# MiQ Emissions Calculator Methodology

The purpose of this document is to outline the methodology used in the **MiQ Emissions Calculator**. The tool helps an operator to determine their bottom-up inventory. Assumptions and emissions factors are outlined below.

**Disclaimer:** The tool is for the purpose of guiding operators on what to expect for MiQ. It is to be treated as a screening tool for demonstrative purposes only. There may be applicable emissions sources not included in this tool. **All methane emissions must be quantified** to a minimum level of facility specificity dependent on the source type, as outlined in the MiQ Standard for Methane Emissions Performance. For North American operators, many currently used source type calculations meet the minimum requirements for MiQ and are utilized in this tool. Note, all emissions and leaks identified through advanced monitoring requirements under MiQ must also be quantified and reconciled in an Operator's emissions inventory.

This tool is not suitable for use to determine preparedness to other regulatory requirements or voluntary initiatives. There are additional quantitative steps and completeness checks required if a company wants to apply for MiQ certification to have their performance certified. Refer to MiQ.org for specific guidance.

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## Pneumatic Instruments Venting

The tool uses device counts by high bleed, low-bleed, or intermittent bleed applying a published emission factor.

As per MiQ guidance, operators should be using the emission factor-based method using an actual inventory of each type of pneumatic device and an emission factor representative of the vent rate and actuation frequency of the device.

| Jurisdiction | Emission Factor Reference in the Tool |
|---|---|
| United States | Proposed GHG Rule[2], Table W-1A to Subpart W of Part 98 |
| Alberta | Manual 015[4] factors, Table 20<br>Low bleed – Fisher 4660<br>Intermittent bleed – Fisher 4150<br>High bleed – Fisher L2 0-15 actuating |
| British Columbia | BC WCI[5], Table 360-5 |

## Pneumatic Pump Venting

The tool uses device counts applying published emission factors.

As per MiQ guidance, operators should be using an engineering calculation using count of devices and default or manufacturer-specific emission factors.

| Jurisdiction | Emission Factor Reference in the Tool |
|---|---|
| United States | Proposed GHG Rule[2], Table W-1A to Subpart W of Part 98 |
| Alberta | Manual 015[4] factors, Table 24 |
| British Columbia | BC WCI[5], Table 360-5 |

## Combustion Unit Emissions

Combustion equipment in the tool assumes equipment where fuel is consumed such as:

- Boilers, Line Heaters, Treaters, Catadyne Heaters
- Generators
- Turbines
- Engines

As Canadian emission factors for methane combusted are derived from EPA AP-42, it is assumed these emission factors are consistent across jurisdictions.

Operators should be estimating or metering fuel consumption for each individual unit and inputting the fuel volume by equipment type into the form. Emissions factors applied are in t/GJ where a default Higher Heating Value (HHV) per facility type is incorporated. Operators should include specific gas composition data where available.

See **AB GHG Quantification Methodologies**[3] Chapter 1, Table 1-3 for emission factors converted to metric units.

## Dehydrator Venting

As per MiQ guidance, dehydrator vents should be calculated with engineering estimates or simulation modelling.

The tool assumes this value is known applying a generic vent calculation to the volume, incorporating the concentration of methane in the gas stream. Operators should include specific gas composition data where available.

## Compressor Seal Venting

The tool utilizes default compressor seal vent rates. If seal vents are measured, an operator can override the emission factor providing justification in column I of the “Inputs and Outputs” tab.

See **AB GHG Quantification Methodologies**[3] for default compressor seal vent factors in Alberta and BC under Chapter 4, table 4-6A. For reciprocating compressors, the number of seals/throws should be input on the “Emission Factors and Defaults” tab as emission factors for reciprocating compressors are per hour, per throw, per compressor unit. For centrifugal compressors, seal vent rates are per hour per compressor.

See **Subpart W**[1] for default compressor seal vent rates in US. Emissions factors are per compressor unit. Section 98.233(o)(10) provides an emission factor for centrifugal wet seal compressors and Section 98.233(o)(10) for reciprocating units. There are no changes in methodology under the Proposed **US EPA GHG Rule**[2], therefore emissions factors are derived directly from the existing regulation. Emission factors for the US are converted from standard cubic feet (scf) to cubic meters ($m^3$) using a conversion factor of 35.315 scf/$m^3$.

See **NGSI Methane Intensity Protocol**[6], Table 3, for the centrifugal dry-seal compressor emission factor for the US. Emission factor was converted to volume applying a methane density of 0.6785 kg/m3.

See factors utilized below:

| Jurisdiction | Emission Factor Reference in the Tool |
|---|---|
| United States | Subpart W[1], Section 98.233(o)(10) and Section 98.233(o)(10) and NGSI[6] Table 3 |
| Alberta | AB GHG Quantification Methodologies[3] Chapter 4, Table 4-6A |

| | |
|---|---|
| British Columbia | AB GHG Quantification Methodologies[3] Chapter 4, Table 4-6A |

## Flaring Emissions

For **associated gas flaring**, **and well testing flaring** the operator should input the number of flares, or events. The calculation assumes a gas-to-oil ratio at the well and utilizes the oil production volume input by the operator to calculate a volume.

Default gas-to-oil ratios are provided per facility type. If a more specific value is known, it should be overwritten in cell D6 on the "Inputs and Outputs" tab.

For general **flare stack emissions**, an engineering calculated, or metered, volume should be input into the tool.

A default destruction efficiency of 98% is utilized and can be overwritten in cell A35 of the "Emission Factors and Defaults" tab. Provide justification in column I of the "Inputs and Outputs" tab if over-riding this default value.

## Tank Venting

The tool provides a default Gas-in-solution factor for **hydrocarbon storage tank** venting. A GIS factor differs from the GOR in that it represents the ratio of gas that is remaining in the solution post separation. The tool then utilizes the oil production volume input by the operator to calculate a volume.

Default gas-in-solution ratios are provided per facility type. If a more specific value is known, it should be overwritten in cell D7 on the "Inputs and Outputs" tab. Operators should include specific gas composition data where available.

For **produced water tanks** the tool assumes the volume is calculated by the operator and applies a general vent calculation for methane emissions. Operators should include specific gas composition data where available.

For screening purposes, for produced water tanks, operators should utilize an emission-factor based calculation using an emission factor representative of related conditions (salt conc) and practices along with the volume of produced water handled.

More detailed methodology for methane accuracy includes simulation modelling, tank vent measurements and performing tank vent compositional analysis.

## Associated Gas Venting and Flaring

Associated gas venting is treated the same way as associated flaring in the tool, as noted above. The Gas-to-oil ratio is applied along with annual oil production to determine vented volumes.

Operators should input specific gas composition information, a GOR value and actual oil production providing justification of the source of information when over-riding default values.

## Venting Events

All non-routine venting events should be captured for MiQ methane intensity. These volumes should be calculated based on number of events, duration, and estimated volumes. The tool assumes the operator has these values calculated and utilizes a generic vented methane emissions calculation. The operator should include specific gas composition data where available.

See MiQ guidance for event-specific methodology requirements. These are shown in a table on the “Instructions” tab.

Examples of non routine vents that should be captured include:

- Compressor and vessel Blowdowns
- ESD Plant-wide blowdowns
- Pigging
- Well vent liquids unloading
- Well workovers/completions
- Compressor Starts
- Pressure relief valve (PSV) upsets
- Associated Gas venting
- Well drilling vents

## Fugitive Emissions

The tool assumes published component counts for fugitive leak quantification based on each jurisdiction. This is for screening purposes only. MiQ certification requires two levels of monitoring, which may lead to the discovery of fugitive emissions: Source Level and Facility Scale (aka site level) monitoring. If an operator knows their actual leak rates, the volume can be overwritten in the leaking sources table of the “Inputs and Outputs” tab. This source can alternatively be entered as a miscellaneous source in the bottom table of the “Inputs and Outputs” tab.

For screening purposes, if an operator wants to see an estimated impact on more frequent OGI surveys, they can leave the leaks blank and enter the number of surveys per year. The tool will calculate an estimated reduction in leaks as increased monitoring would theoretically lead to the discovery and repair of leaks resulting in reductions.

Also, for US jurisdictions, the operator should input whether the fugitive's methodology being used is strictly based on components counts or based on surveys where alternative factors are provided in the regulation.

Factors Utilized are shown below:

| Jurisdiction | Emission Factor Reference in the Tool |
|---|---|
| United States | Proposed GHG Rule[2], Table W-1E to Subpart W of Part 98* |
| Alberta | Manual 015[4] factors, Table 26** |
| British Columbia | BC WCI[5], Table 360-1*** |

**Factors assume all components gas service converted from scf/hr to m3/hr. Where if you survey then column "using any of the methods in § 98.234(a)(1) through (6)" is used and if component counts are used then column "using Method 21 as specified in § 98.234(a)(7)" is used*
***Factors assume sweet gas 0-1000ppm converted to volume [m3/hr] applying a gas density of 0.723 [kg/m3]*
****Factors assume fuel gas converted to kg and then volume [m3/hr] applying a gas density of 0.723 [kg/m3]*

## Other

The tool highlights potential emission sources that may be applicable to the operation. If an alternative emission source is known, MiQ requires it be captured. In other words, **all** emission sources of methane are to be captured. The "other" table allows for a miscellaneous entry of any source that is not provided in the tool inputs.

## Reconciliation

Reconciliation of emissions is a quantitative assurance process required to ensure a more complete emissions estimate that adequately covers the complete distribution of emission rates. The process cross-references the results of top-down inspections by an operator, typically completed also to meet the Facility-Scale requirements of MiQ certification, and quantified emissions with a bottom-up inventory to ensure an operator's Methane Intensity falls within a designated MiQ Grade band.

If reconciliation is performed the variance factor realised can be input into Cell D20 of the "Inputs and Outputs" tab. This will adjust the total methane emissions accordingly.

## References


1. Subpart W: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-W/section-98.233
2. Proposed US EPA GHG Rule: https://www.epa.gov/system/files/documents/2022-04/revisions-and-confidentiality-determinations-for-data-elements-under-the-greenhouse-gas-reporting-rule.pdf

3. Alberta GHG Quantification Methodology: https://open.alberta.ca/dataset/5d79b86b-7811-413f-88d8-acd36cb9d6d2/resource/bf059e7e-29ba-4a78-8bee-6e97871faada/download/aep-alberta-greenhouse-gas-quantification-methodologies-version-2-2-2021-12.pdf
4. Manual 015: https://static.aer.ca/prd/documents/manuals/Manual015.pdf
5. BC WCI 2012: https://www2.gov.bc.ca/assets/gov/environment/climate-change/ind/quantification/wci-2012.pdf
6. NGSI Methane Intensity Protocol: https://www.eei.org/-/media/Project/EEI/Documents/Issues-and-Policy/NGSI_MethaneIntensityProtocol.pdf?la=en&hash=8A2A2B5D4F237F65533229871B743988EE37917B