel, especially for some energy-intensive smelting and refining processes. Solid fuels are used as reducing agents and electrodes are carbon-based, while natural gas keeps metal liquid and prevents reoxidation. In non-metallic mineral product manufacturing, natural gas and solid fuel supply heat needed to produce lime, cement, and other products. In mining and quarrying, current open-pit and most underground mines use diesel-powered mobile equipment, while electricity is used for underground mine ventilation and ore processing.

Mines in remote regions often lack access to the electricity grid and natural gas. As a result, most remote mines rely on diesel generators to supply heat and electricity. Liquefied natural gas is being considered at some sites with road access while reliance on diesel at other remote sites is being reduced by the integration of wind power and energy storage technologies (Box 18).

[196] A petajoule is a unit of measurement for energy and is equal to 1×10^{15} joules (one million billion joules).

Box 18: Renewable Energy

The Canadian minerals sector is a leader in sustainable mining practices and many sites have invested in renewable energy sources and technologies to reduce their emissions. These initiatives underline the industry's commitment to reducing its carbon footprint and improving its economic and social impact. The table below provides examples from companies and sites across Canada.

Name (Company, Location)	Description
Raglan Mine project (Glencore and Tugliq Energy, Quebec)	Two wind turbines, reducing diesel consumption by 4.4 million litres and producing 10% of their electricity annually.[197] They aim to achieve 42% renewable energy by 2028.[198]
Diavik Diamond Mine (Rio Tinto, Northwest Territories)	Wind farm generates 191 million kWh, cutting diesel use by 43.4 million litres.[199] Solar panels added in 2024 generate 4.2 million kWh of solar energy emitting 2,900 tonnes of GHG.[200] The mine will enter the closure phase in 2026 and the solar farm will produce about 25% of the electricity needed during the closure phase.
Snowline Gold's Forks exploration camp (Snowline Gold, Yukon)	Installed a solar generator reducing carbon emissions by 90% and saving 12,572 litres of diesel per season.[201]
SunMine solar facility (Teck Resources, British Columbia)	Reclaimed a former mining site for a solar facility generating 1.05 MW of clean energy annually.[202]
Renewable energy projects (Atlantic Mining, Nova Scotia)	Exploring renewable energy at the closed Touquoy Gold Mine site to support Nova Scotia's clean energy goals.[203]
Carol Lake Mine Project Rio Tinto IOC, Newfoundland and Labrador)	Installation of an electric boiler to displace emissions from the usage of the heavy-fuel oil boilers, as well as instrumentation and fuel-efficient burners to further reduce heavy fuel oil consumption from induration machines. Over the lifetime of this project IOC will see a cumulative reduction of about 2.2 million tonnes of greenhouse gas emissions.[204]
McIlvenna Bay project (Foran Mining, Saskatchewan)	Already powered by hydroelectricity.[205] On January 28, 2025, Canada announced $41 million investment for clean energy use at McIlvenna Bay mining, which will go towards a battery electric vehicle fleet, ventilation on-demand and a heat recovery system, a water cycling system, and the integration of a pyrite removal system.[206]

[197] https://www.glencore.ca/en/media-and-insights/insights/raglan-mine-operates-its-second-wind-turbine

[198] https://www.glencore.ca/en/raglan/sustainability/environment/Environment---Green-and-clean-energy

[199] https://www.riotinto.com/en/operations/canada/diavik

[200] https://www.riotinto.com/en/news/releases/2024/rio-tinto-completes-construction-of-its-solar-power-plant-at-diavik-diamond-mine

[201] https://snowlinegold.com/2022/08/02/snowline-gold-announces-agreement-with-nacho-nyak-dun-development-corporation-to-power-main-camp-with-large-scale-solar-generator/

[202] https://www.sec.gov/Archives/edgar/data/886986/000095014220000131/eh2000182_ex9901.htm

[203] https://www.miningweekly.com/article/st-barbara-explores-pumped-hydro-at-nova-scotias-closed-touquoy-mine-2024-10-22

[204] https://www.riotinto.com/en/can/news/releases/2024/rio-tinto-ioc-and-government-of-canada-partner-to-decarbonize-iron-ore-processing-in-labrador-west

[205] https://foranmining.com/projects/mcilvenna-bay-project/

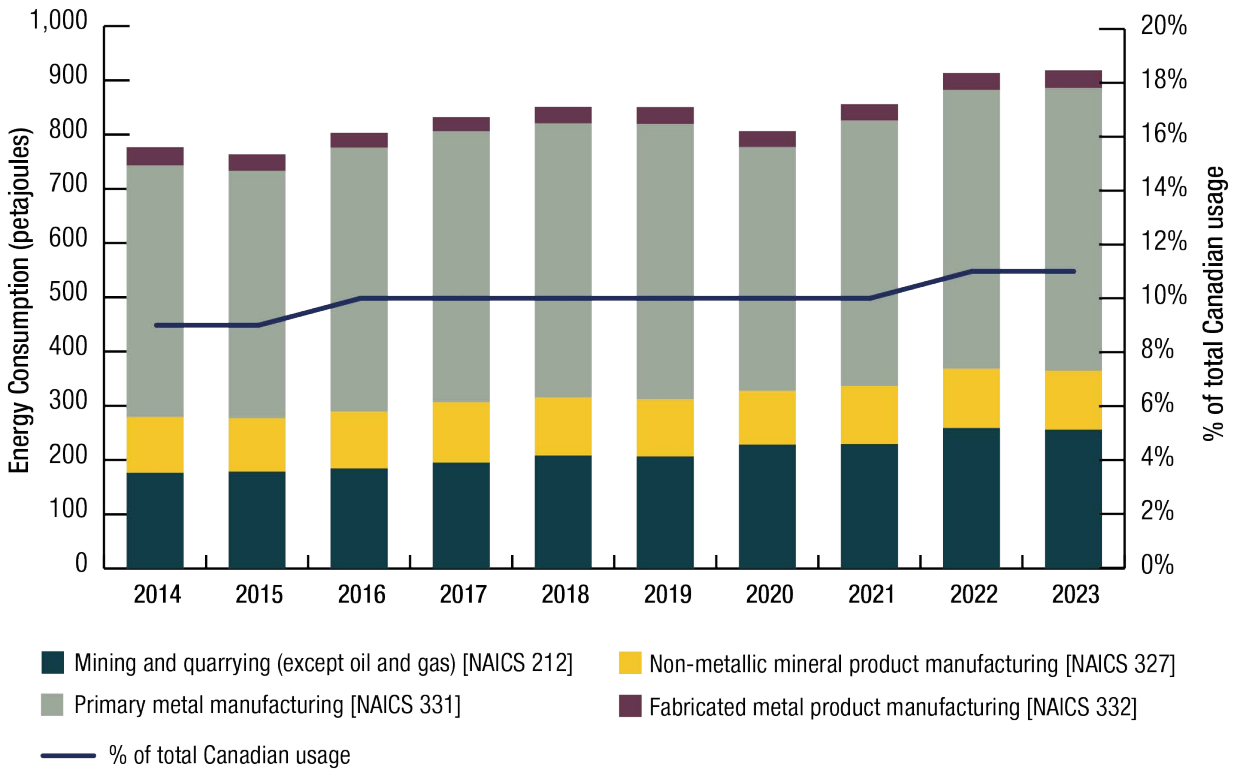
[206] https://www.canada.ca/en/innovation-science-economic-development/news/2025/01/government-of-canada-investing-in-foran-mining-corporations-critical-minerals-production-in-saskatchewan.html

Name (Company, Location)	Description
Jansen project (BHP, Saskatchewan)	Expected to begin late 2026, will produce 8.5 million tonnes of potash per year. Expected to produce 50% less GHG per tonne of product and use 60% less water than similar projects.[207]

Generating renewable energy on site is particularly impactful at remote sites such as Raglan, Diavik, and Voisey's Bay. These sites are not connected to provincial or territorial power grids, and all electricity is generated on site, primarily using diesel-powered generators. Generating renewable energy on site reduces diesel usage for power generation and reduces the amount of fuel that needs to be transported to the site, which reduces transportation-related emissions.

In 2023, the minerals sector accounted for 11% of total Canadian energy consumption,[208] up from 9% in 2014 (Figure 47).[209] Total energy consumption by all industries in Canada increased 4% over the same period. Total energy use by the minerals sector increased from 777 petajoules (PJ) in 2014 to 918 PJ in 2023. Subsector contributions to the total sector's consumption were relatively stable over the period with primary metal manufacturing [NAICS 332] being the largest contributor, averaging 58% (±2%) of the total sector's consumption.

Figure 47: Minerals sector energy consumption, 2014–2023



Sources: Canadian Energy and Emission Data Centre, Statistics Canada

[207] https://www.bhp.com/what-we-do/global-locations/canada/jansen

[208] Glossary

[209] Appendix A – Data Considerations

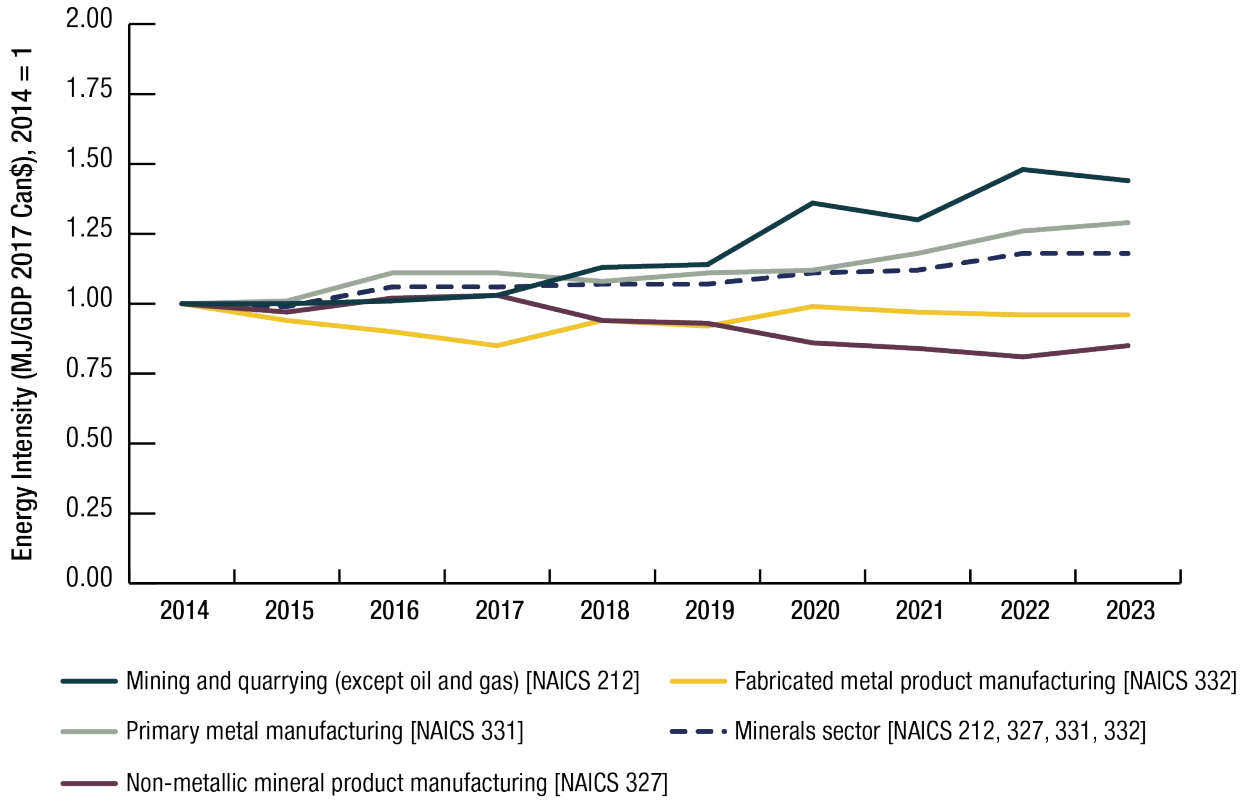
Minerals sector energy intensity[210] increased from 13 MJ/GDP in millions of 2017 Can$ to 15 MJ/GDP (215%) between 2014 and 2023 (Figure 48).

The change in intensity between 2014 and 2023 was largely driven by the mining and quarrying (except oil and gas) [NAICS 212] and primary metal manufacturing [NAICS 331] subsectors which increased 44% and 29%, respectively. Emissions intensity of the non-metallic mineral product manufacturing [NAICS 327] subsector decreased 15% and that of the fabricated metal product manufacturing [NAICS 332] subsector decreased 4%.

Changes in subsector intensity are influenced by changes in product mix, production levels, exchange rates, technology, and site openings and closings. Electricity is among the largest sources of energy, so adoption of EVs in mines may also be a driver of overall energy consumption.

Energy intensity for the total of industrial sectors including minerals but excluding electrical power generation increased 1% between 2014 and 2023, while averaging 10 MJ/GDP in millions of 2017 Can$ each year.

Figure 48: Minerals sector energy intensity (GDP), 2014–2023 (2014 = 1)



Sources: Canadian Energy and Emission Data Centre

[210] Glossary

4.6 Environmental Expenditures

Highlights

- Between 2014 and 2021, the minerals sector's environmental capital expenditures increased by 10% from $970 million to $1.07 billion in constant 2023 Can$.
- Environmental operating expenditures increased by 42% from $1.60 billion to $2.27 billion between 2014 and 2021.
- A notable 102% increase in operating expenses between 2019 and 2020 was driven by an 11-fold increase in spending on air pollution management in the primary metal manufacturing subsector [NAICS 331] in terms of constant 2023 Can$.

Analysis

Expenditures on environmental protection (environmental expenditures)[211] provide an indication of the level of commitment and investment the industry is making to protect the environment and maintain healthy ecosystems. They also reflect the desire of Canadian and international governments to protect the natural environmental via regulation that requires or incentivizes these types of expenditures. Conversely, upward trends in environmental expenditures could also reflect increased numbers of mines approaching the closure and reclamation phases of the mineral resource development cycle or that existing practices have proven ineffective and a course correction at higher cost is needed to comply with regulatory requirements.

Significant variations in capital spending occur as large and capital-intensive projects are initiated and completed over the course of one or a few years.

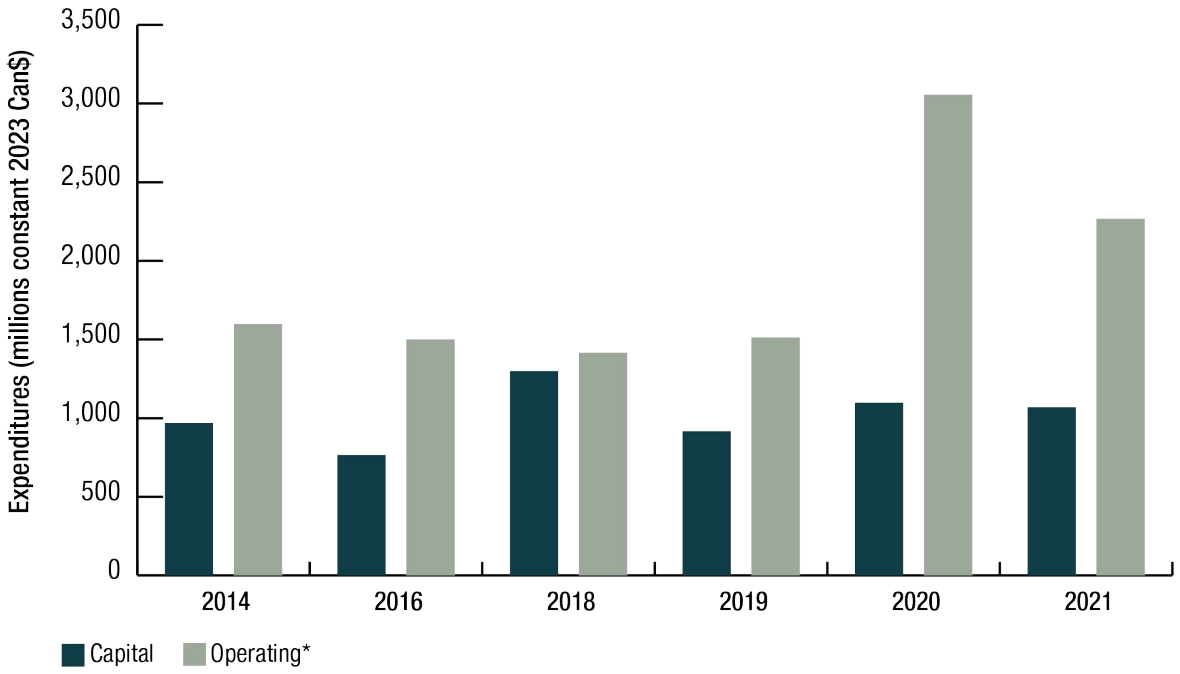
Capital and operating environmental expenditures are shown below for selected years in Figure 49.[212] Data was unavailable for the years 2015 and 2017. In addition, total capital expenditures in 2018 were estimated for the fabricated metal product manufacturing subsector [NAICS 332] because that data was labelled by Statistics Canada as too unreliable to publish. The 2018 data should be considered an estimate only and used with caution.

The minerals sector's share of total Canadian capital and operating environmental expenditures increased between 2014 and 2021. Notably, operating expenditures more than doubled between 2019 and 2020. This large increase was driven by the primary metal manufacturing subsector [NAICS 331] and is discussed in more detail below.

[211] Glossary

[212] Appendix A – Data Considerations

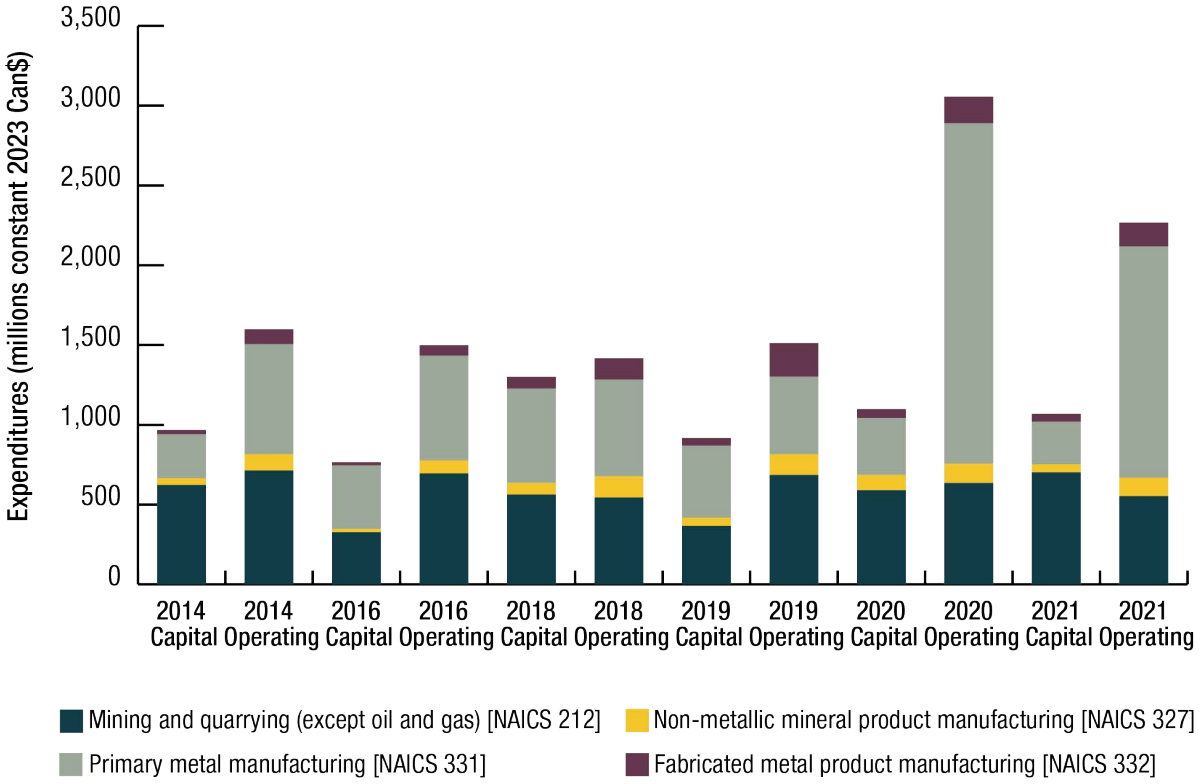
Figure 49: Environmental protection expenditures in the minerals sector, in millions of constant 2023 Can$, for selected years, 2014–2021



Source: Statistics Canada
* Fees, fines and licences expenditures are excluded from operating expenditures.
NB: 2018 capital expenditures for fabricated metal product manufacturing [NAICS 332] are estimated via back calculation from total expenditures as Statistics Canada considered the data point too unreliable to publish.

A comparison of subsector capital and operating expenditures between 2014 and 2021 is shown below (Figure 50). As discussed above, the large increase in operating expenditures in 2020 was driven by a more than four-fold increase in expenditures in the primary metal manufacturing subsector [NAICS 331] between 2019 and 2020, while operating expenditures on environmental activities for all other subsectors decreased. The increase in primary metal product manufacturing [NAICS 331] expenditures is especially significant as the subsector contributed an average of 49% to the total minerals sector operating expenditures between 2014 and 2021. The driver of the increase in the subsector's operating expenses was spending on air pollution management, which experienced an 11-fold increase between 2019 and 2020.

Figure 50: Environmental protection expenditures, by subsector, in millions of constant 2023 Can$, in selected years, 2014–2021



Source: Statistics Canada
NB: 2018 capital expenditures for fabricated metal product manufacturing [NAICS 332] are estimated via back calculation from total expenditures as Statistics Canada considered the data point too unreliable to publish.

Section 5: Conclusion

Enhancing the economic, social, and environmental performance of the minerals sector is crucial for its image, reputation, and long-term sustainability in Canada. The products extracted and processed by this sector are integral to critical infrastructure, such as highways, communication networks, electricity grids, and housing, as well as essential everyday items like electronic devices, toothpaste, and fertilizers that improve crop yields and plant resistance to disease. These products are fundamental to modern life and comfort, sovereignty, and national security.

The minerals sector is a cornerstone of Canada's economy, driving both national and local economic growth, fostering international trade, and supporting key industries globally. Companies in this sector are often significant contributors to the local economies of communities hosting or adjacent to their operations.

The MSPR aims to quantify and describe the sector's activities over the past decade, focusing on its economic, social, and environmental performance. The report also highlights successes, identifies data gaps, and points to areas for improvement. These topics were explored in the preceding report using 22 indicators based on reliable datasets spanning from 2014 to 2023, depending on data availability.

From an economic perspective, the minerals sector saw growth between 2014 and 2023, with increased production value, employment, and average hourly wages. Socially, the sector made progress by reducing fatal injury rates and improving the representation of female and Indigenous workers. Environmentally, positive outcomes included higher spending on environmental capital and operating expenditures, significant reductions in sulphur dioxide emissions, and a notable decrease in greenhouse gas emissions intensity. However, challenges remain, such as the sector's shrinking contribution to overall GDP, decreased business expenditures on research and development, and rising energy consumption intensity.

The Canadian minerals sector is not immune to the effects of global events and trends. As predicted in the 2022 edition of the MSPR, "the rapidly changing landscape of geopolitics and trade will inevitably affect Canada's minerals sector, as will climate change." This remains just as true in 2025, if not more so. Global supply chains for minerals are interconnected, and ongoing geopolitical tensions, along with shifting trade policies, present significant challenges for the sector.

Canada's Critical Minerals List, first published in 2022 and expanded in 2024, includes 34 mineral commodities, creating opportunities for industry and trade. The Canadian Critical Minerals Strategy (2022) aims to position the country as the global supplier of choice for critical minerals while addressing challenges such as supply chain vulnerabilities, environmental and social concerns, and global demand shifts. Critical minerals are vital for clean energy and green technologies, powering electric vehicle batteries, solar panels, and wind turbines.

The global COVID-19 pandemic disrupted the minerals sector in 2020, impacting data trends and highlighting vulnerabilities in the industry. As of 2025, the pandemic has transitioned from a global crisis to an endemic situation, taking its place in history.

Addressing future challenges and opportunities will depend on enhancing Canada's appeal as a prime destination for exploration and mining investment. This will require sustained investment, increased productivity, and innovation, including support for geoscience and engineering education, attracting and retaining skilled workers, producing high-quality geoscience data, and maintaining a strong global reputation. It will also require progress in key areas such as infrastructure development, Indigenous partnerships, community engagement, and streamlining permitting processes, alongside other regulatory reforms.

Regardless of these challenges, the minerals sector will remain a cornerstone of Canada's way of life, continuing to contribute to the nation's socio-economic vitality. By providing well-paid employment, creating economic opportunities, and generating prosperity across rural, remote, and urban communities, the sector plays a crucial role in the national economy.

As demand for minerals and metals grows—particularly those essential for green technologies like electric vehicles, batteries, and renewable energy infrastructure—Canada's role as a stable and responsible supplier will become even more important. By embracing international collaboration, Canada can strengthen economic ties and reinforce shared values of sustainability, environmental stewardship, and responsible resource management in an increasingly fragmented global landscape.

The authors of the MSPR look forward to future editions of the report, which will continue to evolve and define new economic, social, and environmental indicators. This will enable more effective monitoring, evaluation, and understanding of the Canadian minerals sector's performance.

Section 6: Glossary

Business expenditures on research and development (BERD) – Research and development (R&D) encompasses all activities undertaken to discover or develop new processes or products. R&D expenditures are defined as expenditures for R&D work performed within the company, including work financed by others. R&D is used as a proxy to measure innovation, which is essential to the long-term competitiveness of the sector.

Capital expenditures (CAPEX) – Include costs associated with procuring, constructing, or upgrading long-lived physical assets such as property, buildings, and machinery and equipment.[213] Capital expenditures are sometimes abbreviated as CAPEX.

Coal – includes thermal (used for energy production) and metallurgical coal (used in production of steel).

Constant Can$ – Unless otherwise specified, dollar amounts in this report are in terms of constant 2023 Canadian dollars. The constant dollars calculation was done by using implicit price index data from Statistics Canada (Table 36-10-0130-01) and setting 2023 as the base year (2023 = 1.00).

Employment – Number of individuals directly employed by establishments classified within the mining, mining-related support activities, and mineral processing subsectors.[214] See also *Skilled labour supply.*

Energy consumption – The energy used from all sources each year. This value includes electricity as well as energy derived from fuels such as diesel, natural gas, and uranium.

Energy intensity – The ratio of energy consumption to output in terms of GDP.

Environmental expenditures – Total capital (investment) and operating (current) expenditures incurred by businesses to comply with current and to anticipate future Canadian and international environmental regulations, conventions, or voluntary agreements. Expenditures are subdivided by Statistics Canada into environmental monitoring, environmental assessments and audits, reclamation and decommissioning, wildlife and habitat protection, waste management and sewage services, pollution abatement and control processes (end-of-pipe, including waste management), pollution prevention processes, fees, fines and licences, and others.

Exploration and deposit appraisal expenditures – Refers to investments made to discover new mineral deposits or reassess known deposits that were previously considered non-economic. Deposit appraisal expenditures are spent to evaluate the economic viability of a deposit. These activities range from regional reconnaissance to detailed deposit definition, using tools like prospecting, mapping, geochemical and geophysical surveys, drilling, and deposit modelling.

Flow-through shares (FTS) – Canada's unique FTS mechanism allows a principal business corporation to obtain financing for expenditures on mineral exploration and development in Canada. FTS investors can receive a 100% tax deduction for the money invested in FTS for exploration and 30% for development. Several provinces also offer additional tax credits or deductions to FTS investors to encourage exploration investment in their jurisdictions.

Gender diversity – Equitable or fair representation of people of different genders. It most commonly refers to an equitable ratio of men and women but may also include people of non-binary genders.[215]

Gender, diversity, and inclusion (GDI) – A set of guiding principles with a goal of creating welcoming environments that values participation of and input from all individuals. Gender refers to an individual's personal and social identity as a man, woman, or non-binary person (a person who is not exclusively a man or a woman).[216] In this sense, it refers to the goal of equitable representation of all genders in the minerals sector. Equity is fair and respectful treatment of

[213] Detailed information regarding the compilation and dissemination of capital investment data can be located at https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=2803

[214] Statistics Canada's Labour Statistics within the Canadian System of National Accounts provides aggregated data for NAICS 213117 – contract drilling (except oil and gas) and NAICS 213119 – other support activities for mining, which taken together, comprise activities related to mineral exploration and development.

[215] Sharon E. Sytsma (2 February 2006). Ethics and Intersex. Springer Science & Business Media. pp. 38–. ISBN 978-1-4020-4313-0.

[216] Statistics Canada

all individuals by considering their unique experiences and differing situations and ensuring they have access to the resources and opportunities that are necessary for them to attain just outcomes. Diversity is the variety of identities in an organization, group, or society. Inclusion is the practice of deliberately fostering an environment where all feel welcome, respected, and valued.[217]

Greenhouse gases (GHGs) – GHGs trap heat in the Earth's atmosphere and contribute to climate change. Major sources include fossil fuel combustion and process emissions. Fuel combustion emits gaseous carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Process emissions of CO_2 and other gases arise from decomposition of carbonate minerals, use of reducing agents to produce metals from oxides, transformation of iron into steel, and other manufacturing processes.[218] Organizations consider emissions as divided into three categories referred to as scopes. Scope 1 and Scope 2 include direct and indirect emissions from an organization's facilities, processes, and inputs that may generate offsite emissions. Scope 3 includes emissions across an organization's upstream and downstream value chain.[219]

Gross domestic product (GDP) – Represents the total dollar value of all finished goods and services produced by a given jurisdiction or industry. GDP includes only final goods and services; it does not include intermediate goods and services used to make another product. Real GDP is adjusted for inflation whereas nominal GDP is expressed in current dollars.

Indigenous identity – The Labour Force Survey (LFS) measures the Indigenous population using the concept of Indigenous identity. A person has an Indigenous identity if he or she reports as identifying with at least one Indigenous group, for example, North American Indian (First Nations person), Métis, or Inuit. This is based on the individual's own perception of his/her Indigenous identity.[220]

International trade – Measurement of the exchange of capital, goods, and services across international borders or territories. Trade variables include domestic exports (goods grown, extracted, or manufactured in a territory, including goods of foreign origin that have been materially transformed in the territory); imports (all goods that have crossed into a territorial boundary whether for immediate use or to be stored in bonded Customs warehouses); re-exports (the export goods of foreign origin that have not been materially transformed in a territory); and total exports (the sum of domestic exports and re-exports). Balance of trade is measured by subtracting imports from total exports.

Impact assessment – Examination of the potential positive and negative effects of a proposed project. In so doing, it considers a comprehensive list of potential factors and proposes measures to mitigate a project's adverse effects. This includes components of follow-up programs for projects that are allowed to proceed. These follow-up programs verify the accuracy of an assessment and effectiveness of any mitigation measures.[221] See also *Participant funding program*.

Job vacancy rate – The number of job vacancies expressed as a percentage of labour demand; that is, all occupied and vacant jobs.

Lockouts – see *Strikes and lockouts*.

Metal and Diamond Mining Effluent Regulations (MDMER) – Environment and Climate Change Canada (ECCC) is responsible for administering and enforcing the Metal and Diamond Mining Effluent Regulations (MDMER) under the *Fisheries Act*, which prohibits the release of deleterious substances to waters frequented by fish unless otherwise

[217] https://www.canada.ca/en/canadian-heritage/services/sport-participation.html

[218] GHG emissions are expressed in carbon dioxide equivalents (CO_2e). Emissions from industrial processes and product use were excluded in prior reports. Historical data was restated to include all sources. Process emissions are particularly significant sources of GHG emissions for Primary Metal Manufacturing and Nonmetallic Mineral Product Manufacturing.

[219] https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-are-scope-1-2-and-3-emissions

[220] https://www150.statcan.gc.ca/n1/pub/71-543-g/71-543-g2020001-eng.htm

[221] https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/basics-of-impact-assessments.html

authorized via regulations.[222] In 2018, the MDMER replaced the 2002 Metal Mining Effluent Regulations (MMER). The MMER applied to all metal mines (except placer mines), milling facilities, and hydrometallurgical facilities with effluent flow rates of 50 m^3/day or more that deposited a deleterious substance in any water or place defined by the regulations. The MMER/MDMER prescribe maximum authorized effluent concentrations for arsenic, copper, cyanide, lead, nickel, zinc, radium-226, and total suspended solids. The regulations also prescribe an upper and lower limit for effluent pH. Effluent must also pass a test to demonstrate that it is not acutely lethal to fish (rainbow trout are used as the test species) and the MDMER added a requirement that effluent not be acutely lethal to *Daphnia magna*, a small aquatic invertebrate organism.

The MDMER extended application to include diamond mines and introduced more stringent effluent quality limits that came into effect in June 2021. Facilities must submit quarterly and annual reports to the Minister of the Environment detailing effluent monitoring results as well as information on any instances of non-compliance with limits for release of deleterious substances, effluent pH, and acute lethality test results.[223,224] The MMER/MDMER also include comprehensive requirements for monitoring in the water bodies into which effluent is released. This includes regular water quality monitoring and monitoring fish and small organisms, such as insect larvae that fish eat, every three years.

The following enforcement measures are available in response to alleged violations of the Fisheries Act and/or its regulations, including the MDMER, and the *Canadian Environmental Protection Act's* National Pollutant Release Inventory requirements:[225]

- Warnings
- Directions for remedial or preventative action to be taken by an alleged offender (specific to the *Fisheries Act*)
- Ministerial orders
- Court injunctions
- Prosecution, which may result in the imposition of fines, penalties, and/or court orders on conviction

Metallurgical coal – see Coal

Mine closure – Occurs when a mine's ore-extracting activities have ceased indefinitely with no clear intention of resuming operations in the foreseeable future. Mine closure is usually due to the depletion of economically mineable reserves. Closure comes with the responsibility of remediation at the end of a mine's life.

Mine opening – A mine is considered open when the operating company announces it has achieved commercial production or when it is reported as such by the regulating jurisdiction.

Mine reclamation – Describes the process of restoring mined land to a satisfactory state. It aims to eliminate unacceptable risks to the public, limit the spread of contaminants, restore sites to a visually acceptable condition, and return developed sites to a condition compatible with future use. Although the process of mine reclamation occurs at the end of the mining cycle, the planning of mine reclamation activities occurs prior to a mine being permitted or started and gradual restoration during operations is encouraged and/or required. The framework for site reclamation and remediation includes a requirement that companies provide full funding of their future obligations up front. This reduces the likelihood of future insolvency and the negative impact mine failures have on the economy.

Mine reopening – The opening of a mine that had previously been closed or suspended.

[222] https://www.canada.ca/en/environment-climate-change/services/managing-pollution/sources-industry/mining-effluent/metal-diamond-mining-effluent/tailings-impoundment-areas/guide-process-listing-water-bodies-fish-schedule-2.html

[223] https://laws-lois.justice.gc.ca/eng/regulations/SOR-2002-222/page-3.html#h-684816

[224] https://laws-lois.justice.gc.ca/eng/regulations/SOR-2002-222/page-2.html#h-684726

[225] https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/publications/compliance-enforcement-policy-fisheries-act.html

Mine suspension – Occurs when a mine's ore-extracting operations have indeterminately ceased with a reasonable probability that operations will resume once the situation is resolved. Reasons can include production no longer being economically viable due to commodity price declining, technical issues, and in rare instances, when there are safety issues. Strikes and lockouts are excluded because of their unpredictable nature.

Minerals industry – see Minerals sector

Minerals sector – The Mining Sector Performance Report defines the minerals sector (or minerals industry) as comprising the following North American Industry Classification System (NAICS) codes: mining and quarrying (excluding oil and gas) [NAICS 212], non-metallic mineral product manufacturing [NAICS 327], primary metal manufacturing [NAICS 331], and fabricated metal product manufacturing [NAICS 332].

National Pollutant Release Inventory (NPRI) – A public database maintained by Environment and Climate Change Canada including an inventory of releases, disposals, and transfers. Any facility that meets the NPRI reporting requirements is required to report their pollutant releases, disposals, or transfers.[226] This includes the release of a substance to the environment within the physical boundaries of the facility, such as releases to air, surface water, and land. There are three main factors that determine if a facility has to submit an NPRI report:

1. The activities that take place at the facility
2. The total number of hours worked at the facility
3. The substances manufactured, processed, otherwise used, or released to the environment at the facility

Reporting to NPRI is mandatory under the *Canadian Environmental Protection Act*, 1999. Routine reporting of releases and accidental or non-routine releases (e.g., spills and leaks) for over 300 substances is included under NPRI. The MMER/MDMER, on the other hand, were created under Section 36(3) of the *Fisheries Act* and apply to releases to water. This section focuses on releases to surface water of arsenic, cadmium, lead, nickel, selenium, and nine other metals.

Natural Resource Indicators (NRI) – according to Statistics Canada, NRI "provide timely information which facilitates ongoing monitoring and analysis of the economic contribution of the natural resources sector in Canada. This sector is split between four subsectors; energy, minerals and mining, forestry, and hunting, fishing, and water. A downstream natural resources sector is also measured."[227]

Natural Resources Satellite Account (NRSA) – an expandable framework that presents Statistics Canada's data applicable to the natural resource sector.[228]

Participant Funding Program – Program administered by the Impact Assessment Agency of Canada and designed to support public engagement and Indigenous consultation during assessments.[229] It provides funding at stages throughout the process and includes implementation of follow-up programs.

Public geoscience data – Public geoscience broadly refers to geological, geophysical, and geochemical data, information, and knowledge provided by governments and through academic research as a public good. The availability of such data and information has long played an important role in fostering a strong mineral investment climate in Canada and is widely acknowledged to be one of Canada's competitive advantages in attracting mineral exploration, which has contributed to the country's standing as a leading exploration target and mineral producer.

Research and development – see Business expenditures on research and development.

[226] https://www.canada.ca/en/environment-climate-change/services/national-pollutant-release-inventory/report/requirements-fact-sheet.html

[227] https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=1556454

[228] https://www150.statcan.gc.ca/n1/pub/13-604-m/13-604-m2017086-eng.htm

[229] https://www.canada.ca/en/impact-assessment-agency/services/public-participation/funding-programs/participant-funding-program.html

Reserves and resources – The Canadian Institute of Mining Metallurgy and Petroleum (CIM)[230] Definition Standards on Mineral Resources and Reserves establish definitions and guidance on the definitions for mineral resources, mineral reserves, and mining studies used in Canada. Based on these standards, *Mineral Resources* are a concentration or occurrence of solid material of economic interest in such form, quality, and quantity that it has a reasonable prospect of economic extraction. Mineral Resources are subdivided, in order of increasing level of geological knowledge and confidence, into inferred, indicated, and measured categories. An Inferred Mineral Resource has a lower level of confidence than that applied to an Indicated Mineral Resource. An Indicated Mineral Resource has a higher level of confidence than an Inferred Mineral Resource but has a lower level of confidence than a Measured Mineral Resource. *Mineral Reserves* are the economically mineable portion of a measured and/or indicated resource demonstrated by at least a pre-feasibility study. Mineral Reserves are subdivided in order of increasing confidence into Probable Mineral Reserves and Proven Mineral Reserves. A Probable Mineral Reserve has a lower level of confidence than a Proven Mineral Reserve.

Resources – see Reserves and resources.

Skilled labour supply – Skilled labour implies workers with specific experience or specialized training and education including university degrees, college diplomas, and trade certificates. In the Mining Sector Performance Report, these are compared against workers holding high school diplomas, or less. The supply of skilled labour depends on the education levels of potential employees entering the workforce and the degree programs from which they graduated.

Strikes and lockouts – The International Labour Organization defines a strike as a temporary work refusal or slowdown by employees designed to limit production to attain key demands from employers. A lockout is defined as a total or partial temporary closure of places of employment, or the hindering of the normal work activities of employees, by employers, to resist key demands from employees.[231]

Tailings – Residual materials that remain after economic minerals have been recovered by physical separation or other methods. They are a mixture of finely ground sand- to silt-sized waste minerals, water, residual reagents, and products of various chemical reactions that may take place following tailings disposal.

Thermal coal – see Coal.

Value – see *Value of mineral production*.

Value of mineral production – A calculation of the volume of extracted commodities at the current price of the commodity.[232] It includes metallic and non-metallic minerals and coal.

Wage gap – The magnitude of the difference between average hourly wages of two groups of employees (e.g., female vs. male or Indigenous vs. non-Indigenous). For example, if a female employee in the minerals sector earns $28 per hour while a male employee earns $30, the wage gap would be $2 ($30 - $28 = $2).

Waste rock – Rock that is removed to access ore. Waste rock is generally not processed before disposal.[233]

[230] https://mrmr.cim.org/en/standards/canadian-mineral-resource-and-mineral-reserve-definitions/.

[231] International Labour Organization, 1993, *Resolution Concerning Statistics of Strikes, Lockouts and Other Action Due to Labour Disputes*, http://www.ilo.org/global/statistics-and-databases/standards-and-guidelines/resolutions-adopted-by-international-conferences-of-labour-statisticians/WCMS_087544/lang--en/index.htm.

[232] Details regarding the methodology used in computing the mineral production of Canada can be located at https://mmsd.nrcan-rncan.gc.ca/prod-prod/ann-ann-eng.aspx.

[233] https://www.canada.ca/en/environment-climate-change/services/national-pollutant-release-inventory/publications/guidance-reporting-tailings-waste-rock.html

Section 7: Appendix

Appendix A – Data Considerations

2.1 – Value of Mineral Production

It is important to note that the value of mineral production is displayed in current dollars (not adjusted for inflation). Given this, the BCPI is included on the graphs, and the volume and value produced are noted to highlight the impact that commodity price fluctuations have on the value of mineral production.

2.3 – International Trade

Trade data at Natural Resources Canada is collected and disseminated using stages that differ slightly from NAICS codes. *Stage 1 – mineral extraction* involves the discovery of ore, ore extraction, and processing to the concentrate stage. Scrap material, ash, and tailings are included in this category. *Stage 2 – smelting and refining* refers to the metallurgical extraction process, the product of which is a relatively pure mineral, metal, or alloy. Some of the activities related to this stage are smelting and refining, roasting, calcining, direct reducing, and leaching. Products classified under this stage include powders, flakes, dusts, cathodes, ingots, pig, blocks, and plates. *Stage 3 – semi-fabrication* involves the manufacturing or processing steps required to bring products to a semi-finished or semi-fabricated stage or form, or to a state for use as input in other industries. Products related to Stage 3 include rods, plates, sheets, thin strips, pipes, rails, wires, metal-based structural forms, and a number of chemicals and compounds. Ingot moulds are also included. *Stage 4 – final fabrication* includes products of Stage III that have undergone further processing, such as elements produced by the metal framing industry, hardware items, tools, and cutlery. This stage includes products such as pipe fittings, forged and cast parts, grinding balls, and rail parts.

2.6 – Capital Expenditures

As of 2015, Statistics Canada updated its methodology related to the capital investment account system. As a result, expenditures related to mineral exploration are no longer classified under "capital investment, construction," but instead under "intellectual property." Historical data have been updated to reflect this change.

2.7 – Research and Development

Statistics Canada's data for BERD and R&D personnel contain several years with gaps or missing subsector data because of the application of confidentiality rules and/or data quality issues. Data contained in this section are only presented for years where the data were available for all subsectors.

Starting with the 2014 reference year, several aspects of the Annual Survey of Research and Development in Canadian Industry have been redesigned, including concepts, methodology, collection methods, and data processing systems. Readers should exercise caution when comparing data for the periods prior to 2014 to those of subsequent years. In particular, primary metal (ferrous) and primary metal (non-ferrous) were discontinued as standalone subsector categories by Statistics Canada as of 2016. The Primary Metal Manufacturing subsector category is now used instead and was calculated as the sum of primary metal (ferrous) and primary metal (non-ferrous) subsector data for years prior to 2016.

2.8 – Government Revenues

Although not captured by statistics in this section, it is important to note that minerals sector contributions to government revenues extend beyond corporate income tax and royalties. Minerals sector activity drives other economic activity that contributes to Indigenous communities through impact benefit agreements and government revenue, including sales taxes on goods and services purchases, employee income taxes, contributions to the Canada Pension Plan and the Quebec Pension Plan, and property taxes to municipalities.

3.1 – Employment

Data are from Statistics Canada and are Labour statistics consistent with the System of National Accounts (SNA). This dataset reconciles information from the Survey of Employment Payroll and Hours and the Labour Force Survey (LFS), along with information from the Census and administrative data sources (i.e., Canada Revenue Agency T4 tax slips). This allows for the capture of such categories as self-employment, which in turn allows for a more complete employment value estimate.

This dataset also disaggregates industry categories in a manner that enables the reporting of employment for the mining-related support activities subsector, which includes mineral exploration activities and contract drilling. It is important to note that this industry category is not inclusive of all mineral exploration employment since it does not capture the numerous professional services (i.e., geological, financial, legal) contracted by the mineral exploration industry, which are classified under other industries.

Job vacancy rate for each year was calculated as the average of the monthly vacancy rates for a given year.

3.2 – Indigenous Employment

The Indigenous employment numbers presented in this section are sourced from Statistics Canada's Labour Force Survey (LFS). National Labour Force Survey estimates are derived using the results of the LFS in the provinces. Territorial LFS results are not included in the national estimates, but are published separately.[234] Specifically, while the LFS calculates employment for Canada's three territories and includes Indigenous identity questions, it employs a different methodology than that used for the provinces. The LFS excludes persons living on reserves and settlements. As such, the data included in this section are not comprehensive and may underestimate the number of Indigenous individuals employed in the minerals sector. Some data was suppressed for reasons of privacy and so breakdowns of employee numbers were not available for certain subsectors.

For Natural Resources Satellite Account-based indicators (wage gap data), the minerals and metals sector includes activities involved in:

- Extracting and initial processing of mineral products (also referred to as "mineral and mining" or primary production)
    - Extraction of coal, metallic minerals (e.g., copper, gold, lead, nickel, silver, and zinc), and non-metallic minerals (e.g., diamonds, potash, salt and stone)
    - Services for mining and quarrying, and exploration
    - Primary metallic mineral products (e.g., aluminum and aluminum-alloy ingots and billets, iron and steel basic shapes, ferro-alloy products, and refined precious and base metals)
    - Primary non-metallic mineral products (e.g., clay products, glass and glass products, and cement)
- Downstream processing and manufacturing of metal products ("downstream mineral and mining"), which use a large portion of metal products as inputs:
    - Secondary metal products (e.g., iron and steel pipes and foundry products)
    - Tertiary metal products (e.g., cutlery and forged and stamped products)
    - Miscellaneous metal products (e.g., communication and energy wire and cable, and motor vehicle metal stamping)

[234] https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3701

3.3 – Skilled Labour Supply

In some cases, and as seen in the Skilled Labour Supply indicators above, Statistics Canada data is sometimes organized using Natural Resources Indicators (NRI),[235] which are an extension to the Natural Resources Satellite Account. The NRIs cover the economic activity of the Canadian natural resources sector, which is further broken down into several subsectors including minerals and mining, energy, forest, and hunting, fishing, and water. Downstream subsectors that would normally fall outside of the natural resources sector are also considered, including downstream mineral and mining.

The "mining-relevant programs" included in the Skilled Labour Supply section were selected from those available in Statistics Canada Table 37-10-0235-01, based on discussions with the Mining Industry Human Resources Council.

3.4 – Gender, Diversity, and Inclusion

Figures in Section 3.4 that include wage information are based on data from the Labour Force Survey (LFS), which is sent to approximately 60,000 Canadian households. It should be noted the LFS was not designed to produce estimates for detailed occupations and industries under the North American Industry Classification System (NAICS). The data may contain a greater degree of sampling variability at the 3-digit NAICS-level compared to numbers drawn from the overall survey. Nevertheless, the data is included here as an indicator of longer-term trends over a period of approximately 10 years. Looking at the industries of interest in this case [NAICS 327, 331], while there is a large total employed population for each industry of approximately 50,000 people, the number of females employed in the industries is low relative to males, potentially resulting in higher variability in the data compared to the total employed population or even the total number of employed males. This may produce what appear to be anomalous data points for certain years; however, the overall trend is considered factual.

For Natural Resources Satellite Account-based indicators (immigrant and visible minority jobs and wage data), the minerals and metals sector includes activities involved in:

- Extracting and initial processing of mineral products (also referred to as "mineral and mining" or primary production)
    - Extraction of coal, metallic minerals (e.g., copper, gold, lead, nickel, silver, and zinc), and non-metallic minerals (e.g., diamonds, potash, salt, and stone)
    - Services for mining and quarrying, and exploration
    - Primary metallic mineral products (e.g., aluminum and aluminum-alloy ingots and billets, iron and steel basic shapes, ferro-alloy products, and refined precious and base metals)
    - Primary non-metallic mineral products (e.g., clay products, glass and glass products, and cement)
- Downstream processing and manufacturing of metal products ("downstream mineral and mining"), which use a large portion of metal products as inputs:
    - Secondary metal products (e.g., iron and steel pipes and foundry products)
    - Tertiary metal products (e.g., cutlery and forged and stamped products)
    - Miscellaneous metal products (e.g., communication and energy wire and cable, and motor vehicle metal stamping)
    - Services and custom work (e.g., coating, engraving, and heat treating)

3.5 – Funding for Public Participation in the Impact Assessment Process

Data from government PFPs and similar programs provide only a partial perspective of funding for public participation in impact review processes for the minerals sector. Mining company efforts to solicit and incorporate public feedback

[235] https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5367

into project design are critical components to obtaining public acceptance of a project and allow for the development of a more responsible mineral project. However, aggregate funding provided by companies is not currently available.

Note that data presented and described in Section 3.5 has been reviewed for accuracy by the Impact Assessment Agency of Canada.

3.6 – Workplace Health and Safety

The data from the Association of Workers' Compensation Boards of Canada's National Work Injury /Disease Statistic Program reports lost-time claims and fatalities accepted for compensation by one of the 12 Canadian Workers' Compensation Boards or Commissions. This does not include all worker compensation claims, as claims with no time loss are not included.[236]

Note that workplace health and safety is expressed as either the fatal or non-fatal injury rate per 10,000 workers in the mining and quarrying (except oil and gas) subsector. The number of incidents is divided by the number of jobs and then multiplied by 10,000.

4.1 – Waste Rock and Tailings

NPRI information is a starting point for identifying and monitoring sources of pollution in Canada. The information collected by mining facilities that meet the thresholds is reported to the NPRI and is used to help determine if regulatory or other action is necessary to ensure reductions. Only facilities reporting non-zero tonnes of tailings and waste rock were included in this analysis. Although NPRI reviews data for inconsistencies and errors, some inaccuracies and reporting errors may occur, such as reporting quantities manufactured, processed or otherwise used instead of quantities released and reporting of inappropriate units and decimal errors. The NPRI provides Canadians with annual information on industrial, institutional, commercial, and other releases and transfers in their communities.

NPRI reporting requirements for on-site waste rock and tailings disposal came into effect in 2009. Facilities were asked to report retroactively for 2006 through 2008, and there may be some errors in the estimation of historical levels. There have also been several changes in reporting requirements. These changes may impact values and trends for some substances. The 2006–2008 requirements were applicable only to mining and oil sands facilities that generated or disposed of tailings or waste rock from the processing of bitumen, coal, diamonds, potash, or metals. The 2009–2010 requirements applied to all facilities that generated or disposed of tailings and waste rock, subject to certain exemptions and exclusions. In addition, some facilities do not meet any threshold that would trigger tailings and waste rock reporting requirements for an NPRI substance (e.g., certain potash and coal mines).

Every effort was made to clean and vet this data. Some remaining anomalous data points could be due to reporting artifacts, changes in reporting methodologies, or changes in compliance rates with NPRI requirements, both positive and negative. Ongoing work in this area will result in the continuous improvement of the NPRI as a data source to provide credible trends over time.

4.2 – Mine Effluent and Discharges to Surface Water

This section uses data collected under MDMER (formerly MMER) as reported to Environment and Climate Change Canada (ECCC).

The MDMER data is self-reported by the regulated community and is therefore limited by what has been reported to ECCC. Note that closed mines and mines on long-term care and maintenance are also subject to the MDMER.

Compliance rate under MDMER is calculated by measuring percentage of reported test results for all metal and diamond mines within limits authorized for the reported year for substances, pH levels, and fish toxicity. This is done by dividing the number of monthly mean results that meet the authorized limits by the total number of monthly

[236] http://awcbc.org/?page_id=4025.

mean results reported each year. For pH, this is done by dividing the number of pH measurements that are within the allowable pH range by the total number of pH measurements reported each year. For non-acute lethality, this is done by dividing the number of non-lethal toxicity test results for a given species by the total number of toxicity test results for that species reported each year.

NPRI reporting of releases to surface water provides insight on the industry's performance in limiting releases of NPRI substances to the environment but does not suggest the presence or absence of risk to aquatic ecosystems. Releases can be underestimated or overestimated because of the procedure for estimating releases when analytical results are below the Method Detection Limit (MDL).

Under NPRI, total releases for each substance integrates changes in the volume of effluent released and changes in the concentrations of substances in that effluent. Significant variation in net precipitation can impact effluent volume and is an important driver of variations in annual releases on a site-specific basis. Effluent quality is usually less variable, but total annual releases can increase over a short period of time due to a major spill or a comparatively long time due to an ongoing leak at one or more sites.

Effects on the health of fish, other organisms, and aquatic ecosystems depend upon chemical speciation, environmental concentrations, conditions that modify toxicity, and exposure as well as other factors. A great deal of other data and information are available for Canadian mines and used by regulators, businesses, communities, and other stakeholders to assess risks and priorities for action. In some cases, a better understanding of the complex interaction between ecosystems is required to assess long-term, cumulative impacts on local and regional environments.

4.3 – Air Emissions

For more information on the NPRI, consult the guide on using and interpreting data from the National Pollutant Release Inventory.[237]

4.4 – Greenhouse Gas Emissions

Two datasets were used to express minerals sector GHG emissions as a percentage of Canada's overall emissions. Subsector and total industrial GHG emissions were sourced from the Canadian Energy and Emissions Data Centre. The 2018 values were used because 2019 data for mining and quarrying are not available from the Canadian Energy and Emissions Data Centre. That data, which is sourced from Statistics Canada, has not been released beyond the reference year 2018. The Statistics Canada "Physical Flow Account for GHG emissions" dataset is the source for total Canadian emissions.

4.5 – Energy Consumption and Efficiency

Two datasets were used to express minerals sector energy use as a percentage of Canada's overall emissions. Subsector energy use is sourced from the Canadian Energy and Emissions Data Centre. The Statistics Canada "Supply and demand of primary and secondary energy" dataset is the source for total industrial and total Canadian energy use.

4.6 – Environmental Expenditures

Capital expenditures include the costs associated with procuring, constructing, or upgrading physical assets such as property, buildings, and machinery and equipment. Operating expenditures include spending needed for the day-to-day operation of a business or project including, but not limited to, employee compensation, energy and supplies, rental or leasing expenses, repairs and maintenance, licence fees, taxes, services, and depreciation.

Capital expenditures data by type of activity for each subsector were sometimes suppressed to meet confidentiality requirements or were too unreliable to be published for selected years.

[237] https://www.canada.ca/en/environment-climate-change/services/national-pollutant-release-inventory/using-interpreting-data.html

Appendix B – Additional Information

2.4 – Exploration and Deport Appraisal Expenditures

Reserves of selected major metals as of December 31 of each year, by jurisdiction
(metal contained in proven and probable mineable ore, in operating mines, and deposits committed to production)

Canada

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	10,215	2,287	88	2,972	121	5,498	2,070
2015	9,937	2,725	83	3,009	101	5,345	1,984
2016	9,101	2,604	40	2,231	98	3,626	1,910
2017	8,984	2,790	165	2,286	96	5,074	2,578
2018	8,115	2,296	118	1,913	77	4,865	2,597
2019	7,348	2,236	203	2,180	75	4,480	2,359
2020	7,001	1,977	176	1,630	69	5,223	2,611
2021	7,713	1,909	160	1,454	80	4,714	2,709
2022	8,254	2,219	79	947	64	4,865	3,127
2023(p)	7,032	2,301	58	331	70	5,473	3,131

Source: Statistics Canada
.. – data not available
(p) – preliminary

Newfoundland and Labrador

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	234	348	..	..	..	16	10
2015	534	807	..	..	..	24	5
2016	493	744	..	..	..	22	5
2017	461	690	..	..	..	26	4
2018	440	657	..	..	..	24	4
2019	404	347	..	..	..	21	3
2020	379	560	..	..	..	20	4
2021	279	524	..	..	..	7	2
2022	375	570	..	..	..	19	4
2023(p)	256	558	..	..	..	..	..

Source: Statistics Canada
.. – data not available
(p) – preliminary

Nova Scotia

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	..	..	..	..	..	..	..
2015	..	..	..	..	..	..	..
2016	..	..	..	..	..	..	..
2017	..	..	..	..	..	..	..
2018	..	..	..	..	..	..	..
2019	..	..	..	..	..	..	..
2020	..	..	..	..	..	..	..
2021	..	..	..	..	..	..	..
2022	..	..	..	..	..	..	..
2023(p)	..	..	..	..	..	..	..

Source: Statistics Canada
.. – data not available
(p) – preliminary

New Brunswick

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	..	..	..	..	..	..	..
2015	..	..	..	..	..	..	..
2016	..	..	..	..	..	..	..
2017	20	..	124	331	..	372	..
2018	20	..	80	210	..	242	..
2019	..	..	67	176	..	200	..
2020	..	..	104	274	..	316	..
2021	..	..	96	258	..	289	..
2022	..	..	..	..	..	284	..
2023(p)	..	..	..	..	..	..	..

Source: Statistics Canada
.. – data not available
(p) – preliminary

Quebec

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	266	325	8	523	..	570	615
2015	304	408	4	688	..	581	610
2016	267	385	4	593	..	523	587
2017	258	423	5	537	..	456	525
2018	221	365	2	373	..	404	551

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2019	344	429	10	681	..	517	458
2020	192	333	..	185	..	303	316
2021	176	305	..	188	..	311	338
2022	105	255	..	128	..	251	302
2023(p)	138	382	..	107	..	219	509

Source: Statistics Canada
.. – data not available
(p) – preliminary

Ontario

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	1,880	1,296	..	501	..	2,093	969
2015	1,656	1,158	..	439	..	1,948	919
2016	1,551	1,152	..	343	..	1,497	895
2017	1,572	1,351	..	291	..	1,785	1,153
2018	1,452	1,274	..	239	..	1,668	1,141
2019	1,322	1,197	..	177	..	1,326	1,050
2020	1,114	1,085	..	180	..	1,095	1,338
2021	1,115	1,080	..	113	..	733	1,375
2022	1,281	1,395	..	86	..	924	1,570
2023(p)	1,213	1,361	..	81	..	296	1,582

Source: Statistics Canada
.. – data not available
(p) – preliminary

Manitoba

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	305	319	..	1,196	..	583	65
2015	285	352	..	1,172	..	579	52
2016	219	323	..	955	..	534	47
2017	176	325	..	793	..	457	42
2018	148	0	..	758	..	444	58
2019	147	..	..	681	..	491	68
2020	133	..	..	643	..	466	66
2021	116	..	..	625	..	508	68
2022	93	..	..	507	..	425	58
2023(p)	423	..	..	91	..	372	52

Source: Statistics Canada
.. – data not available
(p) – preliminary

Saskatchewan

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	..	..	..	..	..	..	9
2015	..	..	..	..	..	..	7
2016	..	..	..	..	..	..	11
2017	..	..	..	..	..	..	14
2018	..	..	..	..	..	..	19
2019	..	..	..	..	..	..	16
2020	..	..	..	..	..	..	15
2021	..	..	..	..	..	..	18
2022	..	..	..	..	..	..	15
2023(p)	..	..	..	..	..	..	11

Source: Statistics Canada
.. – data not available
(p) – preliminary

Alberta

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	..	..	..	..	..	..	..
2015	..	..	..	..	..	..	..
2016	..	..	..	..	..	..	..
2017	..	..	..	..	..	..	..
2018	..	..	..	..	..	..	..
2019	..	..	..	..	..	..	..
2020	..	..	..	..	..	..	..
2021	..	..	..	..	..	..	..
2022	..	..	..	..	..	..	..
2023(p)	..	..	..	..	..	..	..

Source: Statistics Canada
.. – data not available
(p) – preliminary

British Columbia

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	7,368	..	36	348	..	1,112	355
2015	7,026	..	34	322	..	1,108	353
2016	6,505	..	36	335	..	1,031	341
2017	6,443	..	37	335	..	1,963	589
2018	5,894	..	34	356	..	1,983	507

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2019	5,130	..	126	465	..	1,911	333
2020	5,144	..	34	294	..	1,853	397
2021	6,027	..	29	216	..	1,729	477
2022	6,400	..	26	178	..	1,551	761
2023(p)	5,002	..	..	..	..	2,700	634

Source: Statistics Canada
.. – data not available
(p) – preliminary

Northwest Territories, The Yukon, Nunavut

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
2014	162	..	44	383	..	1,125	47
2015	133	..	44	381	..	1,106	39
2016	66	..	0	0	..	20	25
2017	55	..	..	..	..	16	239
2018	40	..	..	..	..	13	403
2019	40	..	..	..	..	14	375
2020	38	..	38	55	..	1,170	420
2021	..	..	36	54	..	1,136	381
2022	..	..	53	48	..	1,695	366
2023(p)	..	..	58	52	..	1,887	343

Source: Statistics Canada
.. – data not available
(p) – preliminary

3.4 – Gender, Diversity and Inclusion

Minerals sector and subsector employees by gender

Minerals Sector [212, 327, 331 and 332] employees

Year	Total (count x 1,000)	Male (count x 1,000)	Female (count x 1,000)	Male %	Female %
2014	341.3	294.6	46.7	86%	14%
2015	353.7	305.0	48.7	86%	14%
2016	344.2	285.2	59.0	83%	17%
2017	347.1	296.6	50.5	86%	15%
2018	339.2	288.7	50.5	85%	15%
2019	327.7	276.4	51.2	84%	16%

Year	Total (count x 1,000)	Male (count x 1,000)	Female (count x 1,000)	Male %	Female %
2020	311.6	265.2	46.4	85%	15%
2021	305.6	253.7	51.9	83%	17%
2022	318.5	268.6	49.9	84%	16%
2023	338.6	284.4	54.2	84%	16%

Source: StatCan

Mining and quarrying (except oil and gas) [NAICS 212] employees

Year	Total (count x 1,000)	Male (count x 1,000)	Female (count x 1,000)	Male %	Female %
2014	72.8	64.4	8.5	89%	12%
2015	75.6	66.6	8.9	88%	12%
2016	72.4	62.6	9.8	87%	14%
2017	76.1	65.7	10.4	86%	14%
2018	72.8	61.8	11.1	85%	15%
2019	73.0	63.0	10.0	86%	14%
2020	63.9	54.5	9.4	85%	15%
2021	64.9	54.9	10.0	85%	15%
2022	74.0	61.1	12.8	83%	17%
2023	81.1	67.8	13.4	84%	17%

Source: StatCan

Non-metallic mineral product manufacturing [NAICS 327] employees

Year	Total (count x 1,000)	Male (count x 1,000)	Female (count x 1,000)	Male %	Female %
2014	49.3	41.5	7.8	84%	16%
2015	54.9	45.2	9.6	82%	17%
2016	49.5	41.3	8.2	83%	17%
2017	49.9	40.3	9.6	81%	19%
2018	44.0	37.7	6.3	86%	14%
2019	45.0	37.2	7.8	83%	17%
2020	49.2	40.8	8.4	83%	17%
2021	43.3	36.0	7.3	83%	17%
2022	41.5	35.0	6.5	84%	16%
2023	45.5	38.4	7.1	84%	16%

Source: StatCan

Primary metal manufacturing [NAICS 331] employees

Year	Total (count x 1,000)	Male (count x 1,000)	Female (count x 1,000)	Male %	Female %
2014	70.5	61.0	9.5	87%	13%
2015	77.6	68.7	8.9	89%	11%
2016	70.9	61.2	9.8	86%	14%
2017	73.6	64.9	8.7	88%	12%
2018	70.7	61.0	9.6	86%	14%
2019	65.8	57.6	8.2	88%	12%
2020	69.5	60.6	8.8	87%	13%
2021	65.4	55.6	9.8	85%	15%
2022	68.5	60.6	8.0	88%	12%
2023	68.7	59.6	9.0	87%	13%

Source: StatCan

Fabricated metal product manufacturing [NAICS 332] employees

Year	Total (count x 1,000)	Male (count x 1,000)	Female (count x 1,000)	Male %	Female %
2014	148.6	127.7	20.9	86%	14%
2015	145.7	124.5	21.2	85%	15%
2016	151.4	120.2	31.2	79%	21%
2017	147.4	125.7	21.8	85%	15%
2018	151.7	128.2	23.5	85%	15%
2019	143.9	118.7	25.2	82%	18%
2020	129.1	109.2	19.9	85%	15%
2021	132.0	107.2	24.8	81%	19%
2022	134.5	111.9	22.6	83%	17%
2023	143.3	118.6	24.7	83%	17%

Source: StatCan

3.7 – Mine Openings and Closures

The following tables summarize mine openings, re-openings, suspensions, and closures in Canada, by type of operation and jurisdiction.

Precious metals

Jurisdiction	Status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Alberta	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
British Columbia	Opening	0	0	0	1	1	0	0	0	0	0
	Reopening	0	0	0	0	0	0	1	0	1	0
	Suspension	0	2	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Manitoba	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	3	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
New Brunswick	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	1	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Newfoundland and Labrador	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	1
	Closing	0	0	0	0	0	0	0	0	0	0
Northwest Territories	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Nova Scotia	Opening	0	0	0	2	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	1	0	0	0	1
Nunavut	Opening	0	0	0	1	0	2	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	1	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Ontario	Opening	0	1	0	1	1	2	0	1	0	1
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	1	0	1	0	0	0	0	0	1	0
	Closing	1	0	0	1	0	0	0	0	0	1
Prince Edward Island	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Québec	Opening	1	1	1	0	1	0	0	0	1	0
	Reopening	0	0	2	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	1	0
	Closing	2	2	0	0	2	2	1	0	0	0
Saskatchewan	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	2	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	1	0	0	0	0	0

Jurisdiction	Status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Yukon	Opening	0	0	0	0	0	1	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	1
	Suspension	0	0	0	0	0	0	0	0	1	0
	Closing	0	0	0	0	0	0	0	0	0	0

Source: NRCan

Base metals

Jurisdiction	Status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Alberta	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
British Columbia	Opening	1	1	0	0	0	0	0	0	0	0
	Reopening	0	1	0	0	0	1	0	0	1	0
	Suspension	1	1	1	0	0	0	1	0	0	1
	Closing	0	0	0	0	0	0	0	0	0	0
Manitoba	Opening	1	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	1	0	0	0	0	0	0
	Closing	0	0	0	0	1	0	0	0	1	0
New Brunswick	Opening	0	0	1	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	1	0	0
	Suspension	0	0	0	0	0	0	0	0	1	0
	Closing	0	0	0	0	0	0	0	0	0	0
Newfoundland and Labrador	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	2
	Closing	0	1	0	0	0	0	0	0	0	0
Northwest Territories	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	1	0	0	0	0	0	0	0	0
Nova Scotia	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Nunavut	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Ontario	Opening	3	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	1	0
	Suspension	0	0	1	1	0	0	2	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Prince Edward Island	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Québec	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	1	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	1	0
Saskatchewan	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Yukon	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	1	0	0	0
	Suspension	0	1	0	0	1	0	0	0	0	1
	Closing	0	0	0	0	0	0	0	0	0	0

Source: NRCan

Other metals

Jurisdiction	Status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Alberta	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	1	0	1	0	0
	Suspension	0	1	0	0	0	0	2	0	0	0
	Closing	0	0	0	0	0	0	1	3	1	0
British Columbia	Opening	0	0	0	0	0	0	0	0	0	1
	Reopening	0	0	1	2	1	0	0	1	0	0
	Suspension	5	0	1	0	0	0	1	0	0	0
	Closing	0	0	3	0	0	1	0	0	0	0
Manitoba	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
New Brunswick	Opening	0	0	0	0	0	0	1	1	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	1	0	0	1	0	0	0	0
Newfoundland and Labrador	Opening	0	0	0	0	1	0	0	0	0	0
	Reopening	0	0	0	0	0	0	1	1	0	1
	Suspension	1	0	0	0	0	0	1	0	2	1
	Closing	0	0	1	0	0	0	0	0	0	0
Northwest Territories	Opening	0	0	0	1	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	1	0	0
	Suspension	0	1	0	0	0	0	1	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Nova Scotia	Opening	0	0	0	1	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	1	0
	Suspension	0	0	0	0	0	0	1	0	0	1
	Closing	0	0	1	0	0	0	0	0	0	1
Nunavut	Opening	1	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Ontario	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	1	0	0	0	0
	Closing	0	0	0	0	0	1	0	0	0	0
Prince Edward Island	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Québec	Opening	0	0	1	0	1	1	0	0	0	0
	Reopening	0	0	0	0	1	0	0	0	0	2
	Suspension	0	1	0	0	0	1	0	0	1	1
	Closing	0	0	0	0	0	0	0	0	0	0
Saskatchewan	Opening	0	1	0	1	0	0	0	0	0	0
	Reopening	0	1	0	1	0	0	0	0	2	0
	Suspension	1	0	2	0	2	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0
Yukon	Opening	0	0	0	0	0	0	0	0	0	0
	Reopening	0	0	0	0	0	0	0	0	0	0
	Suspension	0	0	0	0	0	0	0	0	0	0
	Closing	0	0	0	0	0	0	0	0	0	0

Source: NRCan

4.1 – Waste Rock and Tailings Disposal

The Environmental Code of Practice for Metal Mines (Environment Canada, 2009) recommends environmental management practices to mitigate environmental concerns associated with the management of waste rock and tailings at each stage of the mine life cycle. Other documents from a range of sources, including the Mine Environment Neutral Drainage (MEND) Program, the Mining Association of Canada, and the Canadian Dam Association provide a wide range of guidance on managing the physical and chemical risks associated with tailings and waste rock. Management of tailings and waste rock falls primarily under provincial/territorial jurisdiction, and in addition to establishing legal requirements, some provinces and territories also provide additional and relevant guidance.

In 2009, the National Pollutant Release Inventory (NPRI) began collecting information on the quantities of substances deposited in tailings management facilities and waste rock piles. Reporting requirements for tailings and waste rock were applied retroactively to 2006 for certain types of mining operations. NPRI requires reporting on the quantities of 253 substances and substance groups in tailings and waste rock produced each year. This analysis includes mineral, metal, and diamond mines as well as coal. Oil and gas extraction is excluded.[238]

The type of facility or operation that is obliged to report to NPRI is laid out in Part I of the *Canada Gazette*.[239] Generally, facilities report if they have at least 10 full-time equivalent employees (20,000 hours) or perform certain activities (e.g., incineration, municipal wastewater treatment, stationary combustion). In addition, substances are reportable if thresholds for quantity manufactured, processed, used, or released (air pollutants) are exceeded or if certain activities occur (e.g., incineration for dioxins/furans).[240]

It is important to emphasize that NPRI data on the quantities of substances in tailings and waste rock do not provide a measure of the release of these substances to the environment (releases of substances from tailings and waste rock must be reported but are not reported separately from other releases reported by the facilities and so cannot be analyzed independently of other sources at the facilities). Tailings and waste rock are managed on site at mine facilities and are not released unless a failure occurs. In addition, these data do not provide a meaningful indication of the risk of release of these substances to the environment. This is because NPRI data do not provide:

- Information needed to assess risk on a site-specific basis, such as the physical characteristics and chemical or mineralogical composition of the tailings or waste rock, including chemical or mineral forms in which NPRI substances occur; and
- Information regarding how tailings, waste rock, and associated water are managed to prevent or control any releases from tailings and waste rock to the air in the form of dust or to surface water.

Further description of potential limitations of the NPRI data is included in Appendix A – Data Considerations. Ongoing discussions with respect to this indicator will attempt to improve the way in which this data is presented in future editions of the Mining Sector Performance Report.

Under NPRI, pits and quarries with production of <500,000 tonnes are exempt from reporting. Open pit mines are not included in the definition of a pit or quarry and are subject to reporting requirements. Exclusions apply to unconsolidated overburden, inert waste rock, and stable or inert constituents of tailings.

NPRI lists 253 substances and substance groups to be reported in tailings and waste rock, subject to exemptions and thresholds prescribed in the legislation. However, this section focuses on reported quantities (in tonnes or kilograms) for a much smaller set of substances, consistent with the substances described in Section 4.2 on releases to surface water.

To help drive improvement in the way that mining companies manage risks associated with tailings management, the Mining Association of Canada (MAC) has comprehensive requirements and guidance for tailings management as part of the Towards Sustainable Mining® initiative (Box 11).

[238] Data was retrieved based on North American Industry Classification System (NAICS) codes: 212 Mining and quarrying (except oil and gas), 327 Non-metallic mineral processing sector, 331 Primary metal manufacturing, and 332 Fabricated metal product manufacturing. Code 212 included diamond mining under 2123 Non-metallic mineral mining and quarrying.

[239] https://www.gazette.gc.ca/rp-pr/p1/2022/2022-02-12/html/sup1-eng.html

[240] Underhill, J. (2019). *Canada's National Pollutant Release Inventory*. Environment and Climate Change Canada. https://www.epa.gov/sites/default/files/2019-08/documents/800am_junderhill.pdf

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