2013

**Yukon Hiring Requirements and
Available Talent Forecasts:**
*Mineral Exploration, Mining,
and Support Services*

Prepared for the Department of Education and Economic Development, Yukon Government and in partnership with Derome and Associates Development + Management Inc.

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1. Introduction and Overview

1. Introduction and Overview

This report complements and expands on an initial research report completed for Derome and Associates – Development + Management Inc. in November 2011[1]. The initial research focused on the hiring needs of the extraction sector of Yukon's mining industry and was extensively used for Phase One of the Centre for Northern Innovation in Mining (CNIM) Feasibility Study completed in January 2012. The Study, released in September 2012[2], was commissioned by Yukon College and funded in part by Yukon Government and CanNor.

The current report expands on the initial research to include the exploration, service and placer mining sectors of the mining industry. For the first time a detailed estimation of the mining labour workforce is available for Yukon. In addition to forecasting the hiring needs for Yukon's industry over the next 10 years, the research also estimates the talent that will become available in that time, and provides a gap analysis for 42 occupations that make up more than 95 per cent of the Yukon mining labour pool.

Yukon's mining industry employed an estimated 2,675 workers in 2012 and includes 960 mining workers and 1,710 exploration and services workers. As a result of its location, population base and types of industries, the mining labour market in Yukon differs from other parts of Canada and even the other territories. The labour force in Yukon has a larger cohort of younger and older workers with a gap in mid-career age groups, is highly mobile, retires later than the national average in mining, and employs a large proportion of Aboriginal people.

Yukon's mining industry has been through many economic cycles over its long history. Currently, its mined minerals are hot commodities on international markets, with a value of mineral production over $402 million in 2011[3]. The territory is set to expand its mineral production nearly threefold over the next 10 years; however, labour market challenges have the potential to derail the expansion.

Prices for copper, gold, silver, and other minerals mined in Yukon remain strong. All time high commodity prices in 2011 spurred extensive exploration and investments in developing new projects. Despite recent economic uncertainty and cooling trends felt over the 2012 exploration season, prices are expected to remain elevated by historical standards over the next 10 years and the industry is expected to continue on a growth trend. Demand for Yukon's resources will continue to grow as the world continues to rapidly urbanize and new technologies are developed and sold on a mass scale.

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1 Yukon Mining Industry Employment and Hiring Requirements Forecast: Phase One, 2012
2 Centre For Northern Innovation in Mining - CNIM Feasibility Study, September 2012
3 See NRCAN estimates of mineral production, *http://mmsd.mms.nrcan.gc.ca/stat-stat/prod-prod/2011-eng.aspx*

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However, over the forecast horizon, labour market trends and challenges will threaten the industry's growth potential. For example, Yukon's mineral exploration geoscientists are rapidly ageing and retirement rates are expected to increase by 60 per cent over the next 10 years. In mining, employers currently rely on a large contingent of workers who live in other provinces—which creates economic, social and infrastructure challenges and a need to explore ways to encourage these workers, and their families to relocate to Yukon.

Furthermore, rapid expansion and development activities will place demands for new skills that Yukon has not attracted or trained over the past decade. In particular, demand for underground miners will increase as will demands for several categories of technologist and technician in geosciences and mineral processing. The length of time it takes to train workers to fill these highly specialized roles complicates workforce planning. It can take 4 or more years to acquire the basic skills and knowledge required for many of the mining occupations facing supply constraints, and nearly a decade or more to acquire important industry experience to replace retiring workers.

A gap will emerge between the amount of new labour supplied to mining occupations and the demand for new labour and replacements of workers leaving the mining industry. Using customized labour market forecasting models to project the industry's needs over the next 10 years, the Mining Industry Human Resources Council's (MiHR) analysis shows that this gap will widen rapidly in the next 4 years, and remain for the next decade. Labour demand in the industry will be nearly 150 per cent higher in 2023 compared to the demand in 2012; meanwhile, labour supply could be approximately 12 per cent lower in 2023, if nothing is done to address the skills and labour shortages and fill the projected gaps.

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Much of the industry's success will rely on its ability to attract and retain key talent. One option is to focus efforts on career awareness and outreach to attract new younger workers from school, other industries, or other countries and provinces/territories. The territory has realized small increases in the number of students entering mining occupations in the last 5 years; however, Yukon shares its borders with jurisdictions that are themselves facing skilled labour shortages in their mining industries. Efforts to mentor and train youth in the skills and knowledge required to replace the retiring workforce will also be important; particularly in exploration which faces challenges of an ageing workforce and lack of mid-career professionals to assume senior roles. Immigrants have the potential to meet the demand, but they tend to settle in large urban cities in southern Canada, may require language and skills training, and may need to reconcile foreign credentials and work experience.

Meeting the projected needs will take a collaborative, cooperative, and multi-stakeholder approach. Solutions will be found in bringing together employers, government, industry associations, education and training providers at all levels, and communities to discuss multi-faceted approaches. In short, all options must be on the table in planning and developing initiatives to meet the industry's labour market pressures head on and close the growing talent gap.

About the Report

The Mining Industry Human Resources Council (MiHR) has prepared this report in partnership with Derome and Associates for the Government of Yukon to augment the feasibility work completed for the Centre for Northern Innovation in Mining (CNIM) at Yukon College. The report presents MiHR's forecasts of hiring requirements and available talent for Yukon's mining industry over a 10 year horizon. The projected gaps between hiring requirements and available talent for a select group of occupations relevant to Yukon's mining industry are analyzed and recommendations to address the gaps are discussed.

- The hiring requirements forecasts are customized to incorporate Yukon-specific factors (e.g., commodity mix) to predict change in employment and replacement requirements over a 10 year horizon, under three economic scenarios. In addition to an industry-wide outlook, forecasts are also broken-down for three prominent mining sectors in Yukon; the extraction, mineral exploration, and support services sectors. Finally, forecasts are broken-down for selected occupational categories relevant to the industry.

- The available talent forecasts project the industry's share of talent for each exploration and mining-related occupation over a 10 year horizon, accounting for mobility trends (i.e., interprovincial and international migration) and entries/exits into mining due to various other factors (i.e., school graduates transitioning to work, retirements and separations, etc.)

- A side-by-side comparison of hiring requirements and available talent for selected occupations that are core to the mining industry reveals pressure points and trends. A gap analysis is conducted for all occupations combined, and then is broken-down for each separate occupation. A discussion on strategies for filling the gaps follows.
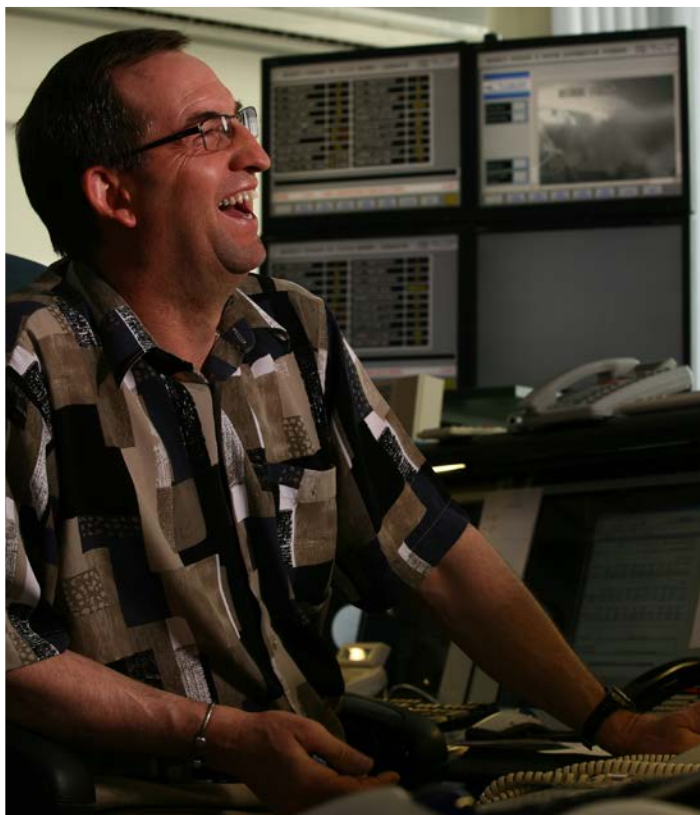
Industry Definition and Scope

MiHR defines the mining industry as including all phases of the mining cycle: prospecting and exploration, construction and development, extraction, processing, and reclamation, closure, care and maintenance. Forecasts presented in this report rely on data collected and aggregated through Statistics Canada. Thus, Statistics Canada's North American Industry Classification Codes (NAICS) and National Occupational Classification for Statistics (NOC-S) codes are used to define the mining industry. More details on the NAICS and NOCS codes included in the forecasts are found in Appendix C. MiHR uses a set of NAICS categories to define the industry sectors identified in this report (i.e., mining and mineral exploration, and support services). A full description of these categories can be found in Appendix B.

Data Collection and Methodology

MiHR forecasts rely on a variety of data inputs, mining industry intelligence, and other information that is incorporated into models and assumptions that drive the analysis. An econometric model uses past trends and consensus forecasts of future conditions to predict mining employment and replacement requirements over a 10 year horizon.

For example, as part of MiHR's hiring requirements forecasts for Yukon, information and data on known advanced development and mine construction projects are considered and captured under a baseline scenario. Expected future developments are balanced against known economic activity and consensus forecasts of future conditions that affect timelines for advanced development activities or force closures or production interruptions, and the net effect of activities on employment is predicted. An expansionary scenario then assumes economic activity will be greater than expected, while a contractionary scenario assumes economic activity will be lower than expected. More on MiHR's forecasting methodology can be found in Appendix A.

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MiHR conducted targeted surveys and interviews to gather the important expertise of stakeholders in Yukon's mining, exploration and support service sectors. Findings from this 'on-the-ground' research were used to inform aspects of the modeling exercise, and validate data from other sources, such as the occupational structure of the workforce, demographic characteristics, participation and turnover. MiHR also hosted a series of mining stakeholder forums in Whitehorse and Vancouver to obtain valuable feedback and strengthen the forecast interpretations and recommendations found in this report.

Secondary industry intelligence is taken from key data sources from Statistics Canada (including the Census, Labour Force Survey, Survey of Employment Payroll and Hours, Canada Business Patterns, and Post-secondary Education surveys), Natural Resources Canada, and information made publicly available by Yukon Government. These sources cover a wide range of important themes: including labour market statistics and reporting (e.g. labour force participation, separation, demographics); notable economic trends; and upcoming major mining projects in Yukon.

Report Overview

This report is divided into six main sections. Section One provides a brief introduction and definition of industry scope. Section Two offers an economic overview of Yukon's mining industry and highlights the important economic variables that are considered in this report. Section Three summarizes the current and future demographic trends in Yukon's mining labour market. Section Four provides forecasts of hiring requirements, and includes estimates for Yukon's exploration and mining sectors, broken down by key mining occupations, over a two, five, and ten year horizon. Section Five presents a forecast of available talent by occupation, and Section Six includes a high-level gap analysis of Yukon's mining HR needs and trends based on comparison of the forecasts presented for hiring requirements and available talent. The report concludes with discussion on potential strategies to address the skills and labour gaps to ensure the future success of the industry.
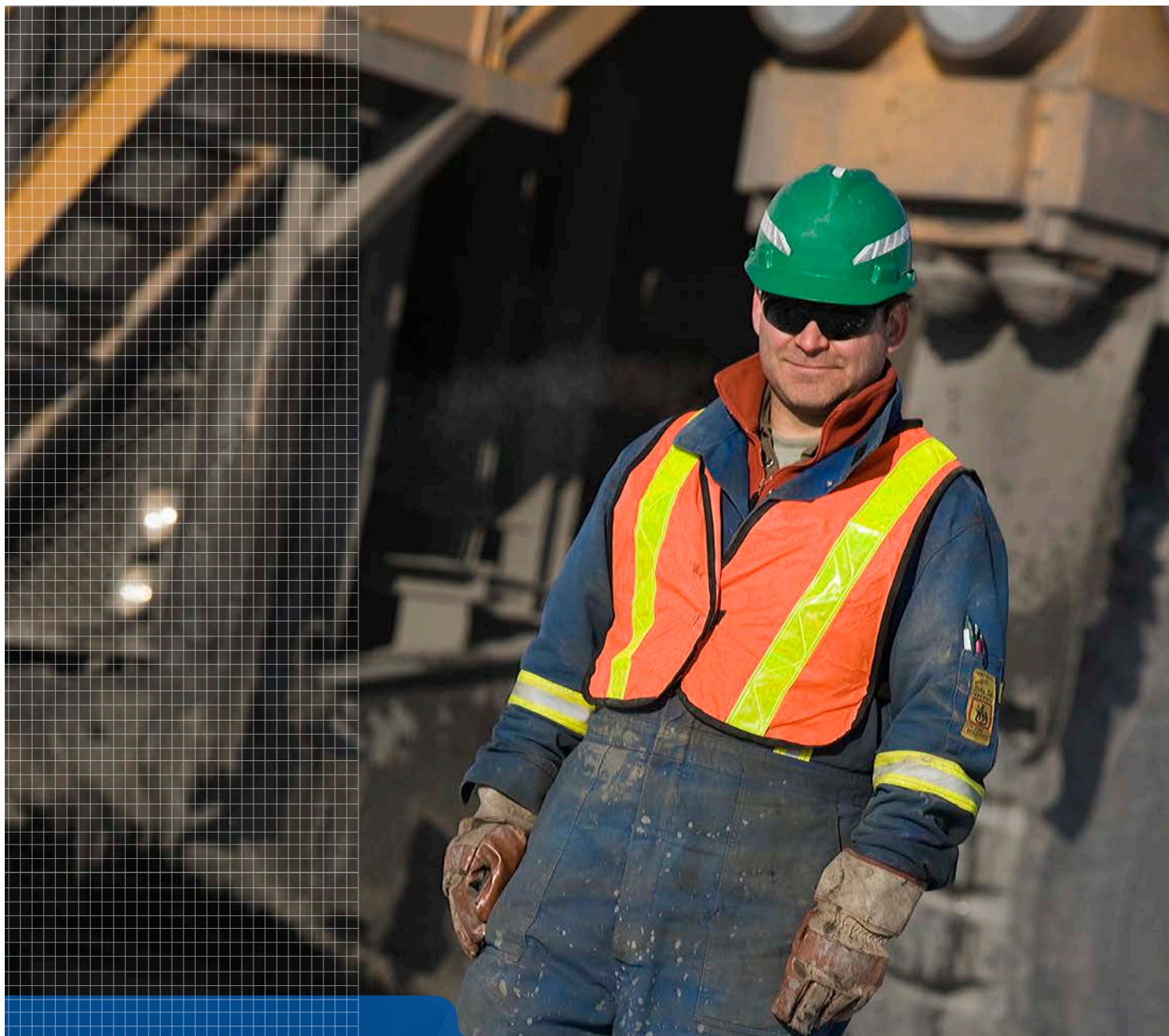
2. Economic Overview

2. Economic Overview

Over the last decade, Yukon's mining industry has established itself as a significant source of wealth and employment. Though Yukon's industry has witnessed many economic cycles over its long history, it currently supports an unprecedented number of producing mines, mine construction activities, strong activity in placer mining, advanced development and mineral exploration projects.

Yukon also produces a variety of mineral resources, as shown in Figure 1. The three most prominent mineral resources in the territory - Copper, Silver and Gold - accounted for the largest shares of mineral production by value in 2011.

Figure 1 – The Value of Mineral Production, by Commodity, in Yukon's Mining Industry, 2011 (CDN, millions)
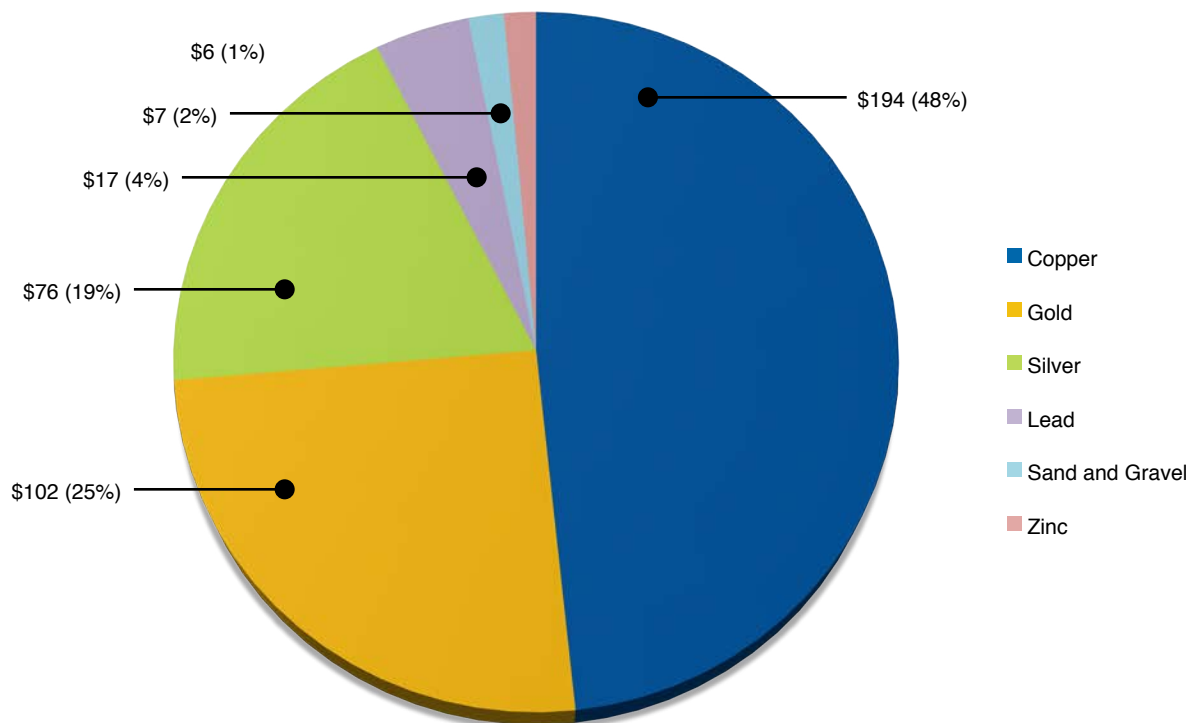
Source: Natural Resources Canada; Mining Industry Human Resources Council

Export Outlook

Recently, strong demand from Asia has expanded export activity of Yukon's resources. While the vast majority of Yukon's mineral exports go directly to the United States, minerals are frequently destined for Asian markets; an important factor when looking at future demand trends. Figure 2 shows the value of Yukon's export activity for base metals (i.e., copper, nickel, lead and zinc) and precious metals (i.e., gold and silver). From 2002 to 2011, the value of Yukon's mineral exports has experienced significant increases. Since 2007, the current emergence in base metal exporting has reinforced the increasing value of exports. Growth in demand for these commodities will have a direct impact on the industry's future labour market challenges.

Figure 2 – The Value of Yukon's Base Metals and Precious Metals Exports, 2002-2011 (CDN, millions)

Legend:
- NAICS 21222 – Gold and Silver Ore Mining
- NAICS 21223 – Copper, Nickel, Lead and Zinc Ore Mining

Source: Mining Industry Human Resources Council; Industry Strategis Database
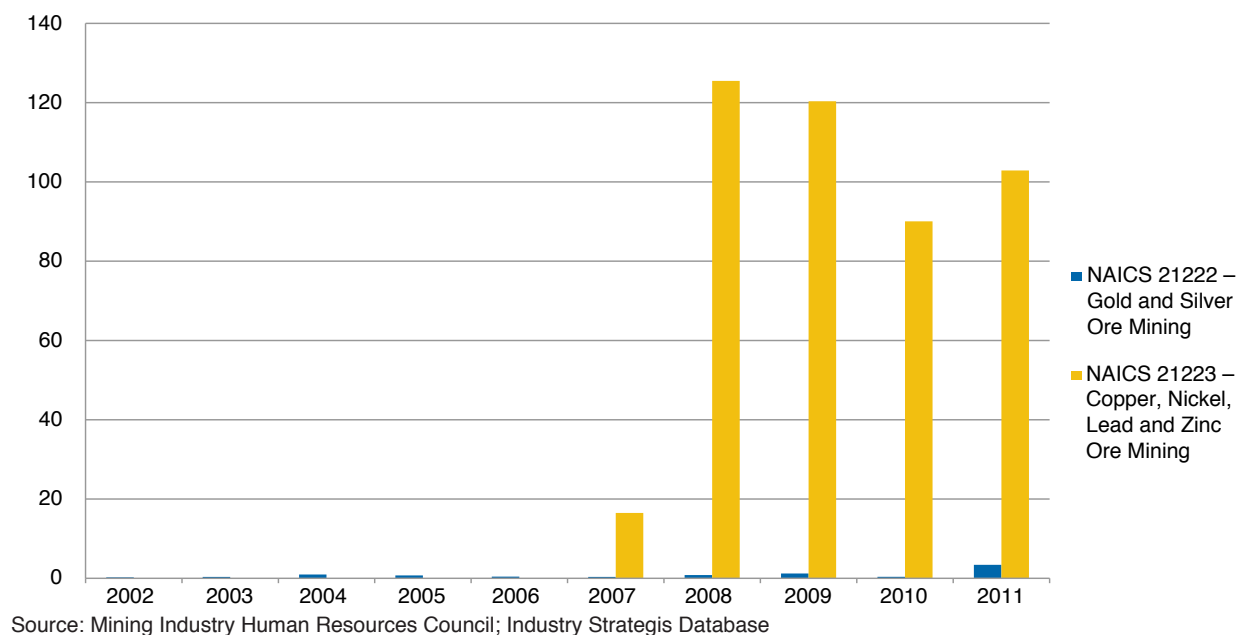
Mineral Prices Outlook

In recent years, demand from Asian countries has elevated commodity prices and driven record high exploration spending in Yukon. Over the forecast horizon, mineral prices are expected to stay high by historical standards; however, they are also expected to experience a partial correction from current levels over the short term. According to World Bank commodity forecasts, prices for copper, silver and gold are predicted to peak within the next couple of years, followed by a period of price adjustment with a modest steady increase thereafter. Illustration of these expected price movements is shown in Figure 3 (for copper) and Figure 4 (for gold and silver). MiHR research has shown a tight relationship between commodity price movements and employment in the exploration and mining industry and these trends are important indicators of future labour market conditions in Yukon.

Figure 3 – Historical and Forecasted Price of Copper

Source: World Bank; Development Prospects Group
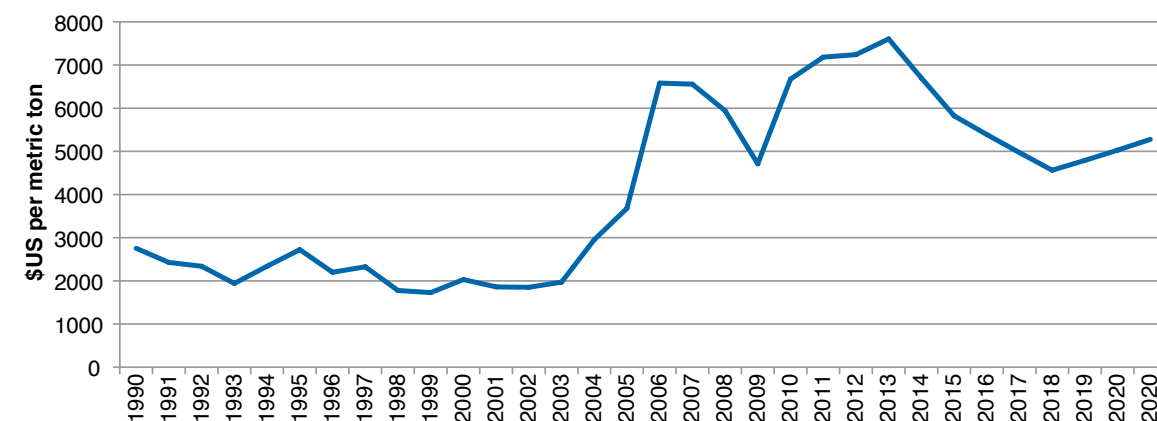
Figure 4 – Historical and Forecasted Price of Gold and Silver

Gold (left axis)   Silver (right axis)
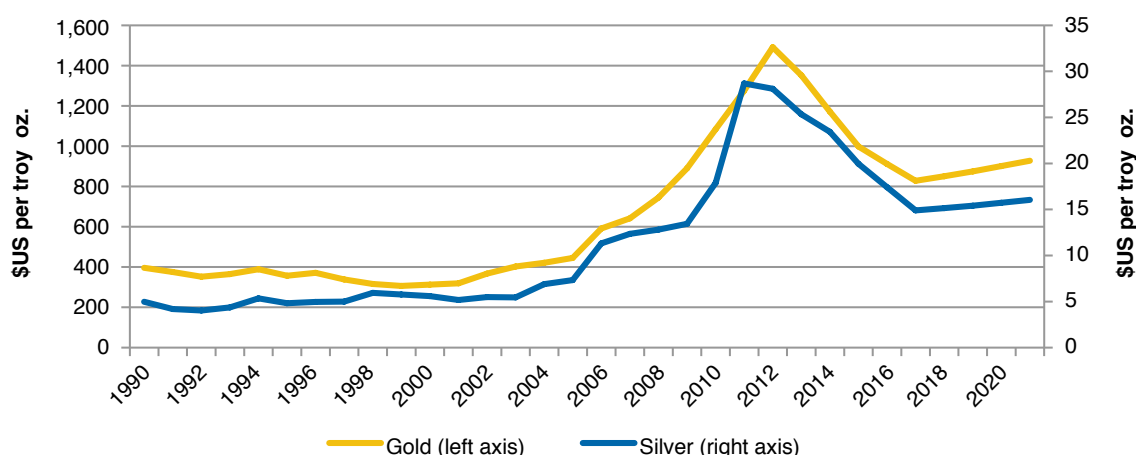
Source: World Bank; Development Prospects Group

Increase in Exploration Spending

As mineral prices have been elevated in recent years, so too has the level of exploration spending in Yukon. Figure 5 shows Natural Resources Canada's estimation of exploration and deposit appraisal expenditures over the past several years. Despite a surge in exploration activity in 2011, the recent instability of the Euro-zone, continued economic uncertainty in the United States, and the prospect of downward-adjusting commodity prices has added caution to predictions of economic activity. Thus, the outlook is balanced with the view that growth in exploration activities may slow to a period of rest until stability has returned to mineral prices and the global economy in general.

Figure 5 – Exploration Expenditures in Yukon
(CDN, millions; 2004—2012)
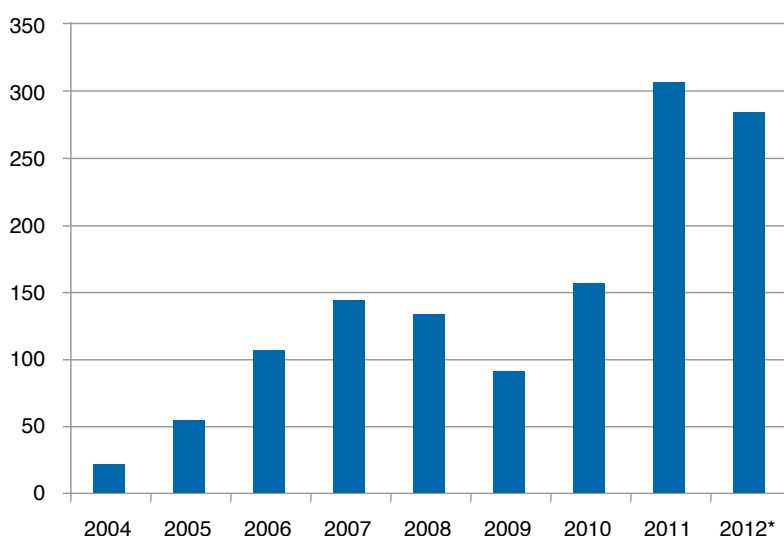
Source: Mining Industry Human Resources Council; Natural Resources Canada (from the federal-provincial-territorial *Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures*; figures for 2012 are estimates)
*Note that the figure in 2012 is relatively optimistic compared with Yukon Government estimate, at $150 million for that year (Yukon Economic Outlook 2012 Update).

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Gross Domestic Product Growth

Figure 6 illustrates the link between Gross Domestic Product (GDP) and employment in Yukon's mining industry from 1997 to 2010. The graph shows a strong correlation between GDP movement and employment - an important relationship that MiHR considers in its employment forecasts. Since the mid-2000's, the industry has observed increases in employment and corresponding increases in GDP; specifically, employment and GDP have risen by 25 and 23 per cent respectively since 2004.

Figure 6 – Gross Domestic Product (GDP) and Employment in Yukon's Mining Industry
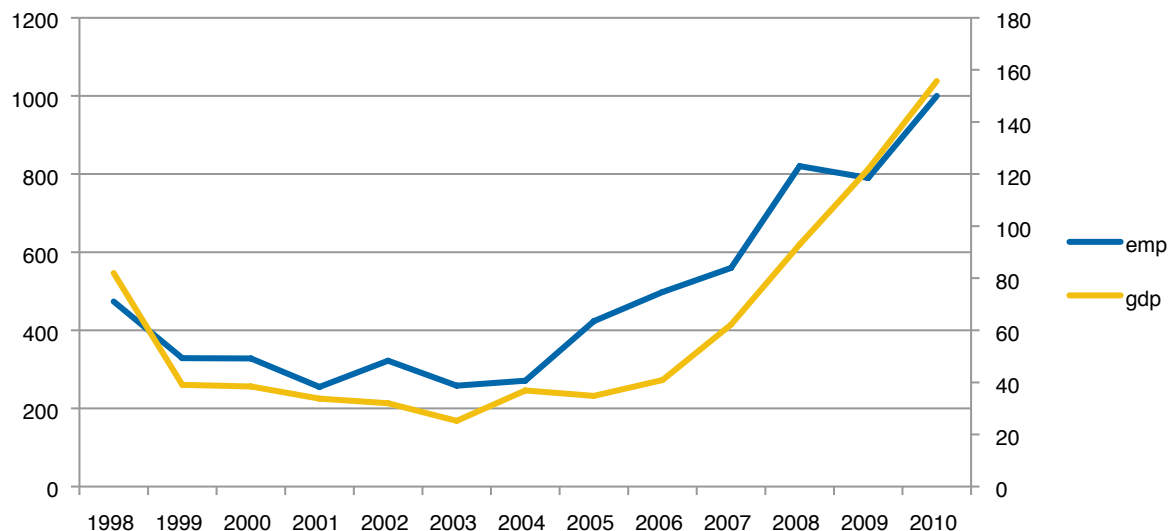
Source: Mining Industry Human Resources Council

While the industry has established momentum over the past decade, research at MiHR shows that GDP growth in mining is naturally sensitive to prevailing economic conditions and typically exhibits large fluctuations over time. Currently, the latent economic effects of the latest global recession present a potential hazard to cautious investors and employers, adding to the economic slowdown over the past year. The forecasts presented in this report account for this natural volatility of the mining industry and despite cooling trends in 2012, overall growth is anticipated over the next 10 years.

3. Mining Labour Market Trends

3. Mining Labour Market Trends

As a result of its location, population base and types of industries, the mining labour market in Yukon differs from other parts of Canada and even the other territories. The labour force in Yukon has a larger cohort of younger and older workers with a gap in mid-career age groups, is highly mobile, retires later than the national average in mining, and employs a large proportion of Aboriginal people.

According to a survey of producers, nearly 47 per cent of the current mining workforce in Yukon does not permanently reside in the territory. In addition to obvious capital and operating costs associated with temporary housing and transport of workers into the region for work rotations, with many coming from as far away as Newfoundland and Labrador, there are other impacts or challenges Yukon employers will face. For example, as the mining labour market tightens in the rest of Canada, despite its young and newly established mining workforce, Yukon will feel the impact from labour market pressures felt in the rest of the Canadian industry. As the needs and labour demands shift in the rest of the Canadian mining industry, workers commuting long distances will have attractive options to work closer to their permanent residence.

Age Profile of Workers in Yukon Mining Occupations

Despite Yukon's long exploration and mining history and tradition, large-scale extraction operations were absent from the territory for more than 15 years until the middle part of the 2000s. This has resulted in a mining labour force that is relatively young and not likely to retire in the short-term. The average age of the mining workforce in the region is 40.6 years and the average age of retirement reflects the national average at 62 years. This means that while the impending retirement of the "baby boom" generation will pose significant challenges for mining operations in the rest of the country where the workforce is older and retires younger, Yukon will likely not experience a large, direct impact. Figure 7 highlights the age profile of the mining workforce in Yukon and Canada.

Figure 7—Age Profile of Yukon Exploration and Mining Workforce Relative to the Canadian Industry (Proportion by age category)
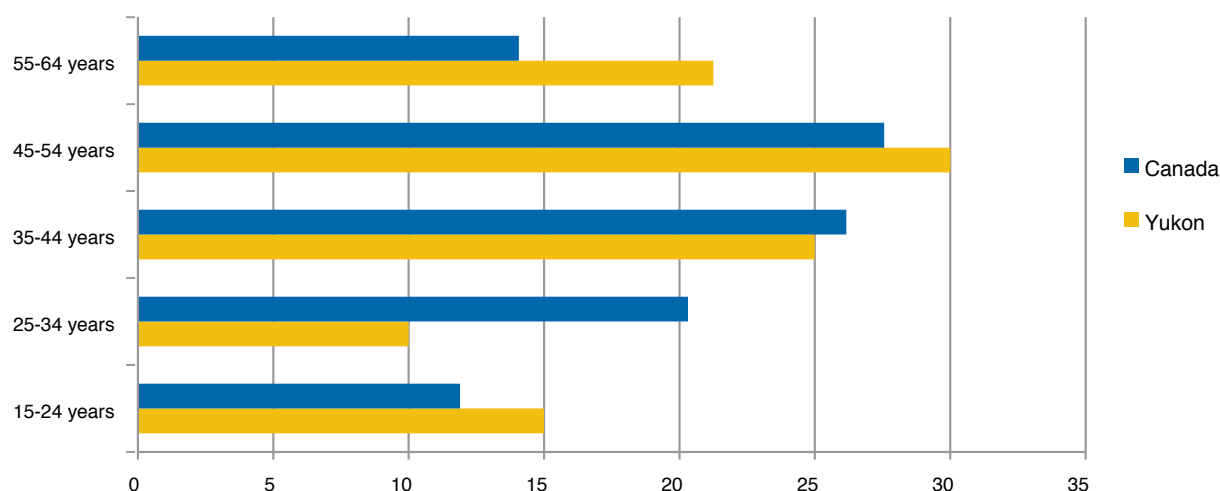
Source: Mining Industry Human Resources Council; Statistics Canada

It is important to note that the age profile of the industry's sectors differs greatly. Currently, the exploration and support services workforce is larger than the extraction workforce. Employment in the mining sector is estimated at 960 workers for 2012, and over 1700 workers in exploration and support services. As Figure 8 illustrates, these ratios of extraction to exploration workers are generally a reverse of those observed in other provinces and territories in Canada, and explain the contrast of Yukon's age profile to that seen in the rest of Canada.

Figure 8 - Employment in Mining Sectors: Yukon and Canada
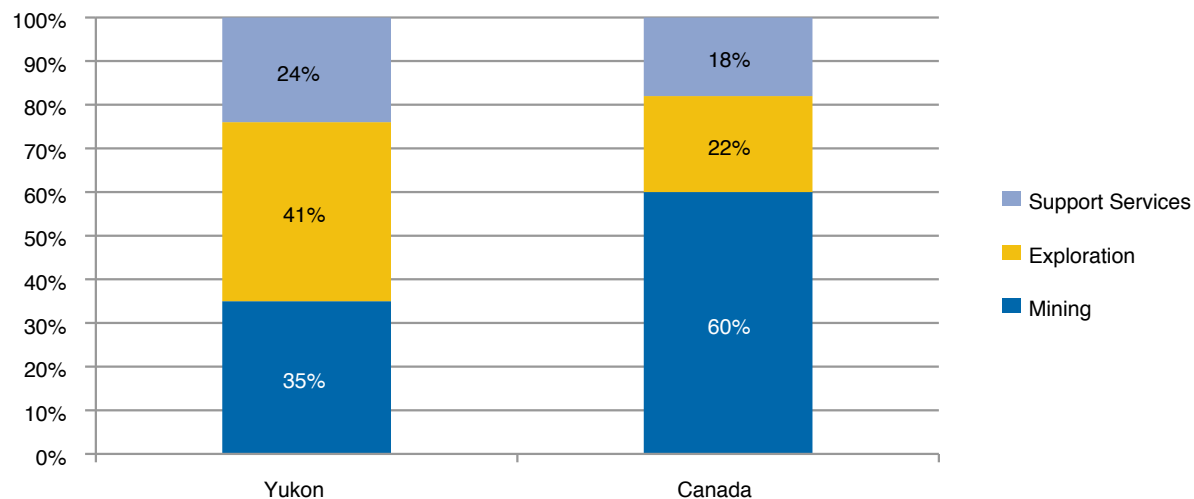
Source: Mining Industry Human Resources Council

The exploration workforce in Canada is older, on average, and retires later than the mining workforce. The large numbers of ageing workers nearing retirement in Yukon are largely in the exploration sector. A recent survey of producers showed that the extraction workforce in Yukon is younger than the Canadian mining workforce; a trend that is common in regions with new mining activity.

There is a much lower proportion of workers in the ages 25-34 cohort than seen in the rest of Canada. This group accounts for only 10 per cent of the labour force in the occupations relevant to mining, compared to the Canadian average of 20 per cent (See Figure 7). This is another trend that is seen in Canadian mineral exploration in general and illustrates the impacts of a larger cohort of exploration workforce compared to extraction in Yukon.

Yukon's proportion of workers in the 15-24 age group is higher than the Canadian average. This indicates that the industry has been successful in attracting younger workers. However, changing demographics will work against the industry in the coming years, as there will be fewer people of school age entering the labour force in general—an artifact of declining numbers of young people overall, rather than a decrease in interest in mining education.

Education Levels in Yukon Mining Occupations

Students leaving school are a significant source of future labour supply for the mining industry. However, MiHR projects there will be fewer students entering into occupations relevant to the mining industry over the next 10 years since the school age population is shrinking, as shown in Figure 9.

Figure 9—Education Flows into Yukon's Exploration and Mining Industry
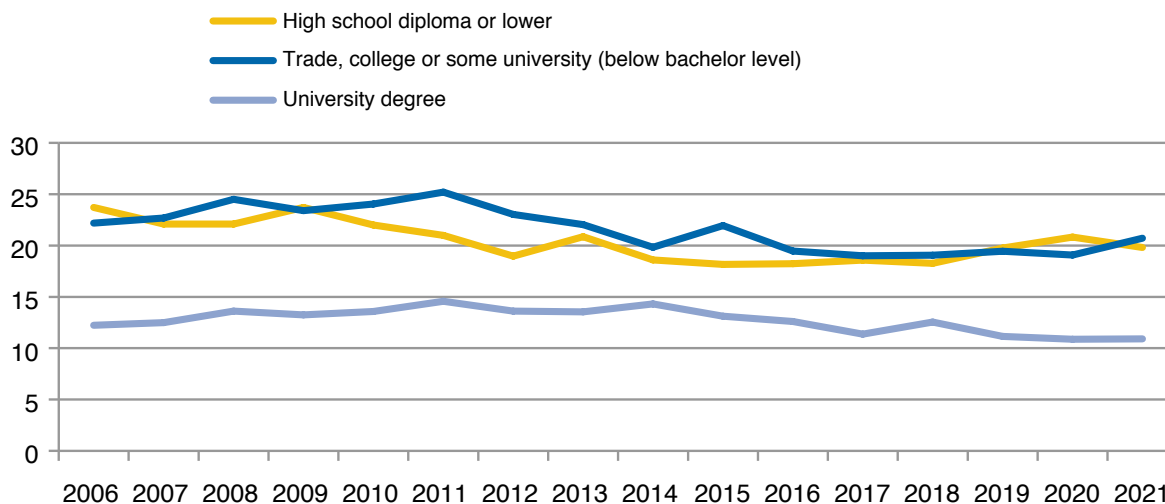
Source: Mining Industry Human Resources Council; Statistics Canada

The forecast assumes that the relative attractiveness of the mining industry to school graduates remains the same moving forward—this assumption provides a baseline for future projections. Changes in education programming, encouraging youth into careers in mining, and new industry/ education initiatives will greatly influence the illustrated trends in a positive direction.

Diversity in Yukon's Mining Industry

Aboriginal Peoples

Yukon mining employs a large proportion of Aboriginal peoples. According to Statistics Canada's 2006 census, the Canadian mining industry already outperforms the rest of the economy with Aboriginal peoples making up nearly 7 per cent of the sectors labour force. According to MiHR's survey of Yukon exploration and extraction employers and producers, currently Aboriginal peoples compose more than one-fifth of the mining labour force in the territory. However, the vast majority of this employment (nearly 60 per cent) is concentrated in support services and labourer occupations.

In MiHR's survey, producers were also asked to indicate the proportion of their workforce that resides in Yukon and self-identify as Aboriginal. On average, over 40 per cent of Yukon-based workforce is Aboriginal (with a range of 13 to 100 per cent) and over three-quarters are employed in trades, labour, and support services occupations. Further, employers indicated that less than 4 per cent of their Aboriginal workforce had completed high school and less than 1 per cent had completed post-secondary education or training as their highest level of education attainment. There is an opportunity for Yukon mining employers and government to partner to identify and address the education gaps and move the Aboriginal workforce into roles that require a post-secondary education.

Immigrants

Yukon mining industry underperforms the Canadian mining industry in employing new Canadians. Immigrants account for only 8.7 per cent of the Canadian mining workforce, as compared to 21 per cent in the labour force as a whole. According to MiHR's survey of Yukon producers, the mining industry in Yukon underperforms the Canadian mining industry; with employers in Yukon reporting less than 1 per cent of the workforce are temporary foreign workers and none currently employ new Canadians (of those who measure this in their workforce data).

International migration in Yukon has seen a small net drain since 2006. In 2011, net international migration into the territory was minimal, while net interprovincial migration cancelled out these gains. International migration is expected to remain steady over the forecast periods, with more people projected to leave the territory for other provinces, due to the high proportion of a commuter workforce and changing labour market conditions elsewhere in Canada. Still, the annual net negative drain on the territory is expected to be fairly modest, over the next 10 years, compared to pressures of an ageing exploration workforce and looming retirements.

Women

Women are underrepresented in Canadian mining and Yukon is no exception. In Canada, women represent about 47 per cent of labour market participants, but in mining only about 14 per cent of the workforce are women. Of the women who are employed in the industry, nearly 80 per cent are found in administrative, HR, and clerical support roles.

Participation of women in Yukon's mining industry follows similar trends to the national industry. Employers indicated in MiHR surveys that their workforce is between 5 and 50 per cent female; with the majority of women in administrative, office, human resources and clerical roles. In exploration, however, women are a growing segment of the workforce, with some of the smaller companies reporting as high as 100 per cent of the seasonal workforce are women.

Other Pressures

In addition to these unique labour market challenges, Yukon mining industry faces infrastructure challenges that all sectors of Yukon's economy share. In particular, housing and related infrastructure challenges are top of mind for Yukon mining employers. Many employers and stakeholders consulted through MiHR's research indicated that housing may be a key factor in driving some of the demographic profile described above. For example, the high proportion of the workforce being non-residents, and low proportions of immigrants working in mining in Yukon may be driven by housing shortages and infrastructure challenges. Some cited long distance commuting as a short term solution for employers that will not remain cost effective.
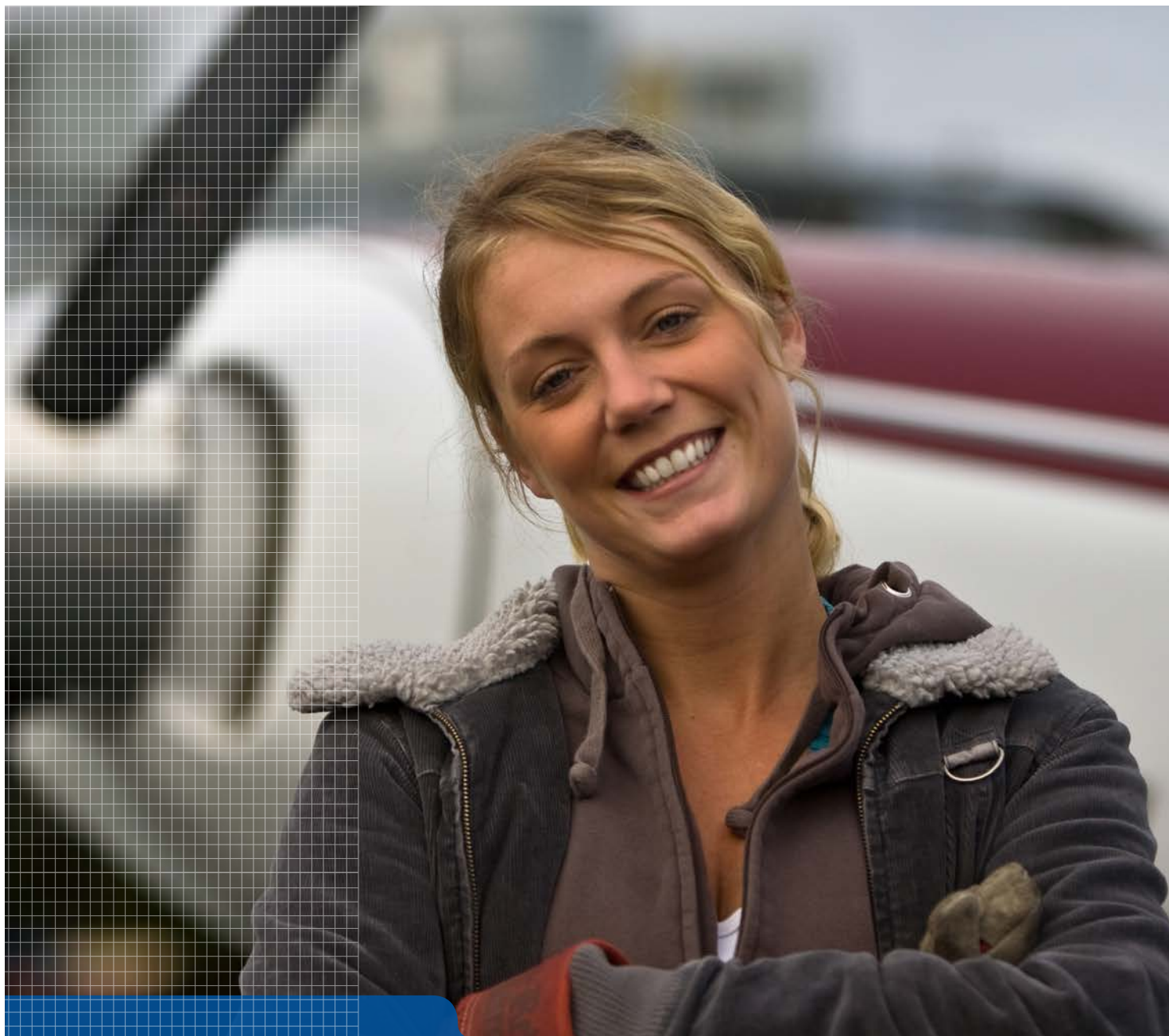
4. Hiring Requirements

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The demand for Yukon minerals will continue to grow over the next 10 years. Asian countries—India, Japan and China in particular—require metals for the production of electronics and appliances. As a result, mineral prices are expected to stay elevated by historical standards, despite price corrections forecasted over the short term. The high prices and increased demand will continue to spur exploration in the territory.

As a result, several mining projects are expected to begin production in Yukon in the near future, even under a contractionary economic scenario. Demand for mining industry employment is expected to be 2.5 times higher than the number of people currently employed in the industry. Employment in mining will show the largest gains, while employment in exploration is expected to shrink slightly as commodity prices experience a partial correction from their current very high levels. Employment in support activities is expected to remain steady, with a shift in the types of services offered as more mines come online and exploration shrinks—a trend already starting to happen with the recent developments of new mineral processing and laboratory activities in the territory.

MiHR's employment estimates, used to forecast hiring requirements and occupation projections discussed in the following sections, include both Yukon residents and the commuter workforce. This is to ensure that the forecasted hiring requirements and the available talent gap analysis provide a complete picture of the projected pressures and labour market conditions.

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Note that employment estimates based on Statistics Canada data alone refer to Yukon residents and not the total mining workforce. Overall employment is estimated to be higher when the commuter workforce is factored in. Hence, MiHR includes other data sources and indicators in its estimates of employment in order to reflect the total mining workforce.

In MiHR's forecasts, the overall employment in mining in the start year, 2012, is estimated at 2,675: 960 in mining extraction and 1715 in exploration and support services. Of the overall estimate, 1200 (or 45 per cent) are Yukon residents.

Description of the Model

MiHR uses an economic model to forecast employment and hiring requirements over a 10 year horizon. The model accounts for the factors affecting the size and composition of the workforce and uses a combination of independent economic forecasts, Statistics Canada data, and information collected directly from industry stakeholders. Details on the hiring requirements model and the methodology used to develop forecasts can be found in Appendix A.

Hiring requirements have two distinct components – 'Net change in Employment' and 'Replacement Requirements.' The following describes these components in more detail.

Net Change in Employment

Net change in employment describes the industry's employment levels in response to cycles of economic activity. MiHR research has demonstrated that fluctuations in employment have a strong correlation with movements in mining GDP. MiHR's employment model predicts changes in employment through factors that are tied to levels of economic activity.

Note that the forecast tables that follow do not show new job growth, but rather represent a net estimate of employment change over the entire forecast period. Net change in employment equally reflects new and increased mining activity with negative workforce adjustments due to mine closures and slowdowns in production. For example, a new mine may open leading to 500 new jobs being created; however, along with this expansion activity, exploration activity elsewhere in Yukon may have concerns about their business environment, and reduce the workforce by 250 workers – this combined activity would result in a net change in employment of 250 workers.

GDP and Employment Forecasts

MiHR builds a forecast of GDP using region-specific commodity prices and other key economic drivers. Intelligence on historical and current price movements, labour productivity, upcoming mining projects and other important indicators of economic trends are also taken into consideration. According to MiHR's projections, real GDP in the industry is expected to undergo steady growth, despite expected corrections to mineral prices. Corresponding growth in employment is expected, overall, in the mining industry to 2023.

Replacement Requirements

Replacement requirements describe the need to replace workers due to retirement and non-retirement separations. Together these factors contribute to the number of departures from the workforce that are not a direct consequence of changing economic conditions, but rather result from the natural behavior of labour force participants.

Retirement

MiHR has projected the likely retirement behavior of Yukon's exploration and mining labour force over the forecast period. A brief description of this is found in Appendix B. The retirement rate for all mining sectors is projected to increase over the forecast horizon, with the greatest rate of increase observed in mineral exploration, largely due to the age and retirement profile of the exploration workforce.

Non-Retirement Separation

The non-retirement separation rate used in MiHR forecasts captures all other separation behaviour that is not related to retirement. MiHR has estimated the non-retirement separation rate to be 4 per cent for Yukon's exploration and mining industry. The estimate is slightly greater than the national non-retirement separation rate in the mining industry, at approximately 2 per cent. This is due to the large commuter workforce and high proportion of mineral exploration workers, who are shown in previous MiHR research to have a higher overall separation rate than the extraction workforce.

The large component of non-resident labour and high degree of labour mobility in Yukon presents challenges in creating reasonable estimates of non-retirement separation rates. The core question is, should workers be counted based upon where they contribute to the economy through spending and living or through where they work for a company and contribute through that organization's spending and investment in the region?

For the purposes of this study, estimates were created for the full mining labour force including non-residents and then validated against other research inputs. Previous MiHR research found that the national non-retirement separation rate in the mining industry is 2 per cent. However, this rate will be higher for any given region of the country, due to interprovincial migration. Survey responses from Yukon producing mines and exploration and support services employers indicated that average turnover rates among mining employers in Yukon are approximately 20 per cent. However, workers leaving a particular mining company may remain in Yukon at another company. Thus, 20 per cent represents the upper-limit of the territorial non-retirement separation rate.

Given these limits, MiHR has estimated the non-retirement separation rate for the mining workforce in Yukon to be 4 per cent – a conservative figure that is between the employer-reported rate and the national industry separation rate.

How Hiring Requirements are Different from Employment Demand

MiHR's forecasts of hiring requirements include all factors that would generate a need to hire workers – thus combine forecasts of changes in employment with projected replacement requirements. The components of hiring requirements are illustrated in Figure 10: On the left, the blue bar represents the estimated employment level at the beginning of the forecast; the light blue bar represents the projected net change in employment due to economic activities, over the next 10 years. However, net change in employment does not capture the full hiring requirement. On the right, the yellow bar shows the portion of the existing labour force that will need to be replaced due to separation and attrition over the forecast period. MiHR's forecasts combine these two factors and predict the industry's overall need to hire workers for all possible reasons (the yellow and the light blue bars).

Figure 10 – How Hiring Requirements are Different from Employment Growth
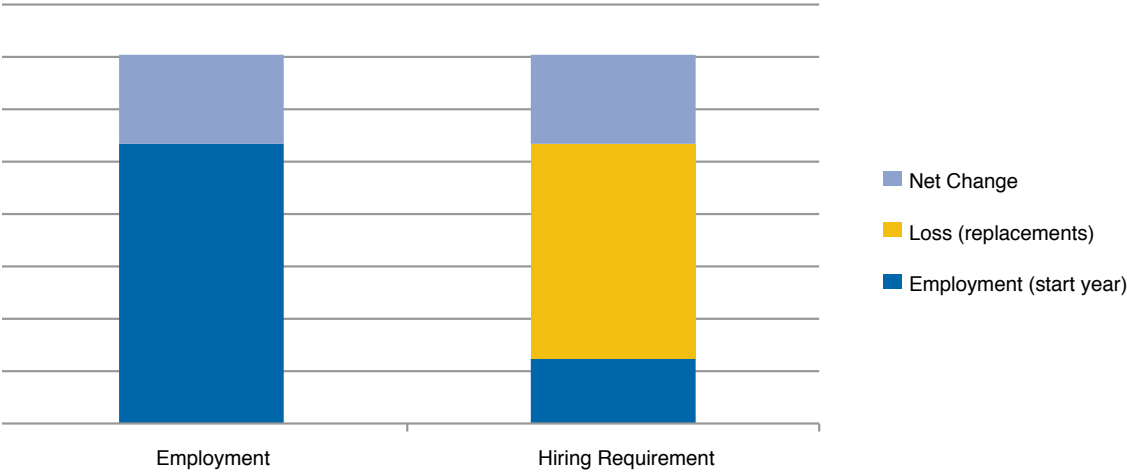
Hiring Requirements Forecasts

In this report, all scenarios are based on the "total workforce," to capture the best possible estimates of the industry's needs over the next 10 years. The ability to capture estimates of the commuter workforce decreases significantly with the inclusion of mineral exploration and support services, with highly mobile workforces, in the definition of the industry[4]. Estimates of total needs better illustrate the gaps Yukon faces in meeting future hiring requirements.

MiHR's hiring requirements forecasts are built on three scenarios – baseline, contractionary and expansionary. Under the baseline scenario, Yukon-specific commodity prices, mining GDP and labour productivity are aligned to various leading economic forecasts and industry intelligence to arrive at an expected projection of employment. The baseline scenario includes assumptions and industry intelligence on mine construction and advanced development activities. This scenario also takes a somewhat conservative approach, given the current climate of global economic uncertainty and forecasted commodity price corrections over the short term. Under the baseline scenario, modest overall growth is expected in the industry. The expansionary scenario assumes greater-than-expected growth, while the contractionary scenario assumes lower-than expected growth. Both expansionary and contractionary scenarios take into account historical economic trends, consensus forecasts of future trends, and are further supported by intelligence of Yukon's mining industry.

Cumulative Hiring Requirements

The cumulative hiring requirements over the next 10 years, shown in Table 1, are projected to be 2,900 workers under a baseline scenario; 4,260 workers in an expansionary scenario; and 1,360 workers in a contractionary scenario. In the first year of the forecast (2012) overall employment in mining is estimated at 2,675; mining extraction employment is estimated at 960; and exploration and support services employment is estimated at 1715.

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4 Due to the high mobility of Yukon's mining workforce, previous MiHR reporting presented hiring requirements forecasts for two cases: The "total workforce" accounted for both residents and non-residents of Yukon, and the "Yukon-based workforce" that only included residents of Yukon. This was done in order to gauge the extent that hiring requirements are stemming from the local needs versus pressures elsewhere.

Table 1—Cumulative Hiring Requirements Forecasts (Total Workforce) by Scenario*, 2013 to 2023

	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
		Retirement	Non-Retirement	
Contractionary	-240	520	1,080	1,360
Baseline	850	680	1,370	2,900
Expansionary	1,860	800	1,600	4,260

Source: Mining Industry Human Resources Council, Summer 2011.
*Note that numbers may not add perfectly due to rounding. Also note that hiring requirements do not translate to new job growth; they reflect net change in employment and replacements.

A year by year breakdown of the hiring requirements, under a baseline scenario, illustrated in Figure 11, reveals annual hiring needs that average to about 280 workers each year, with heavier requirements earlier, as advanced development projects come online and current projects ramp up to full production capacity over the short and medium term.

Figure 11—Annual Hiring Requirements Forecast, Baseline Scenario—2013-2023
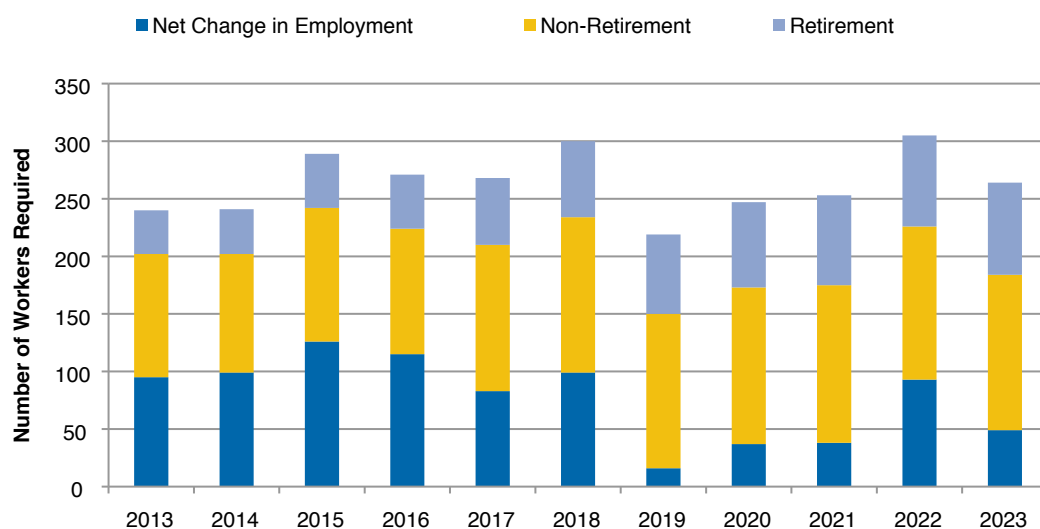
Source: Mining Industry Human Resources Council

Under all three scenarios, cumulative hiring requirements are positive over 2, 5, and 10 year outlooks as shown in Table 2.

Table 2—Cumulative Hiring Requirements, for Three Scenarios, 2, 5, and 10 Year Outlook

	Cumulative Hiring Requirements		
	2015	2018	2023
Contractionary	450	920	1,360
Baseline	820	1,830	2,900
Expansionary	1,000	2,650	4,260

Source: Mining Industry Human Resources Council

Hiring Requirements Forecasts by Occupational Category

Cumulative hiring requirements, under a baseline scenario are broken down by occupation to show the needs for key mining occupations over the next 10 years. Table 3 shows the greatest number of hiring requirements by far will be in *trades and production occupations*, followed by *supervisory and foreman* and then *technologist/technician* occupations. That said, high demand in terms of numbers does not necessarily translate to high concern or difficulty to find. For example, the need to hire over 200 *professional and physical science* workers may be more of a challenge or require longer term planning than other categories; given the education and job experience requirements needed to replace retiring workers in this category.

Table 3 – Hiring Requirements Forecasts by Broad Occupational Category (Total Workforce), Baseline Scenario*, 2013 to 2023

	2015	2018	2023
Trades and Production Occupations	515	1130	1785
Professional and Physical Science Occupations	55	130	200
Human Resources and Financial Occupations	20	50	80
Support Workers	55	125	200
Technical Occupations	75	155	240
Supervisors, Coordinators, and Foreman	85	180	290
All Other Occupations	15	60	105
Total	820	1,830	2,900

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding

Table 14 displayed in Section 6 shows hiring requirements for each key mining occupation, in column 1. High demand occupations include:

- Machine operators, mineral and metal processing
- Heavy equipment operators (except crane)
- Underground mine service and support workers
- Underground production and development miners
- Production workers in mineral and metal processing

However, high concern occupations may include the following:

- Geoscientists and technologists and technicians
- Laboratory technologists and technicians
- Mining engineers and engineering technicians

Hiring Requirements Forecasts by Industry Sector

Forecasts of hiring requirements were produced for each industry sector. These forecasts reveal unique trends in labour market conditions and illustrate each sector's unique response to economic conditions. The extraction sector is forecast to see modest, steady growth with corresponding positive hiring requirements over the next 10 years. The exploration sector is expected to see slight contractions over the short and medium term, in response to predicted price corrections and uncertainty amongst investors over the short term. This contraction translates to negative hiring requirements over the short term, with steady growth forecast over the longer term. The support services sector is expected to respond to the changing profile of the industry and adjust to economic conditions moving forward. The hiring requirement forecasts for this sector show modest growth in a baseline scenario over the forecast horizon.

To put into perspective the starting point for the forecasts presented above, Table 4 summarizes the estimated employment at the start of the forecast (2012) and the proportion of workers based in Yukon versus outside of the territory.

Table 4 – Summary of Estimated Yukon and Non-Yukon Based Employment in 2012, by Industry Sector

Industry Sector	Total Workforce in 2012	Est. Non-Yukon Workforce	Est. Yukon Workforce	Percentage of Yukon-based Workers
Extraction	960	470	490	51
Exploration	1065	745	320	30
Service	650	555	390	60
Total	2675	1770	1200	45

Source: Mining Industry Human Resources Council
Note: Given the industry sector definitions and classification schemes that constrain some of the data analysis, "exploration" and "support services" may include or exclude activities that the sector traditionally would categorize differently.

Extraction

In the extraction sector, which includes production mining activities and placer mining, net change in employment is expected to remain positive over all three scenarios as current producers continue to ramp up to full production capacity and advanced development projects come online over the short term. The cumulative hiring requirements over the next 10 years, shown in Table 5, are projected to be 1,480 workers under a baseline scenario; 3,190 workers in an expansionary scenario; and 1,340 workers in a contractionary scenario.

Table 5 – Cumulative Hiring Requirements Forecasts, Mining (Total Workforce), Baseline Scenario*, 2013 to 2023

	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
		Retirement	Non-Retirement	
Contractionary	500	280	560	1,340
Baseline	610	290	580	1,480
Expansionary	1,810	470	910	3,190

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding.

The cumulative requirements for the three scenarios over a 2-, 5-, and 10-year horizon are shown in Table 6.

Table 6 – Cumulative Hiring Requirements Forecasts, Mining (Total Workforce), Baseline Scenario*, 2015, 2018, 2023

	Cumulative Hiring Requirements		
	2015	2018	2023
Contractionary	560	1,270	1,340
Baseline	560	1,320	1,480
Expansionary	560	2,740	3,190

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding.

Employment is estimated at 960 in Yukon's extraction sector employment in the first year of the forecast (2012). Under the baseline scenario the industry will face hiring requirements that are one and a half times the size of the current workforce.

Mineral Exploration

In the exploration sector, new job growth is expected to stagnate somewhat over the next 10 years, in response to commodity price corrections and a cautious mood amongst investors in response to economic uncertainty. However, negative job growth will be largely offset by high replacement requirements driven by the age profile of the current workforce. The cumulative hiring requirements over the next 10 years, shown in Table 7, are projected to be 630 workers under a baseline scenario; 1,290 workers in an expansionary scenario; and a loss of 180 workers in a contractionary scenario. Employment is estimated at 1065 for Yukon's exploration sector in 2012.

Table 7 – Cumulative Hiring Requirements Forecasts, Exploration (Total Workforce), Baseline Scenario*, 2013 to 2023

	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
		Retirement	Non-Retirement	
Contractionary	-590	130	280	-180
Baseline	-40	210	460	630
Expansionary	420	280	590	1,290

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding.

The cumulative requirements for the three scenarios over a 2-, 5-, and 10-year horizon are shown in Table 8.

Table 8 – Cumulative Hiring Requirements Forecasts, Exploration (Total Workforce), Baseline Scenario*, 2015, 2018, 2023

	Cumulative Hiring Requirements		
	2015	2018	2023
Contractionary	-180	-400	-180
Baseline	100	210	630
Expansionary	260	690	1,290

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding.

Support Services for Exploration and Mining

The support services sector is expected to undergo a shift in activities over the forecast horizon that reflects the changing face of the industry, from predominantly exploration-focused services to more extraction supports. Job losses early in the forecast horizon are expected to be recouped as the sector adapts and steady growth is forecast over the long term. The cumulative hiring requirements over the next 10 years, shown in Table 9, are projected to be 780 workers under a baseline scenario; 940 workers in an expansionary scenario; and 210 workers in a contractionary scenario. Employment is estimated at 650 for Yukon Support Services for Exploration and Mining in 2012.

Table 9 – Cumulative Hiring Requirements Forecasts, Support Services (Total Workforce), Baseline Scenario*, 2013 to 2023

	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
		Retirement	Non-Retirement	
Contractionary	-150	120	240	210
Baseline	290	160	330	780
Expansionary	400	180	360	940

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding.

The cumulative requirements for the three scenarios over a 2-, 5-, and 10-year horizon are shown in Table 10.

Table 10 – Cumulative Hiring Requirements Forecasts, Support Services (Total Workforce), Baseline Scenario*, 2015, 2018, 2023

	Cumulative Hiring Requirements		
	2015	2018	2023
Contractionary	80	50	210
Baseline	170	300	780
Expansionary	190	390	940

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding.

Notable Trends

Yukon mining and exploration industry shares a large portion of its workforce with Northern BC and Alaska. Geoscientists, in particular, are more inclined to follow the geology in their activities as opposed to the political boundaries around that geology. Efforts to encourage local exploration businesses to establish and grow their companies in Yukon and follow the geology in Canada and around the world will ensure a skilled and experienced local workforce is ready for local opportunities.

Yukon exploration and mining industry faces many pressures that are a result of a high proportion of commuters in the labour force. Meeting the hiring requirements outlined here, with increasing the amount of commuters is not a long-term sustainable solution. Efforts are best focused on growing the local workforce. Future research and analysis on the social and economic impacts of fly in fly out operations and commuter workforces will better inform stakeholders' decision making in addressing the needs.

The support services sector is expected to undergo a transition or adjustment phase as the industry continues to move from predominantly exploration to more extraction focused in the decade ahead. This sub-sector is particularly sensitive to changes in economic conditions, particularly given the small size of most of its companies (many of them less than 15 employees). When taken as a group, this sub-sector represents an important segment of the labour force and new understanding of supports needed to ensure success of the industry's small and medium enterprises will ensure Yukon realizes the full potential of the support services sector.

5. Available Talent

5. Available Talent

A natural question, when faced with extreme demand pressures like those illustrated in Section 4, is: where is the industry going to find all the workers needed to address the hiring requirements? This is a complex question and to begin to understand the pressures, MiHR has developed a model of labour supply that projects the amount of talent that will be available to fill vacant roles over the forecast horizon.

Description of the Model

MiHR's model for Available Talent is provided for specific occupations identified to be critical to the mining industry. The model first projects, for each occupation, the pool of labour that the mining industry is expected to draw from, and then predicts the proportion that the industry will successfully attract in a given year. For example, of the total labour pool for all occupations in Yukon, there are an estimated 280 *Heavy Equipment Operators* available in 2023, and the mining industry is predicted to attract 39 per cent of them[5]. The share that the mining industry is predicted to attract is based on historic patterns, and reflects the industry's traditional capacity to attract and retain talent compared to all other industries drawing from that same occupation pool.

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5 The share that the mining industry is able to attract varies among occupations depending on how specific an occupation is to the mining industry; while the mining industry has historically attracted approximately 100 per cent of *underground mine service and support workers* and 39 per cent of *heavy equipment operators* from Yukon's labour pool, it has attracted only 13 per cent of *cooks*. The share of talent that an industry sector attracts is typically stable over time; as the mining industry attempts to increase its own share, competition from other industries is expected to intensify keeping mining's share from expanding in great proportions.

Forecasts of the labour pool were prepared for 66 mining-related occupations of interest (see Appendix C for a complete list). This list was then trimmed to 42 core occupations, given the unique mix of exploration and mining activities in Yukon (the territory does not employ anyone in some of the occupations that MiHR analysis tracks, given that it does not engage in downstream mineral processing activities seen elsewhere in Canada. In a given year, the forecast begins with the previous year's labour pool, and then considers the flows of workers projected to enter and exit during the course of the year. A detailed description of the model and its assumptions can be found in Appendix B.

The Labour Pool for Mining-Related Occupations

Entrants per year

Exits per year
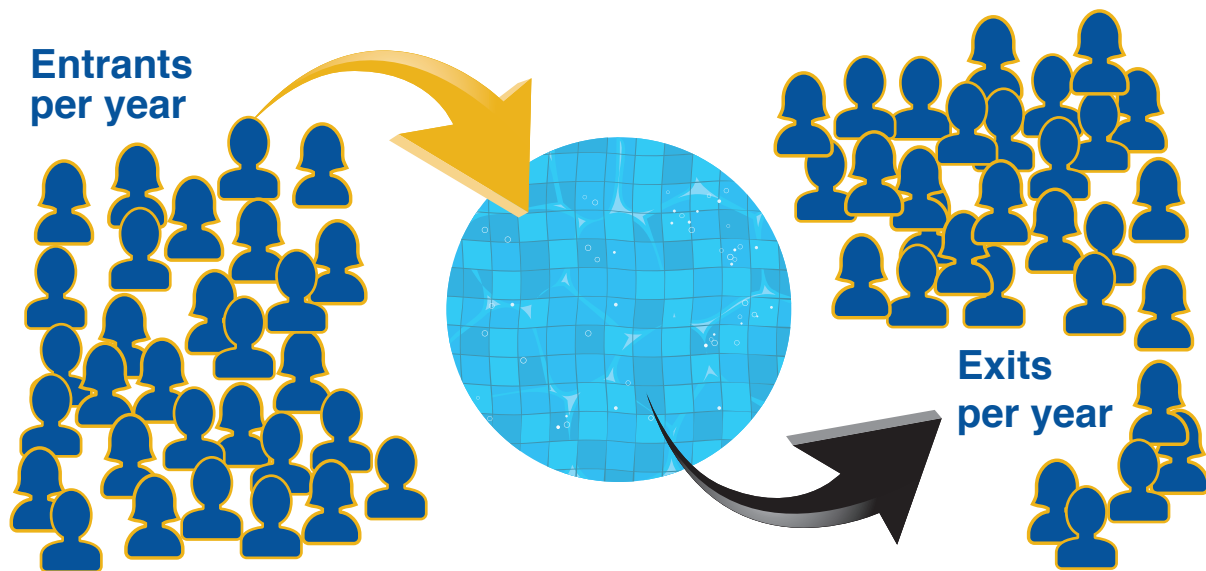
Entrants: The main sources of new entrants include individuals leaving high school or post-secondary school to join the workforce; individuals coming to Yukon from other countries (international migration) or other provinces (interprovincial migration); and "others" such as people changing occupations and those re-entering the workforce after a temporary absence.

Exits: The sources of labour force exits include individuals leaving Yukon to work in other countries or other provinces; workers who have retired; and "others," such as people changing occupations or those who fall ill, are disabled, or deceased.

Figure 12 illustrates the forecast of the labour pool for all key occupations combined (in yellow) and also shows the proportion that the mining industry is anticipated to attract, assuming a continuation of the historic trends (in blue). The figure seems to illustrate an increased flow of talent into the sector over the longer term. The forecasts capture known activities (education and training programs, economic conditions, and advanced development projects) that are expected to translate into a more attractive sector for job seekers, over time. Note, however, that these trends are merely indicators and not significant changes over time.

Figure 12– Forecast of the Labour Pool for Yukon's Mining-Related Occupations
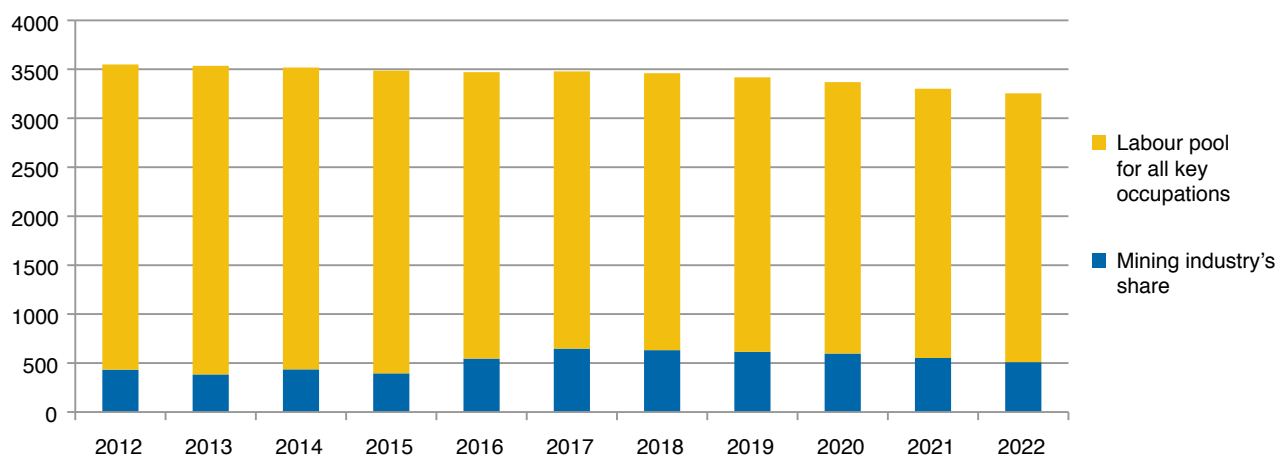
Source: Mining Industry Human Resources Council; The Conference Board of Canada

Available Talent Forecasts

Available talent forecasts describe the number of new entrants to the labour pool–in other words, the workers forecasted to be available to offset the industry's hiring requirements. Of course not all people entering into a mining-related occupation will enter the mining industry. For the key occupations considered in this report, MiHR estimates the entrants that will be available to all industries, and then estimates the share that the mining industry is expected to attract (based on historic flow of workers from these occupations into the mining industry).

Figure 13 shows the total labour pool in a given year, the segment that represents the 42 occupations considered in this report and mining's share of that segment. The mining industry's share is a portion of the workers in the 42 occupations, accounting for entries and exits that have occurred since the previous year.

The smaller arrow in the figure depicts mining's share of the new entrants. This is a smaller portion of the total available new talent for all sectors for the 42 occupations. MiHR's available talent forecast is the cumulative total of new entrants into the mining industry over the forecasting period.

Figure 13 – An Illustration of the Labour Pool and Available Talent
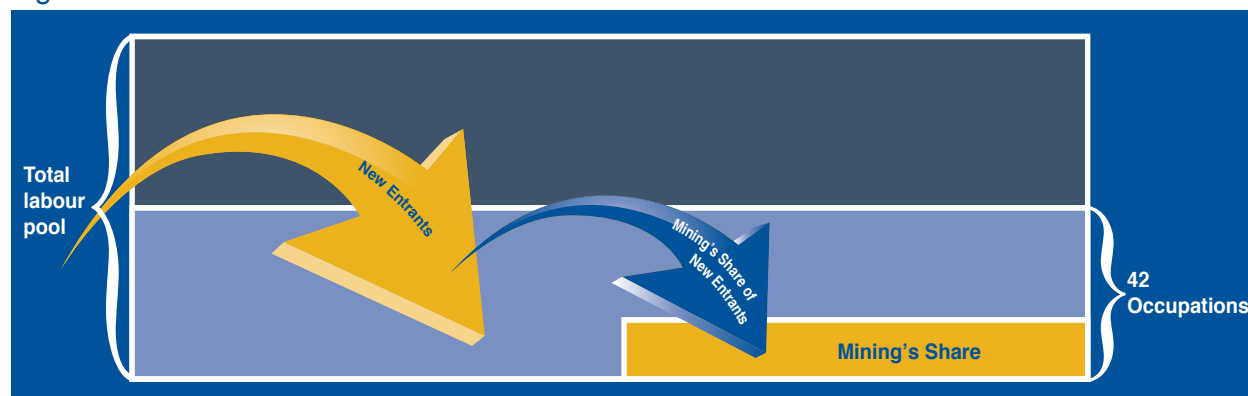
Assuming a continuation of past trends, MiHR has estimated the cumulative number of workers that the mining industry will attract over the next 10 years. (Note that these trends reflect a "status quo" assumption moving forward and are expected to change over time as new education and training programs and industry/education initiatives are introduced to address the currently projected gaps. It is therefore important to revisit the forecasts and gap analysis on a regular basis, to update assumptions and to track the impact of new initiatives on the gaps and analyses presented here.)

Table 11 shows the forecast of available talent over a 2-, 5- and 10-year time-horizon. Over the next 10 years, all three sectors are projected to gain approximately 1920 new entrants for all the selected occupations; the mining industry is projected to attract approximately 280 of these entrants to offset its hiring requirements over the next 10 years.

Table 11 – Cumulative Available Talent for All Key Occupations 2015, 2018, 2023

	2015	2018	2023
Total entrants for key occupations, all industry sectors	540	1080	1920
Mining's share of entrants for key occupations (assuming the historical rate for each occupation)	60	140	280

Source: Mining Industry Human Resources Council
*Note that numbers may not add perfectly due to rounding

A detailed list of all occupations and the associated cumulative share of available talent can be found in Table 14 (in the talent gap analysis section of this report).

Finding Talent in Mining-Related Occupations

The degree to which talent is difficult to find can vary between occupations. For the mining industry, finding talent for a particular occupation can become harder because (1) the labour pool for that occupation shrinks over time, and/or (2) the mining industry relies heavily on that occupation, and is thus sensitive to changes in its labour force.

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Some occupations—such as secretaries and cooks—can be found in many different industries other than mining, so the mining industry accounts for a "small" share of total employment in that occupation. As such, the mining industry has considerable opportunity to recruit needed workers from other industries. Other occupations—such as mining engineers—are very industry-specific, so their concentration in the mining industry is considered "high."

The relative supply pressures shown in Table 12 below do not take into account the demand for workers, or hiring requirements discussed in Section 3. Rather, this table illustrates the relative pressures felt on the talent pool (i.e., whether it is shrinking or growing and what that means for the mining industry). For some occupations such as *land surveyors*, the industry attracts fewer of the total labour pool, and fewer losses are expected to the overall size of the labour pool; in which case supply pressures are more positive for this occupation. For other occupations, such as *underground production* and *development miners*, the talent pool is shrinking and the industry attracts almost all of the workers in this occupation; so the shrinking talent pool will have an impact on industry employers.

Table 12—Labour Pool Pressures, Baseline Scenario to 2023

Losses in Size of Labour Pool			
	Low	**Medium**	**Large**
Low	Land Surveyors, Secretaries (except legal and medical)	Truck drivers, Cooks	Welders and related machine operators
Medium	Geological and mineral technologists and technicians, Geologists, geochemists and geophysicists, Mine labourers	Heavy equipment operators (except crane), Heavy-duty equipment mechanics	Chemical technologists and technicians
High		Primary production managers (except agriculture	Mining engineers, Underground production and development miners, Underground mine service and support workers, Supervisors, mining and quarrying

(Mining's Share is the row label on the left side.)

Source: Mining Industry Human Resources Council

Available Talent Forecasts by Industry Sector

Note that, a sector-specific analysis of available talent is possible to the extent that occupations are assumed to belong to a particular industry sector. For example, available talent for occupations such as underground miners will likely impact the production mining sector, while available talent for geologists are expected to impact the mineral exploration sector.

6. Talent Gap Analysis

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6. Talent Gap Analysis

Understanding the gap between hiring requirements and available talent is important, as it can inform development of targeted strategies and initiatives to fill the gaps. To this end, MiHR's gap analysis provides a side-by-side comparison of hiring requirements and available talent for the selected key occupations that are core to Yukon's industry. The gap analysis is shown below for all occupations combined, and then is broken-down for each separate occupation. A discussion on strategies for filling the gaps follows.

Table 13 shows the gaps between hiring requirements and available talent for the exploration and mining-related occupations combined. In the upper row, the available talent forecast for Yukon's mining industry is given for the next 2-, 5- and 10-years. To ensure appropriate comparison, the middle row provides MiHR's hiring requirements forecast for the key occupations over the next 2-, 5- and 10-years under a baseline scenario (estimated at just over 95 per cent of total hiring requirements). The bottom row is the difference between the upper and middle rows, and reveals the forecasted gap between hiring requirements and available talent.

The forecasts in Table 13 predict that the available talent will not be sufficient to meet the forecasted hiring requirements. Assuming "status quo" moving forward the industry is expected to attract only 280 new entrants to meet hiring needs of 2795 by 2023, leaving a shortfall of 2515 workers.

Table 13 – The Gap for the Selected 42 Occupations 2015, 2018, 2023

	2015	2018	2023
Mining's share of entrants for key occupations (assuming the historical rate for each occupation)	60	140	280
Hiring requirements for key occupations (assuming a baseline scenario)	805	1770	2795
The gap	-745	-1630	-2515

Source: Mining Industry Human Resources Council
*Note: To ensure appropriate comparisons, these figures do not include the full hiring requirements forecast, but rather only the forecasts for the key occupations tracked in the available talent forecasts

Occupational Gap Analysis

The nature of talent gaps varies among occupations. In some cases, there is an existing pool of talent and the industry must strive to attract more new entrants into mining careers (i.e., carve out a larger slice of the pie). In other cases, there simply aren't enough people in the talent pool to meet the industry's needs, let alone the demands from other industries (i.e., need to make the pie bigger). In all cases, the industry must strive to retain the workers already employed and make the best possible use of talent (e.g., through technology innovation, improved productivity, appropriate skills and knowledge development).

A talent gap can also have a different impact depending on the occupation. This is especially true for jobs that are highly specialized and require years of training and experience. A seemingly small gap can pose a challenge when there are only a few people with the specialized skills and experience to perform the role. The occupational gap analysis presented in this report provides gaps in terms of raw numbers, but the analysis should be balanced with the awareness that talent gaps illustrated do not directly translate to mission critical, or high concern gaps.

Table 14 shows the side-by-side comparison of hiring requirements and available talent for each occupation and shows that the size of the talent gaps varies among the occupations considered in this report. The first column shows MiHR's baseline estimates of exploration and mining employment in 2012, for each occupation. The second column shows the total available new talent for all industries by 2023. The third column shows the hiring requirements forecast over the next ten years assuming a baseline scenario. The fourth column shows the exploration and mining industry's share of the available new talent projected for all industries, based on historical trends. The fifth column shows the difference between the forecasted hiring requirements and available talent to reveal a potential gap in that occupation.

Occupations are grouped into broader categories. Among these categories, the *Technologist and Technicians* category collectively exhibits the largest gap between hiring requirements and available talent. The occupations in these categories are expected to face a greater challenge as available talent will not meet the predicted hiring requirements.

Table 14—Cumulative Occupational Breakdown of Hiring Needs and Available Talent, Baseline Scenario, 2013 to 2023

	Mining Employment 2012	Total Available New Talent – All Industries, 2023	Cumulative Hiring Requirements, 2023	Talent Availability – Mining's Share, 2023	Gap
TRADES AND PRODUCTION OCCUPATIONS					
Machine operators, mineral and metal processing	125	0	375	0	-375
Heavy equipment operators (except crane)	182	110	370	40	-330
Underground mine service and support workers	88	30	265	30	-235
Underground production and development miners	68	30	205	30	-175
Labourers in mineral and metal processing	217	0	140	0	-140
Construction millwrights and industrial mechanics (except textile)	39	10	120	0	-120
Industrial electricians	34	0	100	0	-100
Heavy-duty equipment mechanics	108	20	85	10	-75
Carpenters	20	280	60	0	-60
Drillers and blasters	239	0	25	0	-25
Welders and related machine operators	7	10	20	0	-20
Steamfitters, pipefitters and sprinkler system installers	3	0	10	0	-10
Plumbers	3	100	10	0	-10
PROFESSIONAL AND PHYSICAL SCIENCE OCCUPATIONS					
Geologists, geochemists and geophysicists	358	50	100	20	-80
Metallurgical and materials engineers	13	0	40	0	-40
Mining engineers	12	30	35	30	-5
Other professional engineers, n.e.c.	179	0	10	0	-10
Mechanical engineers	30	0	30	0	-30
Electrical and electronics engineers	5	0	15	0	-15
Geological engineers	2	0	5	0	-5
Biologists and related scientists	1	60	5	0	-5
Civil engineers	1	40	5	0	-5

	Mining Employment 2012	Total Available New Talent – All Industries, 2023	Cumulative Hiring Requirements, 2023	Talent Availability – Mining's Share, 2023	Gap
HUMAN RESOURCES AND FINANCIAL OCCUPATIONS					
Specialists in human resources	8	20	25	0	-25
Financial and investment analysts	8	0	25	0	-25
Human resources managers	10	20	15	0	-15
Financial managers	41	50	10	0	-10
Financial auditors and accountants	2	110	5	0	-5
SUPPORT WORKERS					
Administrative clerks	26	90	80	0	-80
Inspectors in public and environmental health and occupational health and safety	34	10	55	0	-55
Cooks	68	220	55	30	-25
Production clerks	3	0	10	0	-10
TECHNICAL OCCUPATIONS					
Chemists and laboratory technicians	92	0	100	0	-100
Geological and mineral technologists and technicians	364	80	40	30	-10
Land survey technologists and technicians	56	0	20	0	-20
Electrical and electronics engineering technologists and technicians	5	10	15	0	-15
Mapping and related technologists and technicians	54	20	10	0	-10
Mechanical engineering technologists and technicians	3	0	10	0	-10
SUPERVISORS, COORDINATORS, AND FOREMAN					
Supervisors, mineral and metal processing	47	0	140	0	-140
Supervisors, mining and quarrying	31	0	95	0	-95
Engineering managers	9	0	25	0	-25
Construction managers	6	10	20	0	-20
Primary production managers (except agriculture)	3	20	10	10	0

Source: Mining Industry Human Resources Council

Table 14 can be used to gauge the degree that the industry needs to change its historical share in order to meet its future hiring needs. For example, heavy equipment operators (except crane) have an available talent forecast of 110 – that is for all industries to draw from; of that number, the mining industry is projected to attract 40, or 36 per cent (based on historical patterns); however, the industry is projected to require 370, or well over 100 per cent of what is available to all industries.

The underlying details of an existing gap can also be devised from careful analysis of Table 14. In one case a gap exists, even though there are sufficient people that the mining industry can draw from. For example, *cooks* is forecasted to attract enough talent in all industries to support the needs of the mining industry. However, the mining industry has not historically attracted enough of the available talent to meet its hiring requirements. In these instances, the industry may aim to increase its own share of the available talent by competing with other industries. This may include a movement to create career awareness and career outreach with respect to those occupations.

In another case, there simply aren't enough people available to meet the industry's demands. For example the forecasted talent available for all industries for *heavy equipment operators*, *underground mine support workers*, and other production occupations is not sufficient to support the needs of the mining industry, even if the industry attracted 100 percent of the available talent. In this instance, the industry may work collaboratively with other industries, education, immigration and others to increase the available talent pool for all industries.

In all cases, negative gaps are forecasted. This trend indicates that pressures will be felt and initiatives are needed to address looming shortages in every occupation. An important element to addressing these gaps is to ensure that the industry strives to retain and make the best use of the talent it already has. Analyses provided here make the core assumption that the currently employed remain employed in Yukon's industry over the forecast horizon. Given the size and scope of the commuter workforce, labour market pressures elsewhere in Canada (and globally), and the transition the industry faces over the next decade as it builds production capacity, non-retirement separations may increase and new occupations appear, in which case the gaps noted here may underestimate the pressures that will be felt.

Figures 14 and 15 illustrate the gaps in *Trades & Production Occupations and Supervisors, Coordinators, Foreman Occupations* respectively. The graphs show that the gaps are largely being driven by substantial hiring requirements in both categories. While *Trades & Production Occupations* do have relatively more forecasted available talent, there is still not enough to offset the hiring requirements. *Supervisors, Coordinators, Foreman Occupations*, however, display very low projections for available talent.

PHOTO COURTESY OF THE GOVERNMENT OF YUKON

Figure 14 – Occupational Gaps in Trades & Production Occupations – Cumulative to 2023

A Machine operators, mineral and metal processing
B Heavy equipment operators (except crane)
C Underground mine service and support workers
D Underground production and development miners
E Labourers in mineral and metal processing
F Construction millwrights and industrial mechanics
   (except textile)
G Industrial electricians
H Heavy-duty equipment mechanics
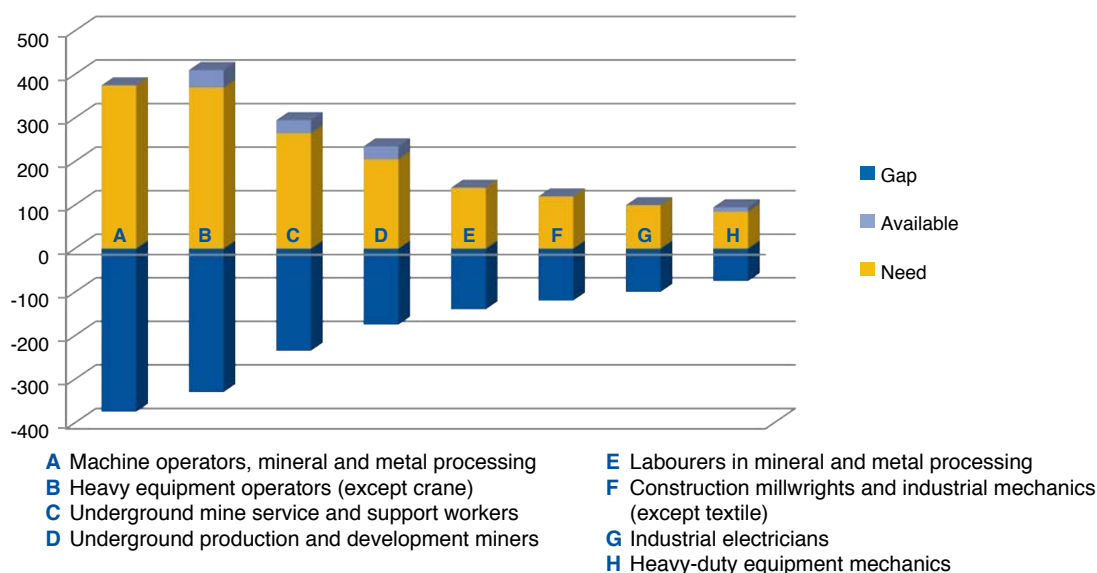
Source: Mining Industry Human Resources Council

Figure 15 – Occupational Gaps in Supervisors, Coordinators, Foremen – Cumulative to 2023

A Supervisors, mineral and metal processing
B Supervisors, mining and quarrying
C Engineering managers
D Construction managers
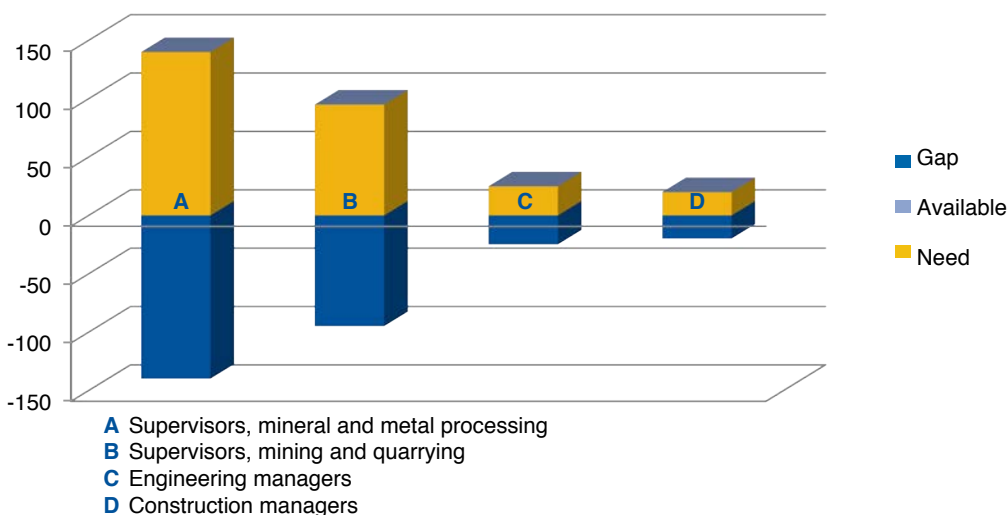
Source: Mining Industry Human Resources Council

Addressing the Gaps

Just as the nature of the talent gaps differ, so too do the strategies to address the gaps. There are many initiatives, partnerships, and programs that will ensure the industry is well positioned to meet its needs. Students can be encouraged to remain in the territory and work in the industry after graduation, perhaps even coordinating efforts with other industries, provinces/territories and countries. The mining industry could further grow the labour pool and optimize the existing workforce by developing the capacity to train workers in time to meet the escalating demand. Retraining and re-engaging the ageing workforce could delay impending retirements in mineral exploration enough so that new generations can acquire the skills and competence to maintain business operations.

Increase Mining's Share of Available Talent

Increasing the share of talent for any one industry is a difficult undertaking. As the labour market tightens, it becomes exponentially more difficult for a particular industry to attract more new entrants in the face of competition from other industries. In addition, the ability of the mining industry to attract talent from other sectors can be limited by unfavorable public perceptions about mining's social and environmental impacts. This includes factors related to working or living in remote locations (e.g. high cost-of-living, access to recreation and leisure activities, and the pressures of a "fly-in fly-out" lifestyle).

Elsewhere in Canada, tight labour markets have driven employers to offer more competitive salaries, increase benefits, and attempt to attract new talent with perks, bonuses, more vacation time and other incentives. While these strategies may result in short-term gains, they can be costly and not sustainable over the longer term. Employers may also look to compete for talent within their own local industry; but this essentially moves around talent that is already employed, as opposed to increasing an industry's share of new entrants to the labour force.

Growing the Labour Pool

In addition to attracting more talent from an available pool, mining industry stakeholders will need to increase the number of new entrants to Yukon's overall mining labour pool in order to meet forecasted hiring requirements. This will require stakeholders, (i.e. employers, educational institutions, government and associations) to coordinate their efforts to attract people at all entry points including: international and provincial migration; boosting education and training to increase the numbers of school graduates; re-attracting labour force leavers (such as retired workers) and attracting other entrants.

Education and Training

Education and training institutions are essential partners in the solution process. Initiatives to support and continue these important partnerships are a critical element in finding solutions. Yukon's mining industry has worked closely with territorial and local governments and training institutions to address workforce needs. In addition, mining stakeholders have invested in in-house training programs to develop the talent they need.

When planning to fill the talent gaps, it is important to take into consideration the time it takes to train and develop the needed experience to be fully competent on the job. Therefore, overcoming supply pressures might be challenging, or unfold over a longer time horizon than discussed here. For some occupations the ability to train and develop talent will be manageable if immediate action is taken (e.g., for underground mine service and support workers). For other occupations, a blend of short term and longer term solutions will be needed (e.g., professional geoscientists).

Workforce Optimization

Workforce optimization and strategic workforce planning ensure that the current workforce is well-tuned and functioning at its best, despite a tightening labour market. Workforce optimization analysis should not be confused with downsizing or other reactionary workforce adjustments. Rather, it is a joint analysis of workforce management, organizational design, technology, equipment, employee training and development, and business outcomes. The approach meant to ensure strategic planning and continuous improvement to support the existing workforce—encouraging communication and partnerships amongst all stakeholders.

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Over time, the ideal strategy for optimization can shift. For instance, fundamental changes in technology can have an impact on the mandatory skills of employees, causing the industry to refocus and identify which skills are necessary. In this case, educational institutions must adapt their programs with the industry needs. The main goal of optimization analysis and design is to ensure that challenges are identified early and all stakeholders are coordinated in addressing issues.

Retaining and Re-engaging the Ageing Workforce

Targeted efforts to retain mature workers will ensure that the knowledge and experience of older workers are properly transferred to new talent entering the industry. Yukon's exploration sector is already an attractive choice for young people starting geoscience careers, with challenging and promising properties and ore bodies to define and develop. Special efforts to retain and develop young people, through industry-education partnerships, mentoring and knowledge transfer programs, and re-engaging the ageing workforce will ensure that the wealth of knowledge and experience of retiring workers is passed along to the future workforce.

Next Steps

This report is intended to provide a foundation for understanding the unique labour market conditions and outlook for Yukon's mineral exploration and mining industry. Findings and gap analysis can be used to support and develop targeted solutions in a coordinated and strategic manner. That said, this research has highlighted several issues that warrant further study including:

- Better understanding of the social and economic impacts of a large commuter workforce.

- A broader understanding of the social and economic impacts of rapid industry growth and development on infrastructure, education and training, and communities—including a better understanding of the transition the industry will face in terms of the activities, supports, and structure of the labour force over time.

- Effective approaches and initiatives to attract youth and engage new workers from other provinces and countries—what career awareness, mentoring, and recruiting initiatives are possible and how will they address labour shortages.

- Adopting and adapting the national *Explore for More* industry brand—ensuring that the tools and resources that already exist for the national industry are developed and used within the unique context of Yukon.

- A thorough catalogue and analysis of the supports and services available to encourage and retain Yukon's small and medium sized enterprises that provide supports to the exploration and mining industry.

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- A detailed study and analysis of special populations of labour supply and barriers to inclusion in the industry, to ensure all sources of talent find opportunities in the industry. For example, women are a rapidly growing segment of Yukon's mining workforce and a young extraction sector has a rare opportunity to encourage women into trades and ensure that barriers to inclusion are eliminated early.

- Aboriginal peoples are an important segment of Yukon's mining workforce force; however they are generally employed in entry level positions—a better understanding of the "glass ceiling" for career progression, education and skills development of this important group will ensure that future vacancies in all occupation categories can be filled with local community workers.

- Immigration will be an important source of new talent for the industry. A detailed study on integration of immigrants into the industry and barriers to inclusion will help inform attraction campaigns and initiatives to attract Canada's new immigrants to Yukon (e.g., foreign credential recognition, language training, multicultural assessments, etc).

- Revisit forecasts and gap analysis on a regular basis to adjust for rapidly changing conditions and track progress of initiatives to address the gaps.

Summary

Demand for mining workers will be widespread, but some occupations will face greater supply pressures than others. The four occupations with the greatest labour pressures are: mining engineers, underground production and development miners, underground mine service and support workers, and supervisors (mining and quarrying). These occupations are not easily found in other industries and they are expected to experience large-scale losses. The occupations with the least labour pressures are: cooks, land surveyors and secretaries (excluding legal and medical). These occupations are widely found in industries outside of the mining industry and are expected to experience relatively low losses.

Labour market pressures have the potential to derail future progress of the recent economic growth in Yukon's mining industry. To meet its future needs, more workers from schools and other industries will need to be attracted into the mining industry. The territory must also ensure it can attract more workers to relocate from other provinces/territories and countries; and has the ability to train them to meet the industry's demand. In addition, efforts to retain or re-engage retiring workers will be part of the solutions. A combination of approaches is key to the future sustainability and success of the industry.

Appendices

Appendix A

Methodology

This appendix outlines the methodology used by MiHR to produce forecasts of hiring requirements in the mining industry. It also describes the various data that were required, along with the development of the forecasting models. A flowchart depicting this methodology is provided in Figure A1.

Forecasting models of employment were estimated based on the following six steps:

- Step 1: Collect and analyze data that may potentially explain changes in the number of jobs in each region.

- Step 2: Determine the driver(s) that explain the greatest level of variation in the number of jobs in each region by testing various model specifications through regression analysis.

- Step 3: Produce baseline, contractionary and expansionary forecasts for each driver determined in Step 2.

- Step 4: Combine Steps 2 and 3 to produce the forecasts for employment under baseline, contractionary and expansionary scenarios.

- Step 5: Produce forecasts of the total hiring requirements given the change in employment (determined in Step 4) and estimates of retirement and non-retirement separation rates.

- Step 6: Calculate and apply occupational coefficients to produce estimates of hiring requirements by occupation.

Several indicators were considered as explanatory variables for predicting employment.

MiHR's hiring-requirements forecasting model combines the effects of changes in commodity prices, growth of mining GDP, labour productivity, retirement rates, non-retirement separation rates and other economic variables to produce estimates of hiring requirements over the next 10 years.

MiHR partnered with Derome & Associates Management Consultants; Yukon Government, Advanced Education and Economic Development; and Yukon College, Centre for Northern Innovation in Mining for this report. Inputs were also collected from Yukon Producers' Group, and Yukon Chamber of Mines and their members. Partners and supporters gave inputs on the size and age profile of their workforces, turnover and separation patterns they observe, and discussions on other HR challenges and labour market issues they face. In addition, surveys were conducted of the producers, placer mining employers, exploration employers, and support services companies asking for inputs on the size and profile of their workforces and future hiring needs. Findings were used to verify and adjust employment estimates, validate forecasts and augment the assumptions for the forecast scenarios.

Figure A1

Employment and Hiring Requirements Forecasting Model

```
Step 1:                    Step 2:                         Step 3:
Data collection            Model development               Research and obtain
                           and testing                     forecasts of employment drivers
     │                          │                               │
     ▼                          ▼                               ▼
Collect and analyze        Test various model              Develop forecasts
potential drivers    ───▶  specifications and choose       of employment drivers
of employment              model that best explains        for each scenario
                           variation in employment
```

```
                           Step 4:                    Age distribution      Retirement age,
                           Produce forecasts of       of mining employees   by scenario
                           employment, by regions,
                           by scenario                        │                 │
                               │                              ▼                 ▼
                               ▼                         Retirement rate,
                           Changes in employment,        by year, by region,
Non-retirement             by year, by region,           by scenario
separation rate            by scenario
```

```
                           Step 5:                    Occupational
                           Hiring requirement,        breakdown in mining
                           by region, by scenario     industry by region
                               │
                               ▼
                           Step 6:
                           Occupational hiring
                           requirement forecast,
                           by region, by scenario
                               │
                               ▼
                           Aggregate Canadian
                           hiring requirements
```

◼ **Inputs**   ◼ **Outputs**

Source: Mining Industry Human Resources Council

MiHR's model of Available Talent for each occupation starts with the existing supply, adds in new entrants, and then subtracts people who leave. The model assumes three main sources of new entrants: school leavers, immigrants and "others"; the latter group consists generally of people who switch occupations or re-enter the workforce after temporarily leaving it. The model also assumes three paths of departure from the workforce of a specific province or territory: moving to another province/territory or another country; retiring; and leaving for other reasons, which include transferring to another occupation, temporarily leaving the workforce, disability or death.

Model Inputs and Assumptions

Model inputs come from a combination of sources. Due to the level of detail required for these analyses, it was necessary to use census data. The census is the most detailed source of employment data available from Statistics Canada. It provides the simultaneous breakdown of employment by industry, region, occupation and other required demographic detail. The major weakness of the census data is that it is compiled only once every five years and the most recent census data available is from 2006. As such, the forecast for supply data begins in 2007. Where possible, more recent data (e.g., from the Labour Force Survey) is incorporated into the forecast, to verify and validate the estimates from 2007 to 2011. Forecasts, particularly cumulative counts, are for the 2012 to 2023 period only.

Employment by Occupation

MiHR generates estimates of employment, retirements and "other" exits by occupation, as part of its hiring-requirements forecasts. Employment outlooks for each occupation in mining were tied to MiHR's employment forecasts. Employment estimates for each occupation in other industry sectors were tied to The Conference Board of Canada's provincial forecasts for non-mining sectors.

Employment by occupation is used to help estimate migration patterns in the model. Employment for each occupation is divided into two categories: the mining industry and other industries. The census data provides information on the starting points of these two series. The mining portion of employment is taken from MiHR's mining-employment forecasts, and employment for all other sectors is taken from The Conference Board of Canada's employment forecasts. These results are then summed to generate total employment by occupation.

The underlying assumption behind this methodology is that occupational employment in the mining sector will grow at the same pace as the entire mining industry, and that occupational employment outside of the mining sector will grow at the same pace as the rest of the economy. This is a reasonable assumption, as it implies that the share each occupation has—both within the mining sector and within the rest of the economy—will remain constant.

Migration

Net international migration forecasts are based on estimates of net international migration for Canada by occupation, taken from Human Resources and Skills Development Canada's (HRSDC's) Canadian Occupational Projection System (COPS) model. Yukon's share of international-migration flows, relative to the national average, is based on the relative strength of Yukon's labour market.

Net interprovincial migration is based on the balance of inflows and outflows of workers in a particular occupation in Yukon, relative to the Canadian average. This assumes that a surplus of workers (a "soft labour market") leads to net outward migration, while a lack of workers (a "tight labour market") leads to a net inflow of workers to the province. According to modelling done by The Conference Board of Canada (CBoC), the unemployment rate in a region is an important determinant of migration flows, and the gap between supply and demand is a proxy for the unemployment rate for each occupation.

The forecasts of employment by occupation are used to generate net migration estimates for each occupation. Interprovincial and international immigration by occupation is known from the 2006 census. To forecast immigration, the share of immigrants by occupation, relative to total immigration, is kept constant over the forecast period, and applied to the CBoC's provincial forecast for immigration by province. This is done for both interprovincial and international immigration.

This methodology incorporates the relative mobility of each occupation into the forecast. Occupations where people have historically been less likely to move will continue to display this characteristic and those with historically higher levels of mobility will continue to behave in a similar manner. As well, by tying the forecast to the CBoC's existing forecasts for provincial immigration, this methodology incorporates a measure of the attractiveness of a region. The CBoC's forecasts are dependent on the relative tightness of a region's labour markets and its historic ability to attract migrants.

School Leavers

The forecast of school leavers is generated using two methods. The first method is based on the occupation's historic ability to attract people leaving school; if a certain share of the population under the age of 25 has historically entered a particular occupation, it is assumed that the share of entrants will remain similar going forward. Thus, the number of new entrants depends on the age profile of the territory's workforce. School graduation figures and forecasts for specific occupations are also considered.

Second, to estimate the number of school leavers by occupation, the educational attainment of workers aged 25 to 34 is used to establish the education profile for each occupation. The 2006 census provides the most recent data on the number of workers by age group, occupation, and highest certificate, diploma or degree obtained. This information is combined with demographic data for the territory to estimate the number of school leavers per occupation. An estimate of how attractive a particular occupation is to school leavers is also applied for each occupation. Finally, estimates of how many school leavers will enter the workforce every year are created. School-leaver estimates are calculated for three broad levels of education: high school diploma or lower; trade, college or other post-secondary education below the bachelor's degree level; and university degree.

Retirements

Retirement leavers are estimated using MiHR's forecasted retirement rates by province and territory. Consistent with MiHR's existing model, the retirement rate is assumed to be the same across all occupations. Retirement rates are forecasted by first estimating the probability that an individual will retire from the labour force in a given time period. This will depend on many factors, most notably the individual's age and educational background. This behavioural estimation is then applied to the mining labour force, capturing its unique demographic characteristics.

Other Entrants

The last group of new entrants is the "other" category, which largely consists of new people entering from other occupations or re-entering the workforce. Given the degree of training required for many of these occupations, it is very likely that these entrants would be already trained in that occupation. For simplicity, the number of new entrants is assumed to be a certain percentage of the existing labour force. This rate is set equal to the "other" leavers' rate that MiHR uses as part of its existing models and is constant across occupations for a particular province. In this manner, "other" entrants are precisely equal to and offset "other" leavers.

Other Leavers

Other leavers include people moving to other occupations, people temporarily leaving the workforce, and mortality. The leavers' rate is sourced from MiHR's existing models. The model then assumes equilibrium in "other" labour mobility, thus the model matches "other" exits with "other" entrants.

Appendix C

This appendix lists the North American Industry Classification Codes (NAICS) and National Occupational Classification for Statistics (NOC-S) codes used throughout this report to define the mining industry. MiHR is engaged in ongoing, iterative research to include more NOC-S codes in this definition of the sector and to better capture Statistics Canada data related to the mining-industry workforce.

Industry Definition and Scope

Statistics Canada, the main source of Canada's labour market information, uses two different coding systems to classify data: the North American Industry Classification System (NAICS) and the National Occupational Classification for Statistics (NOC-S). Both systems provide a hierarchical structure that divides higher-level categories into more detailed categories in order to group similar establishments and individuals.

NAICS codes are used by statistical agencies throughout North America to describe economic and business activity at the industry level. The system features a production-oriented framework where assignment to a specific industry is based on primary activity, enabling it to group together establishments with similar activities.

The NOC-S system was developed by Statistics Canada and Human Resources and Skills Development Canada (HRSDC) to provide standardized descriptions of the work that Canadians perform in the labour market. NOC-S codes organize labour-force participants according to the nature of work they perform, thereby enabling similar occupations to be grouped. NOC-S codes are specific to Canada.

There is no single NAICS code that directly corresponds to all phases of the mining cycle (which includes exploration, development, extraction, processing and reclamation). Similarly, there is no single set of NOC-S categories that pertain to only mining. People employed in occupation groups that are prevalent in mining also work in a variety of other industries. Together, the NAICS and NOC-S systems provide a means for grouping statistics to obtain estimates of employment and workforce demographics using Statistics Canada data sources. A full description of both classification systems can be found on Statistics Canada's website.

The Mining Sector, Industry Classifications

MiHR has defined the sector according to the following NAICS codes, thereby providing the best correspondence between the industry's main primary and processing activities as defined by Natural Resources Canada. The NAICS codes that define the mining industry include:

- NAICS 2121: Coal mining. This industry group comprises establishments primarily engaged in mining bituminous coal, anthracite and lignite by underground mining, and auger mining, strip mining, culm bank mining and other surface mining.

- NAICS 2122 Metal ore mining. This industry group comprises establishments primarily engaged in mining metallic minerals (ores). Also included are establishments engaged in ore dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served or at mills, such as custom mills, operated separately.

- NAICS 2131 Support activities for mining and oil and gas extraction. This industry group comprises establishments primarily engaged in providing support services, on a contract or fee basis, required for the mining and quarrying of minerals and for the extraction of oil and gas. Establishments engaged in the exploration for minerals, other than oil or gas, are included. Exploration includes traditional prospecting methods, such as taking ore samples and making geological observations at prospective sites.

- NAICS 3311: Iron and Steel Mills and Ferro-Alloy Manufacturing. This industry group comprises establishments primarily engaged in smelting iron ore and steel scrap to produce pig iron in molten or solid form.

- NAICS 3313: Alumina and Aluminum Production and Processing. This industry group comprises establishments primarily engaged in extracting alumina.

- NAICS 3314: Non-Ferrous Metal (except Aluminum) Production and Processing. This industry group comprises establishments primarily engaged in smelting, refining, rolling, drawing, extruding and alloying non-ferrous metal (except aluminum).

- NAICS 2123 Non-metallic mineral mining and quarrying. This industry group comprises establishments primarily engaged in mining or quarrying non-metallic minerals, except coal. Primary preparation plants, such as those engaged in crushing, grinding and washing, are included.

- NAICS 5413: Architectural, engineering and related services. This industry group comprises establishments primarily engaged in providing architectural, engineering and related services, surveying and mapping, laboratory and on-site testing, and specialized design services. Note that only a portion of this NAIC code relates to Geosciences, Surveying and Mapping, and Assay Laboratories)

Occupation Classification

Listed on the following pages are the 66 NOC-S codes that MiHR uses to define the occupations that are essential to the exploration and mining sector. Note that the occupation titles listed below are those used in the Statistics Canada system. Often an occupation can have multiple titles and Statistics Canada offers a means to map or connect job titles back to the proper NOC-S code, found on the Human Resources and Skills Development Canada website (specifically the "Quick Search" box)[6].

For example, a "Quick Search" for "Haul Truck Driver—underground mining" shows that this occupation maps directly to "Underground mine service and support workers". The site will also show which job titles are listed for each occupation category. For example "Heavy equipment operators (except crane)" include job titles such as: apprentice heavy equipment operator; heavy-duty equipment operator; heavy equipment operator; operating engineer, heavy equipment; ripper operator – heavy equipment; shovel operator – heavy equipment; spreader operator – heavy equipment; stacker operator – heavy equipment.

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6 See http://www5.hrsdc.gc.ca/NOC/English/NOC/2011/Welcome.aspx

NOC Code	Title
A111	Financial managers
A112	Human resources managers
A121	Engineering managers
A371	Construction managers
A381	Primary production managers (except agriculture)
B011	Financial auditors and accountants
B012	Financial and investment analysts
B021	Specialists in human resources
B211	Secretaries (except legal and medical)
B541	Administrative clerks
B573	Production clerks
B575	Dispatchers and radio operators
B576	Transportation route and crew schedulers
C012	Chemists
C013	Geologists, geochemists and geophysicists
C015	Other professional occupations in physical sciences
C021	Biologists and related scientists
C031	Civil engineers
C032	Mechanical engineers
C033	Electrical and electronics engineers
C034	Chemical engineers
C041	Industrial and manufacturing engineers
C042	Metallurgical and materials engineers
C043	Mining engineers
C044	Geological engineers
C048	Other professional engineers.
C054	Land surveyors
C111	Chemical technologists and technicians
C112	Geological and mineral technologists and technicians
C121	Biological technologists and technicians
C131	Civil engineering technologists and technicians
C132	Mechanical engineering technologists and technicians
C133	Industrial engineering and manufacturing technologists and technicians
C134	Construction estimators
C141	Electrical and electronics engineering technologists and technicians
C153	Drafting technologists and technicians
C154	Land survey technologists and technicians
C155	Mapping and related technologists and technicians
C162	Engineering inspectors and regulatory officers
C163	Inspectors in public and environmental health and occupational health and safety
G412	Cooks
H013	Contractors and supervisors, pipefitting trades
H016	Contractors and supervisors, mechanic trades
H111	Plumbers
H112	Steamfitters, pipefitters and sprinkler system installers
H121	Carpenters
H212	Industrial electricians
H326	Welders and related machine operators

H411	Construction millwrights and industrial mechanics (except textile)
H412	Heavy-duty equipment mechanics
H611	Heavy equipment operators (except crane)
H621	Crane operators
H622	Drillers and blasters - Surface mining, quarrying and construction
H711	Truck drivers
H812	Material handlers
H821	Construction trades helpers and workers
H822	Other trades helpers and workers
I121	Supervisors, mining and quarrying
I131	Underground production and development miners
I141	Underground mine service and support workers
I214	Mine workers
J011	Supervisors, mineral and metal processing
J111	Central control and process operators, mineral and metal processing
J121	Machine operators, mineral and metal processing
J125	Inspectors and testers, mineral and metal processing
J311	Workers in mineral and metal processing

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