

OGMP 2.0 Technical Guidance Document:

Methane emissions from natural gas transmission systems

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Acknowledgements: The report was co-developed with OGMP 2.0 members through a dedicated taskforce and approved by members.

Methane emissions from transmission systems

The aim of this TGD is to provide more guidance on the quantification and reporting of methane emissions from transmission systems.

Introduction

Natural gas transmission system refers to the large gas infrastructure used to transport natural gas at high pressure from entry points (such as from gas production and processing facilities, international connections and LNG regasification terminals) to exit points (such as distribution networks, industrial consumers or liquefaction terminals). The OGMP 2.0 reporting of transmission systems is divided into the following asset types:

- **Transmission pipelines:** High-pressure welded steel pipelines, which are often buried underground.
- **Transmission stations:** Reduction & regulating stations, measurement stations, valve stations, manifolds, receiving stations, block valve stations, pigging stations, etc. The OGMP 2.0 team encourages members to report all aboveground sites (other than compressor stations) under this asset type. In the case that the OGMP 2.0 member decides to report one or more of these types of sites with the transmission pipelines, a clarification needs to be added in the asset description.
- **Transmission compressor stations**

The following sections present the principal challenges encountered by transmission system operators and detail the approaches they are adopting to meet the requirements of the OGMP 2.0 framework using a risk-based approach.

In the case of transmission pipelines and transmission stations, the challenges are mainly related to the reconciliation process and level 5 reporting, while in the compressor stations mainly due to the quantification of the passing valves found at the vent stack.

OGMP 2.0 requires the creation of a measurement-based emissions inventory for the material assets. This inventory is primarily based on Level 4 reporting (direct source-level measurements, measurement-based emission factors, detailed engineering calculations, and simulation tools) complemented by site-level measurements. The purpose of the reconciliation between source-level inventory (Level 4) and site-level measurements is to ensure that all potential sources have been detected and accurately characterized, clearly attributed and included in the inventory. The Level 5 estimate is defined as the best estimate of annual emissions from an asset, including ALL sources of methane emissions.

Transmission pipelines

According to the data from assets reported at Levels 4 and 5, the main sources of methane emissions from transmission pipelines are:

- **Vents due to operation and maintenance events, and commissioning & decommissioning activities** – These are intentional releases of gas to the atmosphere.

This source of emissions is normally reported at Level 4 based on detailed engineering calculations. For additional guidance, please refer to the Purging and venting, starts and stops TGD.

- **Vents due to incidents or emergencies** – These are unplanned events, which are not part of routine operations. They can be due to equipment failure, over pressurization beyond valve limits, human error, damages or other causes, such as extreme weather events or acts of sabotage.

Following is a non-exhaustive list of potential incidents or incident causes, which are reflected in the Incidents and malfunctions TGD:

- Mishaps/dig-ins of pipelines
- Unstabilized hydrocarbon and LNG spills
- Blowouts
- Breakage, rupture or fatigue
- Explosion/Boiling Liquid Expanding Vapor Explosion (BLEVE)
- Fire
- Third party damages
- Emissions from corroded components
- Flare flame-out/cold flaring
- Construction defect/material failure
- System failure (e.g., overpressure)
- Emergency venting to avoid equipment malfunction
- Climate impact (e.g. floods, lightning strike)

Transmission systems often have cathodic protection, which is normally complemented by preventive pipeline integrity management systems, such as monitoring of flows, pressure and temperature (in the SCADA systems), pigging inspection campaigns, walking detection surveys and/or flyover/driving inspections. All these measures contribute to significantly reducing the risk of having incidents from transmission pipelines, and they are frequently required in the national regulations.

This is reflected in the EGIG database¹. The overall failure frequency over the period 1970-2022 is 0.277 incidents per year per 1,000 km, while in the five year

¹ EGIG, a cooperation between a group of nineteen major gas transmission system operators in Europe to gather data on the unintentional releases of gas in their pipeline transmission systems, collects incident data on 150 thousand km of pipelines every year:

<https://www.egig.eu/overview>

moving average failure frequency in 2022 is 0.101 per year per 1,000 km. Over the last ten years, corrosion, external interference, ground movement and construction defects, represent 25.7%, 22.8%, 19.3% and 17.5% respectively of the pipeline incidents reported.

For additional guidance on how to report this source at Level 4, please refer to the Incidents and malfunctions TGD.

- **Flaring** - Mobile flares are frequently used to mitigate operation and maintenance vents. Flaring is material in some of the transmission pipelines reported. Should members contract the mobile flare service to a third party, the methane DRE² should be provided by the contractor. If the contractor is not providing it, an average DRE of 98% can be assumed. For additional guidance, please refer to the Flaring TGD.

Vents from transmission pipelines, as well as operations with mobile flares, are known sources of methane emissions. Members are responsible for ensuring that all these events and operations are recorded, quantified, and reported.

- **Fugitives** – It is unusual to find leaks in high-pressure welded steel pipelines (please note that emissions due to corrosion, pinholes/cracks, material defects will be reported as incidents).

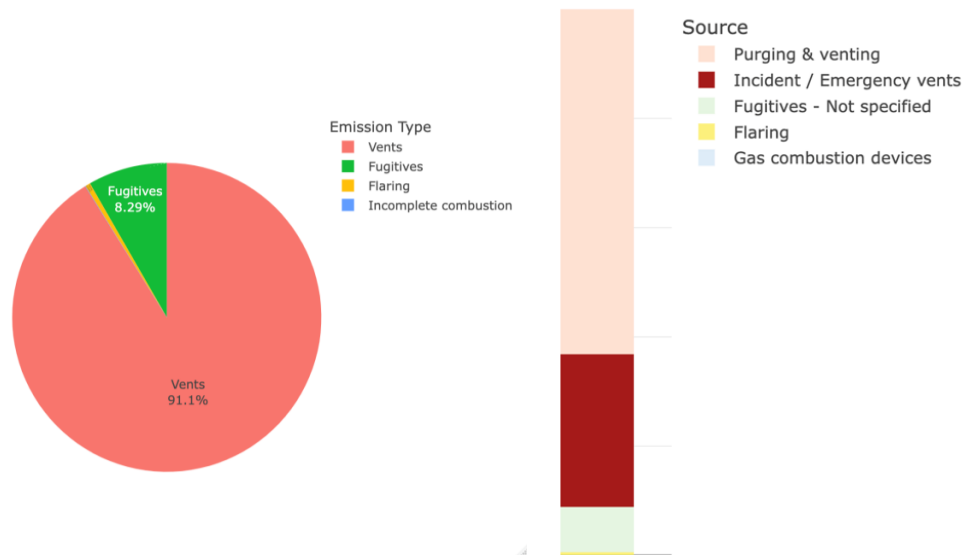
The following graph shows the emission sources from transmission pipelines reported at Level 4 and Level 5.

Fugitives are shown as material due to the following reasons:

- Part of transmission stations (e.g. block valves, pigging valves) reported with the transmission pipelines.
- Part of the incidents reported as fugitives.
- Some members followed a conservative approach and estimated fugitives based on generic emission factors.

The OGMP 2.0 team encourages members to follow this document to harmonize the reporting of methane emission sources.

² Destruction Removal Efficiency



Since the OGMP 2.0 initiative was launched, the majority of transmission system operators have tested sensors mounted on an aircraft as site-level technology for transmission pipelines. However, this approach has the following limitations:

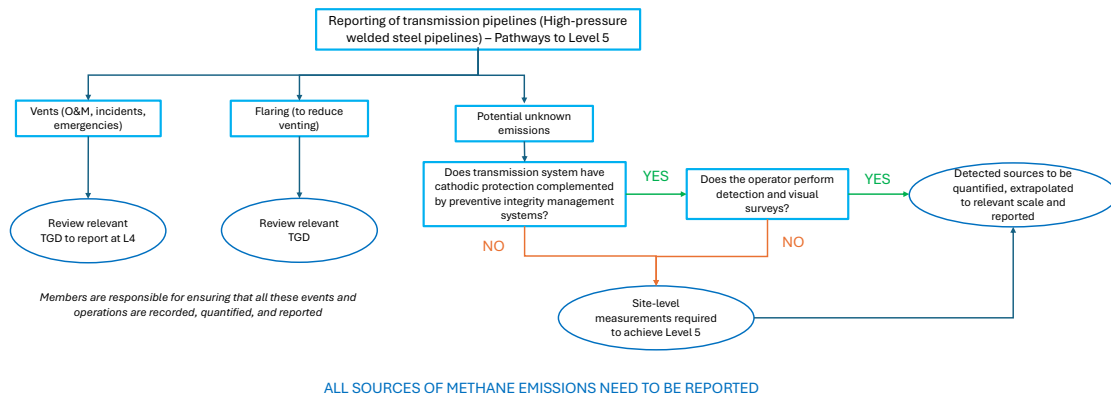
- It does not capture the most material sources of emissions³ (i.e. blow-down of pipelines due to the characteristics of these events).
- It captures only small incidents, but very frequently there are 0 detections in the transmission pipelines.
- Technology performance will be influenced by the emissions rate, the minimum detection threshold of the sensor, the distance (height) to the source, and soil conditions.
- In some regions, service providers offer only emissions detection without quantification capabilities. In this case, the operator will go on the ground to confirm the source and quantify it.

Level 5 reporting for transmission pipelines:

Based on the limitations mentioned above, one of the frequent requests of transmission system operators is whether the OGMP 2.0 team could clarify under which circumstances site-level measurements and reconciliation analysis could be not required for transmission pipelines.

Considering the OGMP 2.0 members’ experience and data, the risk of having material unidentified emissions, the current technology limitations and constraints, and until other solutions are available for this asset type, the OGMP 2.0 team recognizes the following approach as an alternative way to achieve level 5 reporting for transmission pipelines:

³ According to the OGMP 2.0 reporting framework, site-level measurements need to characterize site-level emissions distribution for a statistically representative population, which will provide a complete overview of emissions across an entire site.



This note clarifies that this alternative pathway is available for operators, but does not change approved plans or other pathways for an operator to reach Level 5.

The OGMP 2.0 team encourages members to reach out to their OGMP 2.0 technical focal point to discuss prior to including the approach in their Implementation Plan to ensure consistency with this approach. Details on sampling, measurement frequencies, detection threshold, preventive pipeline integrity management systems, walking detection surveys and/or flyover inspections are to be included in the implementation plan.

In the case that members are testing other approaches, the OGMP 2.0 team encourages them to reach out to their OGMP 2.0 technical focal point to discuss their approach and to document the details and analysis in the implementation plan.

Transmission stations

Along the transmission system, hundreds or even thousands of different types of transmission stations can be found. The transmission system operators need to take into account the potential sources of methane emissions associated with each type of transmission station and its equipment to ensure the sampling strategy is representative of the entire population.

The majority of transmission stations are simple sites, in which all components and equipment are accessible to be covered during the comprehensive LDAR and source-level measurement campaigns.



Source – Photos provided by OGMP 2.0 members

According to the data from assets reported at Levels 4 and 5, the main sources of methane emissions from transmission stations are:

- **Fugitives** – Unintentional release of gas to the atmosphere, which can be caused by corrosion, material defects, loss of tightness, and fitting defects or failures.

For additional guidance on Level 4 quantification, please refer to the Leaks TGD.

- **Vents – Pneumatic devices** – These are intentional releases of gas to the atmosphere due to the operation of the pneumatic actuators.

For additional information, please refer to the Pneumatic controllers, pumps, shutoff valves, and control instruments TGD.

As highlighted in the IMEO Annual Report, “An Eye on Methane 2025: From Measurement to Momentum”, there is a significant mitigation of methane emissions as operators replace pressurized natural gas-actuated pneumatic devices with non-emitting equipment or devices actuated by instrument air or nitrogen.

- **Vents – Purging and venting** - These are intentional releases of gas to the atmosphere.

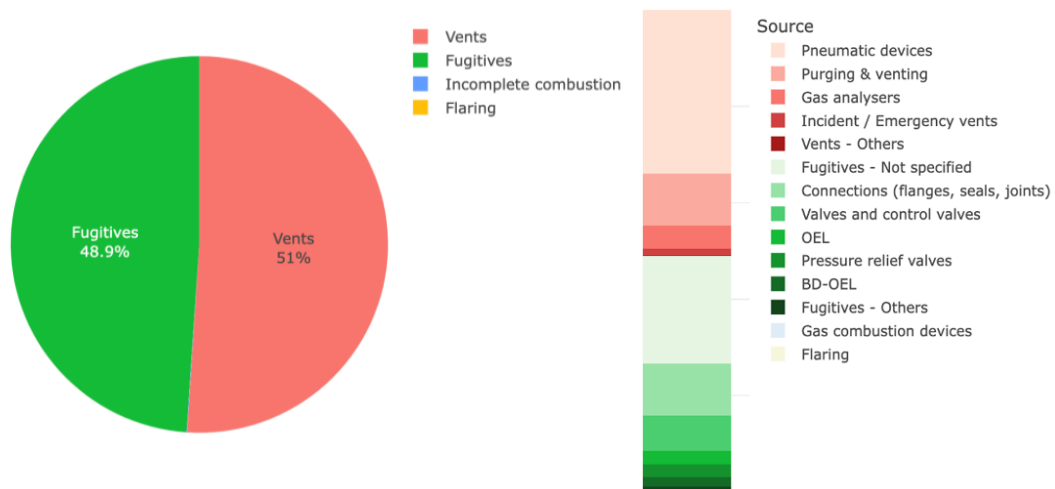
This source of emissions is normally reported at Level 4 based on detailed engineering calculations. For additional guidance, please refer to the Purging and venting, starts and stops TGD.

- **Vents – Gas Analysers** – These are intentional releases of gas to the atmosphere due to the operation of the analysers/chromatographs.

This source of emissions is frequently reported at Level 4 based on the flow meter measurements. For additional information, please refer to the Purging and Venting TGD.

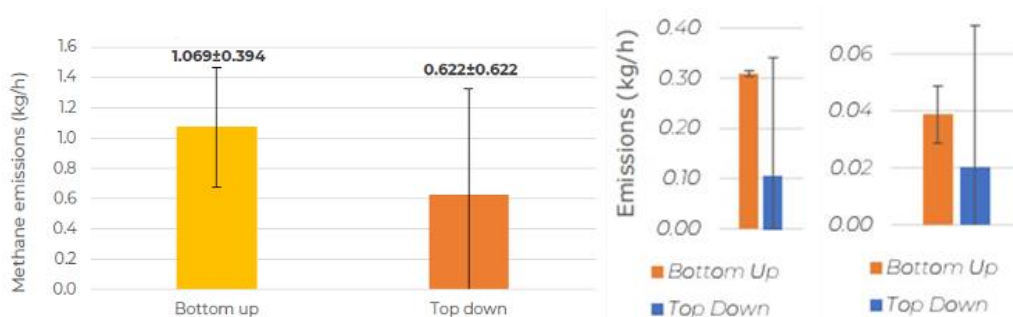
- **Vents due to incidents or emergencies** – These are unplanned events, which are not part of routine operations.

This source of emissions is normally reported at Level 4 based on detailed engineering calculations. For additional guidance, please refer to the Incidents and malfunctions TGD.



The main challenges that the OGMP 2.0 members have faced in reporting at level 5 in this asset type are the following:

- Most emission sources at these sites typically fall below the minimum detection threshold of available site-level measurement technologies. The sources that can be quantified are frequently reported with a very broad uncertainty range. Below some examples provided by the OGMP 2.0 members:



- O&M vents are normally not captured by the site-level technology.
- When robust and frequent LDAR campaigns are performed, the additional learnings from site-level measurements are very limited. The risk of having material unidentified emissions is very low.

Level 5 reporting for transmission stations:

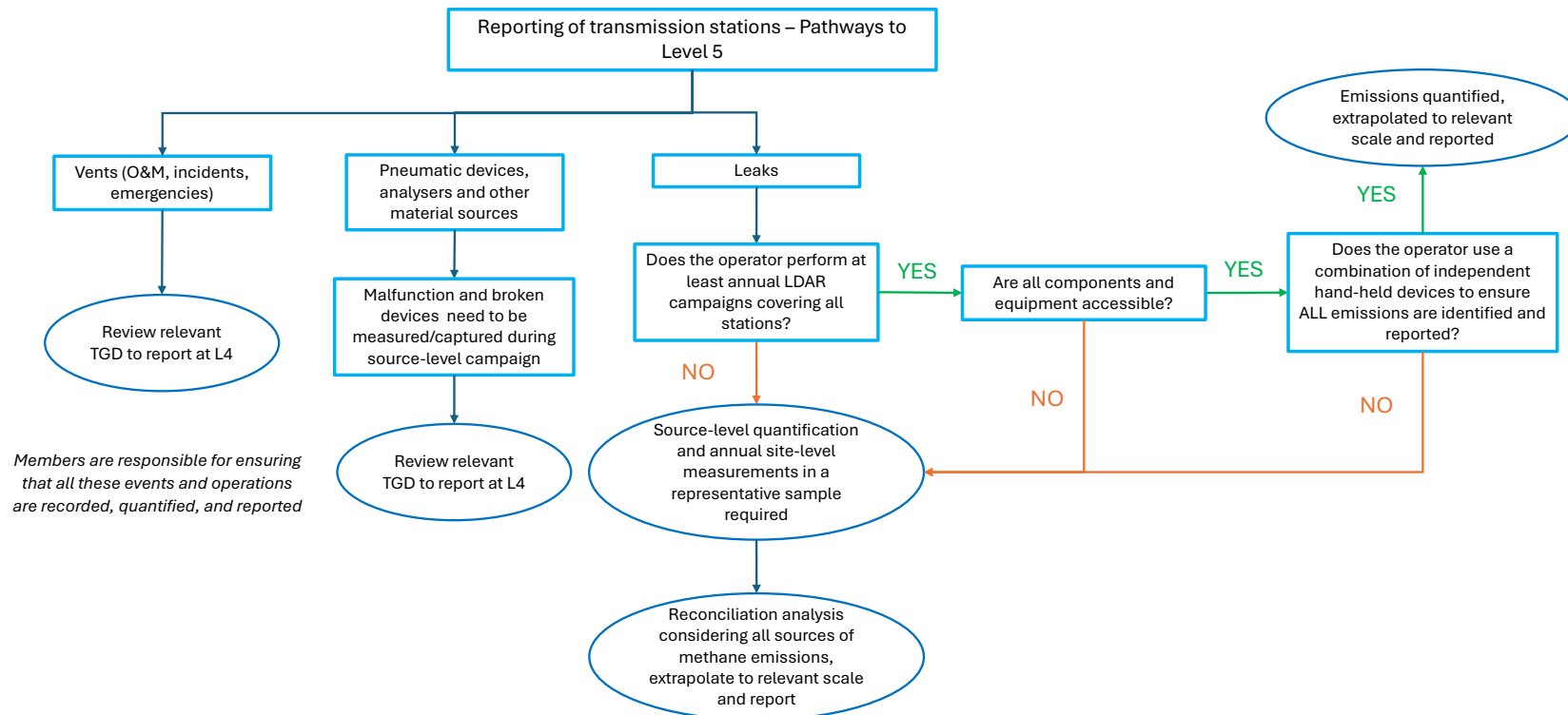
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Based on the limitations mentioned above, one of the frequent requests of transmission system operators is whether the OGMP 2.0 team could clarify under which

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circumstances site-level measurements and reconciliation analysis could be not required for transmission stations.

Considering the OGMP 2.0 members' experience and data, the risk of having material unidentified emissions, the current technology limitations and constraints, and until other solutions are available for this asset type, the OGMP 2.0 team recognizes the following approaches as level 5 reporting for transmission stations:



This note clarifies that this alternative pathway is available for operators, but does not change approved plans or other pathways for an operator to reach Level 5.

The OGMP 2.0 team encourages members to reach out to their OGMP 2.0 technical focal point to discuss prior to including the approach in their Implementation Plan to ensure consistency with this approach. Details on sampling, measurement frequencies, detection threshold, LDAR campaigns and/or flyover inspections will be included in the implementation plan for approval.

In the case that members are testing other approaches, the OGMP 2.0 team encourages them to reach out to their OGMP 2.0 technical focal point to discuss their approach and to document the details and analysis in the implementation plan.

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Once additional approaches are identified and proven to be implementable, this document will be reviewed to incorporate them.

Transmission compressor stations

In the case of the transmission compressor stations, companies are asking for clarifications on how to proceed with:

- Sampling strategies
- Quantification of passing valves and their impact on reconciliation

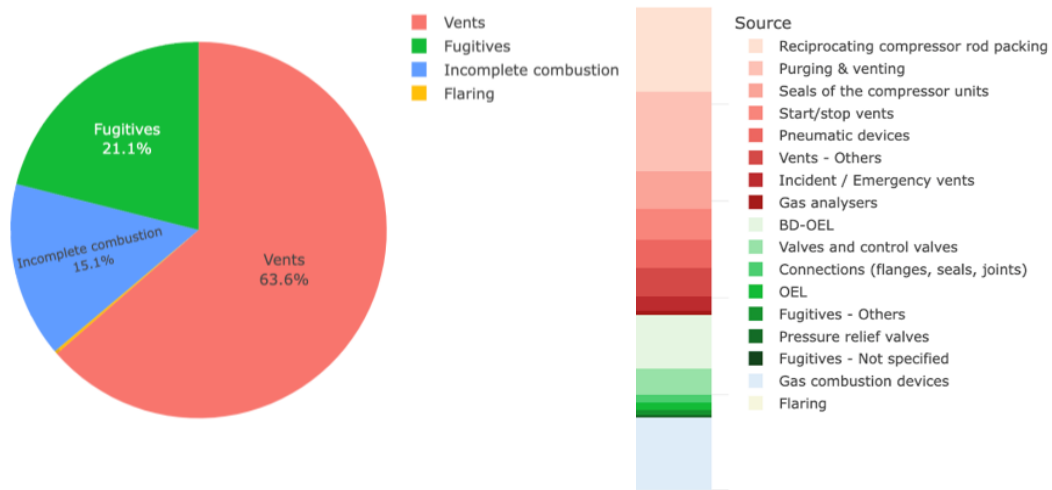
Sampling strategies

The vast majority of transmission system operators report each compressor station individually rather than grouping similar stations within a single asset. However, operators may still group “like” sites when designing their sampling strategy (both at the source level and at the site level).

The identification of a representative population of sites in the asset on which the operator performed the measurements represents the sampling. Measurements need to be extrapolated from the sampled population to the target population for an entire year. This means that the learnings also need to be extrapolated. If this is not done, only the measured and reconciled sites will be at level 5.

Like the process of reconciliation, sampling strategies are likely to evolve over time.

According to the data from assets reported at Levels 4 and 5, the main sources of methane emissions from transmission compressor stations are:



For information on how to report these sources at Level 4, please refer to relevant TGDs.

For information on uncertainty and reconciliation, please refer to the uncertainty and reconciliation guidance.

Reconciliation challenges – Passing valves

The majority of compressor station operators are facing reconciliation issues due to the high variability of the vent stack emissions. After changing the operational conditions of the compressor, the amount of gas passing by blow-down valves and isolation valves that do not completely seat and leak internally is different.

Vent stacks are often non accessible, and unless the operator can use a crane or a scaffold, it will not be possible to perform accurate source level measurements.



Source – Photos provided by OGMP 2.0 members

The cost of these measurements is very high and difficult to justify for a source with high variability. Also, from a safety perspective, it is not always possible to get the permits to perform these kinds of measurements.

The majority of operators attempting instantaneous reconciliation are failing, unless the source-level measurements and site-level measurements are performed in parallel, which is a significant effort.

To harmonize the reporting of this source and to reduce the burden of the operators, the OGMP 2.0 team proposes:

- The OGMP 2.0 team is ready to collaborate with the OGMP 2.0 members, to collect and analyse the measurement-based emission factors for this source, and propose an average or a range of emission factors considering different variables.
- When operators are using site-level technologies capable of providing robust source-level information of the vent stack emissions, this measurement can be used to report this source or to reconcile with the above-mentioned measurement-based emission factor.

The vent stack emissions can be excluded from the reconciliation analysis, but the values are used to report the annual emissions of this source.