Yukon Mining Sector

Methodology for Calculating Emissions Intensity

Reporting for 2024

Yukon

Introduction

The Yukon *Clean Energy Act* sets a target for Yukon mining sector greenhouse gas emissions intensity in the year 2035 and beyond at 45 per cent below the emissions intensity of a baseline period. The legislation states the emissions intensity baseline is the average of the emissions intensities for the years 2014 to 2023. Beginning in 2025, the Minister of Energy, Mines and Resources must report annually on the emissions intensity baseline and the emissions intensity for the year immediately preceding the year in which the report is made.

The Government of Yukon worked with a consultant and the Yukon mining industry to identify how emissions intensity will be defined and calculated. This document describes the methodology that was developed and used for the 2024 reporting year.

Defining Emissions Intensity

Emissions intensity is a measure of greenhouse gas emissions per unit, where the units are a particular measure of the amount of mining activity. It is important that the units used be representative of the level of mining activity and that data exist to quantify the units.

$$\textit{Mining emissions intensity} = \frac{\textit{Total greenhouse gas emissions}}{\textit{Units of mining activity}}$$

Mining activities are different for each of the quartz, placer and post-production and abandoned mines sub-sectors, reflecting the diversity of the Yukon's mining industry. The following units have been used to calculate emissions intensity:

- For the quartz sub-sector, the units are metric tonnes of total material moved, including both ore and waste rock. This enables comparison of different types of quartz mines, regardless of type of mineral mined or mining process used.
- For the placer sub-sector, the units are fine troy ounces of gold and are based on the quantities of gold reported to the Yukon government's mining recorders offices.
- For the post-production and abandoned mines sector, the units are litres of water treated. This metric is directly related to post-production and abandoned mining activity and is recorded by the agencies responsible for mine caretaking and reclamation.

Only the emissions produced by the mine's activities at the mine site (known as Scope 1 emissions), are included in the total greenhouse gas emissions.

The Yukon's main electrical grid relies predominantly on hydroelectricity. Consequently, mines that are connected to the grid produce fewer greenhouse gas emissions than mines that use diesel to generate electricity on site. The Government of Yukon credits quartz mines that are grid-connected for the reduction in their emissions over what their emissions would have been, had they been generating electricity at their mine-site. The credit works by making the achievement of the target easier for grid-connected mines. The credit only applies to quartz mines.

For mines that were connected to the grid during the baseline period, their hypothetical greenhouse gas emissions - had they used an on-site generator to produce electricity - are included in the total greenhouse gas emissions for each baseline year. This increases the baseline emissions intensity to the level that would have been observed if all mines were off-grid. As a result, currently operating mines that are grid-connected are helped to achieve the 45 per cent reduction target even if they were connected to the grid during the baseline period.

Data Sources

Units of mining activity

Data on the level of mining activity and fuel used in each sub-sector are collected from the Government of Yukon, Government of Canada and Canadian Securities Administrators' System for Electronic Document Analysis and Retrieval (SEDAR)[1]. The relevant agencies and the data held by them are summarized in the table below:

Agency	Division	Data	Source
Government of Yukon	Department of Energy, Mines and Resources, Mineral Resources Branch, Mining Recorders Office	• Raw troy ounces of placer gold reported[2]	• Royalty reports
	Department of Energy, Mines and Resources, Minerals Resources Branch	• Types and quantities of fuel used • Quantity of material moved • Quantity of electricity purchased and generated	• Quartz Mining Licensees' annual reports to the branch
	Department of Energy, Mines and Resources,	• Types and quantities of fuel purchased • Quantity of water treated	• Extracts from financial management data sets for sites

[1] The Canadian Securities Administrator's System for Electronic Document Analysis and Retrieval (SEDAR) is a secure, web-based system used by all market participants to file, disclose and search for information in Canada's capital markets. SEDAR+ Landing Page

[2] The purity of raw gold varies among Yukon creeks, with gold extracted from some creeks only 65 per cent pure and gold extracted from other creeks as pure as 90 per cent. An average gold fineness of 80 per cent (the same factor used by the Yukon Geological Survey) was used to adjust gold volumes from crude troy ounces to fine troy ounces. The number of fine troy ounces of gold produced has been used in the emissions intensity calculations for placer mines.

	Abandoned Mines Branch		maintained by the branch
	Department of Finance, Tax Administration Branch	• Quantity of tax-exempt fuel reported for quartz, placer, and some post-production mines	• Collected through the Fuel Oil Tax Exempt Permit Program
Government of Canada	Crown Indigenous Relations and Northern Affairs Canada, Northern Contaminated Sites Program - Yukon Region	• Types and quantities of fuel purchased • Quantity of water treated	• Extracts from financial management data sets for sites maintained by the regional program
	Environment and Climate Change Canada	• Government of Canada Emission Factors and Reference Values	• Table 4.2 – Emission factors for refined petroleum products for 2025
	Environment and Climate Change Canada	• Government of Canada Global Warming Potentials	• Intergovernmental Panel on Climate Change 100-Year Time Horizon Global Warming Potentials for Carbon dioxide, Methane and Nitrous oxide
SEDAR	Public financial filings	• Quantity of total material moved for quartz mines	• Mining company annual reports

The greenhouse gases used in the calculation and reporting of the emissions intensity are carbon dioxide, methane and nitrous oxide. Reporting occurs in units of carbon dioxide equivalency (CO_2e), a measure used to compare the emissions from various greenhouse gases based on their global-warming potential, by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. Conversion factors are based on Environment and Climate Change Canada Emissions Factors and Global Warming Potentials.

Methodology for Calculating Baseline Emission Intensities

The Department of Energy, Mines and Resources' Energy Branch calculated the baseline emission intensities for each mining sub-sector in 2025. This is a one-time only calculation, and its results will be used to measure progress in future years.

Quartz Mines

For each year a quartz mine had a production license for a full calendar year in the Yukon from 2014-2023 inclusive, the Energy Branch completed the following steps to calculate baseline emissions for the quartz mining sub-sector:

1. Compiled all fuel volumes to be included in Scope 1[3] emissions.
    - Data sources:
        i. One-time direct survey data. This data was collected by a third party to help develop the methodology for calculating the quartz baseline emissions intensity.
        ii. Mineral Resources Branch Quartz Mine Licence reporting. The Yukon government began collecting this data in 2022.
        iii. Yukon Government Tax Administration Branch data. This was only used when no other data was available. The Mineral Resources Branch Quartz Mine Licence data is preferred because it contains fuel *used* annually, whereas the Tax Administration Branch data contains fuel *purchased* annually and may not reflect the volume of fuel *used* annually.
2. For mines that were connected to the grid, converted kilowatt hours (kWh) of electricity purchased to an equivalent litres of fuel, using the 2023 Watson Lake average diesel generator efficiency factor of 719.2 g CO_2e per kWh as a proxy for mine-site generator efficiency. The Watson Lake diesel generator system has similar characteristics to the diesel generators that would most likely have been used at the mine sites existing during the baseline period, had they been generating their power on-site.
    - Data source:

[3] Scope 1 greenhouse gas emissions are produced by the mine activities at the mine site. Scope 2 emissions are those generated indirectly from the consumption of purchased electricity.

i. Annual ATCO Electric Yukon reports to Government of Yukon Department of Environment, Climate Change Secretariate.

3. Added fuel volumes from Step 1 and 2 together.
4. Transformed total fuel volumes to greenhouse gas volumes using standardized greenhouse gas emissions factors for carbon dioxide, methane and nitrous oxide based on Government of Canada Emissions Factors. Applied Government of Canada Global Warming Potentials to convert all greenhouse gases to carbon dioxide equivalency (CO_2e).
    - Data source: Government of Canada Emission Factors and Reference Values
    - Data source: Government of Canada Global Warming Potentials
5. Compiled an inventory of total material moved.[4]
    - Data source: SEDAR annual filing up until 2022, after which data became available from the Quartz Mining Licence reports.
    - Quartz Mining Licence reports from 2022 onwards.
6. Divided the annual total greenhouse gas emissions carbon dioxide equivalent by the annual total material moved, to calculate the intensity for the year.
7. Calculated the average for all annual intensity results for the years each mine was in full operation, for the baseline period. This results in an average baseline for each mine.
8. Averaged the results from Step 7. This results in an average baseline for the quartz sub-sector.

Placer Mines

Due to the complexity of the placer mining data, the Energy Branch hired a contractor to calculate the placer sub-sector baseline emissions intensity. The only fuel data available was fuel purchase data from the Yukon government's Tax Administration Branch and this data was only available starting in 2017, due to the Yukon government's data retention policy for confidential data records. Therefore, the placer sub-sector baseline is a seven-year average rather than a ten-year average. The methodology for the placer sub-sector is described in detail in the technical memo,

[4] Total material moved equals the waste rock and ore that is moved each year.

"Yukon Placer Mining Industry — Baseline Greenhouse Gas Emissions Intensity"[5] produced by the consultant in June 2025. In broad terms, the consultant employed the following method:

From 2017 to 2023 inclusive:

1. Compiled all fuel volumes and resulting greenhouse gas emissions of carbon dioxide, methane, and nitrous oxide from Yukon placer entities.
    - Data source: Government of Yukon Tax Administration Branch
2. Transformed total fuel volumes to greenhouse gas volumes and total CO_2e.
    - Data source:
        i. "2020 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions", published by the British Columbia Government in 2021 (available from https://www2.gov.bc.ca/assets/gov/environment/climatechange/cng/methodology/2020-pso-methodology.pdf).[6]
3. Compiled a total inventory of ounces of gold reported in each year of operation by company, during the baseline period. Adjusted gold volumes from crude troy ounces to fine troy ounces using an average gold fineness of 80%.
    - Data source: Mining Recorder Offices' Records from Dawson City, Mayo and Whitehorse
4. Combined the results of Step 2 and Step 3 into one data set using company names that are similar enough to reasonably assume they are the same entity[7].
5. Divided the total greenhouse gas emissions carbon dioxide equivalent by the ounces of gold reported, for each mining entity in each year.

[5] Vector Research, "Yukon Placer Mining Industry – Baseline Greenhouse Gas Emissions Intensity", June 2025.

[6] See Vector Research, "Yukon Placer Mining Industry – Baseline Greenhouse Gas Emissions Intensity", Page 2 for the specific emissions factor table.

[7] The names that companies use to report their gold production to the mining recorders' offices may vary over time (they may be under an individual's name, or their company's name and the name of their company may change), therefore they are not necessarily the same names used to apply for a fuel tax exemption permit number. Therefore, to ensure that the emissions from fuel purchased to produce gold are divided by the corresponding ounces of gold reported, the data sets must be compared and merged into another data set that contains both fuel purchased and gold reported under one name.

6. Removed mining entities from the data set produced in Step 4 for each year that they reported less than 50 ounces of gold, or where the consultant determined the intensity to be an outlier.
7. Calculated the average for each mining entity of all the annual intensity results for the years the mine was in full operation, during the baseline period. This resulted in an average baseline for each mine.
8. Calculated the average of all the placer mines' emissions intensities using the results from Step 7. This resulted in an average baseline for the placer sub-sector.

Post-Production and Abandoned Mines

For each year a mine has been classified as post-production or abandoned in the Yukon, and had active work on-site[8], from 2014-2023 inclusive:

1. Compiled all fuel volumes purchased for on-site work.
    - Data sources:
        i. Crown Indigenous Relations and Northern Affairs Canada, Northern Contaminated Sites Program - Yukon Region
        ii. Department of Energy, Mines and Resources, Abandoned Mines Branch
2. Transformed total fuel volumes to greenhouse gas volumes using standardized greenhouse gas emissions factors based on Government of Canada Emissions Factors. Applied Government of Canada Global Warming Potentials to convert all greenhouse gases to carbon dioxide equivalency (CO_2e)
    - Data source: Government of Canada Emission Factors and Reference Values
    - Data source: Government of Canada Global Warming Potentials

[8] There is no data for post-production and abandoned mines without active work on-site.

3. For each mine, compiled an inventory of total volume of water treated.
    - Data sources:
        i. Crown Indigenous Relations and Northern Affairs Canada, Northern Contaminated Sites Program - Yukon Region
        ii. Department of Energy, Mines and Resources, Abandoned Mines Branch
4. Divided the annual total greenhouse gas emissions carbon dioxide equivalent by the corresponding annual volumes of water treated.
5. Calculated the average for all annual intensity results for the years the mine was classified as post-production or abandoned and had active work on-site, during the baseline period. This resulted in an average baseline for each mine.
6. Calculated the average of all post-production and abandoned mines emissions intensities using the results from Step 5. This resulted in an average baseline for the sub-sector.

Methodology for Reporting Annual Emission Intensities

Quartz Mines

Starting in 2024, and for each subsequent year, for each quartz mine that has a production license for a calendar year in the Yukon:

1. Compile all fuel volumes to be included in Scope 1[9] emissions.
    a. Data sources:
        i. Mineral Resources Branch Quartz Mine Licence greenhouse gas reporting (This data source is the preferred source because it contains fuel used annually, whereas the Tax Administration Branch data contains fuel purchased annually and may not reflect the volume of fuel used annually.)
        ii. Yukon Government Tax Administration Branch (only use this data if data from (i) is unavailable).
2. Transform total fuel volumes to greenhouse gas volumes using standardized greenhouse gas emissions factors based on Government of Canada Emissions

[9] Scope 1 greenhouse gas emissions are produced by the mine activities at the mine site. Scope 2 emissions are those generated indirectly from the consumption of purchased electricity.

Factors. Apply Government of Canada Global Warming Potentials to convert all greenhouse gases to carbon dioxide equivalency (CO_2e)

   a. Data source: Government of Canada Emission Factors and Reference Values

   b. Data source: Government of Canada Global Warming Potentials

3. Compile an inventory of total material moved[10]

   a. Data sources:

      i. Quartz Mining Licence reports.

      ii. SEDAR annual filing (If total material moved is not available from (i) than it may be available from SEDAR).

4. Divide the annual total greenhouse gas emissions carbon dioxide equivalent by the annual total material moved, to calculate the intensity for the year.
5. Calculate the average for all the quartz mines using the results from Step 4.
6. Calculate the percentage difference in emissions intensity from the baseline for the sub-sector.

Placer Mines

Starting in 2024, and for each subsequent year:

1. Compile all fuel volumes recorded for Yukon placer entities.
   - Data source: Government of Yukon Tax Administration Branch
2. Based on total fuel volumes, calculate greenhouse gas volumes emitted using standardized greenhouse gas emissions factors based on Government of Canada Emissions Factors. Apply Government of Canada Global Warming Potentials to convert all greenhouse gases to carbon dioxide equivalency (CO_2e)
   - Data source: Government of Canada Emission Factors and Reference Values
   - Data source: Government of Canada Global Warming Potentials
3. Compile a total inventory of ounces of gold reported for the year by company. Adjust gold volumes from crude troy ounces to fine troy ounces using an average gold fineness of 80%.

[10] Total material moved equals the waste rock and ore that is moved each year.

- Data source: Mining Recorder Offices' Records from Dawson City, Mayo, Watson Lake and Whitehorse

4. Combine the results of Step 2 and Step 3 into one data set using company names that are similar enough to reasonably assume they are the same entity [11].
5. Divide the total greenhouse gas emissions by the fine troy ounces of gold from Step 3, for each mining entity for the year.
6. Remove mining entities from the data set produced in Step 4 if they reported less than 50 ounces of gold, or if the intensity is determined to be an outlier. To maintain consistency with the baseline outlier boundaries, use the outlier boundary calculation method described in the Vector Research Technical Memo, "Yukon Placer Mining Industry — Baseline Greenhouse Gas Emissions Intensity", Page 4.
7. Calculate the average emissions intensity for the placer sub-sector by averaging the remaining mining entities' emissions intensity.
8. Calculate the percentage difference in emissions intensity from the baseline for the sub-sector.

Post-Production and Abandoned Mines

Starting in 2024, and for each subsequent year, for each mine that has been classified as post-production or abandoned in the Yukon:

1. Compile all fuel volumes purchased for on-site work.
    - Data sources:
        i. Crown Indigenous Relations and Northern Affairs Canada, Northern Contaminated Sites Program - Yukon Region
        ii. Department of Energy, Mines and Resources, Abandoned Mines Branch

[11] The names that companies use to report their gold production to the mining recorders' offices may vary over time (they may be under an individual's name, or their company's name and the name of their company may change), therefore they are not necessarily the same names used to apply for a fuel tax exemption permit number. To ensure that the emissions from purchased used to produce gold are divided by the corresponding ounces of gold reported, the data sets must be compared and merged into another data set that contains both fuel purchased and gold reported under one name.

2. Transform total fuel volumes to greenhouse gas volumes using standardized greenhouse gas emissions factors based on Government of Canada Emissions Factors. Apply Government of Canada Global Warming Potentials to convert all greenhouse gases to carbon dioxide equivalency (CO_2e)
    - Data source: Government of Canada Emission Factors and Reference Values
    - Data source: Government of Canada Global Warming Potentials
3. For each mine, compile an inventory of total volume of water treated.
    - Data sources:
        i. Crown Indigenous Relations and Northern Affairs Canada, Northern Contaminated Sites Program - Yukon Region
        ii. Department of Energy, Mines and Resources, Abandoned Mines Branch
4. Divide the annual total greenhouse gas emissions carbon dioxide equivalent by the corresponding annual volumes of water treated.
5. Calculate the average of all post-production and abandoned mines emissions intensities using the results from Step 4.
6. Calculate the percentage difference in emissions intensity from the baseline for the sub-sector.

Yukon Mining Sector-Wide Emission Reductions

1. Compile total greenhouse gas emissions from each sub-sector (Note: Not on an intensity basis). Calculate a percentage for each sub-sector of the total mining sector emissions (i.e. placer CO_2e emissions are X% of total mining emissions).
2. Multiply the percentages calculated in 1 by the three annual difference percentages calculated in the previous annual methodologies.
3. Sum together for a weighted, mining sector-wide emissions reduction figure.