

TGD – Purging and venting, starts and stops and other process and maintenance vents

SG Approved

Brief description of the source

Venting is the intentional release of gas (or methane-containing vapors) to the atmosphere, typically required by the design, operation, construction and commissioning, or maintenance of the equipment. This can come from a variety of sources and can either be continuous or intermittent. Partner companies are responsible to ensure that all vented emissions source (as defined in the system boundary below) are covered and reported under this source category.

Following is a non-exhaustive list of potential venting and purging points and processes, which are not covered by other TGDs:

- Equipment blowdown, purging and starts, including
 - Separator or vessel blowdown
 - Pipe and pipeline blowdown
 - Compressor and compressor station blowdown
- Well testing
- Drilling mud degassing
- Associated gas venting (not including well casinghead gas venting)
- Venting of off-gases or waste gases
- Venting just before flare ignition
- Desiccant dehydrators
- Acid gas removal
 - Amine absorption
 - Membrane separation
 - Pressure swing adsorption
- Gas releases during sampling
- Refueling of methanol units
- Venting from tanks (tanks not covered by Unstabilized Liquid Storage tanks TGD, such as stabilized condensate, LNG, diesel, naphtha, or other liquids/compounds storage tanks)
- Tank truck and rail tank car filling
- Purging - Process for safely removing air or inert gas from pipework and/or pipeline components and replacing it with gas, or the reverse process.¹

System boundaries

Emissions from vents which are covered by source-specific TGDs, are to be quantified according to these TGDs. All unintended and unexpected, or abnormal sources of methane emissions (including leaks and Incidents and malfunctions) are also not considered under this TGD and should be reported separately (*Leaks TGD* and *Incidents and malfunctions TGD*). Any vented emissions which are sent to a flare fall under that category (*Flaring TGD*) and any emissions redirected towards productive use are not considered here. All remaining methane emissions from venting, purging, starts and stops and other process and maintenance vents are to be reported herein.

Emissions from construction and commissioning can be reported under *Venting*, depending on company practices or local regulation.

¹ Marcogaz glossary

Guidance on materiality is presented in the *General principles TGD*.

Level 3 Quantification Methodologies

Emission factors

Accepted source-level emission factors, as defined in the *General Principles TGD*, or those prescribed by local regulation are considered as providing Level 3 estimates, provided they are specific for the source type. Practitioners are encouraged to use emission factors that best represent conditions and practices at their facilities and adjust factors, where warranted, to more accurately estimate emissions given differences between the reference system on which the emission factor is based, and their systems.

The following references provide example emission factors for a wide range of vented sources and can be used to quantify methane emissions at level 3.

- API Compendium – Section 5
- Default national emission factors (e.g. US EPA²)
- Academic papers

It is important to note that this list is non-exhaustive and that all vented sources might not be covered by the references provided above. If no emission factor is available in the literature for a specific emission source, the emission factor of a similar source or reasonable estimate can be used based on the Partner's best judgement.

Manufacturer estimates

For routine vents coming from commercial equipment, manufacturer estimates can be used to quantify methane emissions at Level 3.

Simple engineering calculations

Simple engineering calculations, specific to the emission source, can be used to quantify methane emissions at Level 3.

Example for vents from oil gas separators

For vents from oil-gas separators, an equation of state, using the Vasquez-Beggs equation, can be used to quantify methane emissions.

Activity data

Venting events can be random, periodic, or regular. For all types of venting events, it is recommended that operating records are maintained to accurately represent events. Their frequency and their duration, or other relevant activity data required by the available emission factor, can be logged to determine the total annual duration of venting for each event or type of event.

For continuous events, the annual hours of operation can also be used to determine annual duration.

For recurring similar events, the duration of a representative sample of events can be taken and multiplied by the frequency of the type of event over the year to determine total annual duration.

² For example, emission factors for mud degassing U.S. EPA, 1977. Atmospheric Emissions from Offshore Oil and Gas Development and Production. Office of Air Quality Planning and Standards, Research Triangle Park, NC. PB272268.

Level 4 Quantification Methodologies

Depending on the emission source, measurements, measurement-based emission factors, process simulation and/or engineering calculations, as detailed below, can be accepted for level 4 quantification.

Direct measurement and Measurement-based Emission factors

Measurements (including continuous and periodic monitoring) or emission factors developed based on representative measured emissions are considered Level 4 emissions quantification. Measurements must be taken that represent the total flow of each gas stream that is vented to atmosphere.

Level 4 emission factors should be based on measurements conducted on a representative sample. Type of vent and other relevant characteristics should be considered in determining 'like' systems that carry a common emission factor. Each system that is not 'like' will require determination of a separate emission for that system based on the appropriate measurement studies. For guidelines on the methodology to develop a statistically representative sample, please refer to the [Uncertainty and reconciliation guidance].

The general principal to level 4 quantification of methane emissions from vents is to quantify:

- Gas flow
- Methane content
- Duration of the event (purge, vent, blowdown, ...)

Methane emissions from gas venting for each emission category is the multiplication of these three elements.

Gas flow

Accepted equipment and techniques, as defined in the *General Principles TGD*, for determining gas flow are to be employed. Practitioners are encouraged to select an appropriate measurement device depending on the characteristics of the vent. Following are typical equipment to measure emissions from vents, but the list is not exhaustive^{3 4}:

- Vane anemometer
- Hotwire anemometer
- Turbine meter
- Electronic packing vent monitor
- Calibrated vent bag
- Coriolis meter
- Orifice meter
- Hi-flow sampler
- Thermal mass meters

Some measurement techniques allow direct measurement of total methane emissions, in which case, it is not necessary to measure methane content separately to quantify emissions.

Methane content

³ More details on various detection and measurement equipment can be found at CCAC, *Conduction Emissions Surveys, Including Emission Detection and Quantification Equipment – Appendix A of the OGMP Technical Guidance Document*, 2017

⁴ More details on various detection and measurement equipment can be found at Marcogaz, *Assessment of methane emissions for gas Transmission and Distribution system operators*, 2019 – Section 7 (p. 34-39)

It can be necessary to determine the methane content of the gas flow to quantify methane emissions from venting. Depending on the vent, the methane content can differ from the average methane content of the facility.

Accepted equipment and techniques, as defined in the *General Principles TGD*, for determining methane content can be employed. In cases where the gas characteristics can be assumed to meet a regulated specification, methane content can be determined in accordance with the *General Principles TGD*.

Frequency and duration of venting events

Venting events can be random, periodic, or regular. For all types of venting events, it is recommended that operated records are maintained to accurately represent events and can be considered similarly to the methodology described for Level 3 Activity Data.

Engineering calculations, process simulation and models

Accepted engineering calculations, process simulations and models, as defined in the *General Principles TGD*, which do not rely on default emission factors or values can be considered as Level 4 quantification methodologies.

Example for blowdowns

For example, emissions from system, equipment or pipeline blowdown can be calculated using volume, pressure drop and temperature data, specific to the equipment or pipeline being depressurized.

$$\frac{p_i * V_i * T_f}{p_r * T_i} = V_f$$

Where:

p_i = Initial pressure of the equipment/system

p_r = Remaining pressure of the equipment/system (generally, atmospheric pressure)

T_i = Initial temperature of the gas being released (kelvin)

T_r = Temperature of the gas after being released (generally, atmospheric temperature) (kelvin)

V_i = Physical volume of the vented equipment or system (m^3)

V_f = Volume of gas released (scm)

Where applicable, standard/normal/atmospheric conditions for the vented equipment or system may be considered (typically, atmospheric pressure and 0 or 20°C atmospheric temperature)