

OGMP 2.0 Technical Guidance Document:

Distribution Grids

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Methane emissions from distribution grids

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

This document reflects the grading requirements related to Level 4 and Level 5 for distribution grids. The OGMP 2.0 team recognizes that the pathway to Level 5 has been challenging but learning curves and maturity of technologies are rapidly evolving.

Science continues to progress, and the OGMP 2.0 members are immersed in a learning process that is reflected in the continuous improvement of their reporting. This evolution and learning will be the basis of the future revision of this interim guidance.

Brief description

Distribution grids are used to transfer gas from the transmission grid, the LNG satellite stations, and the connection with renewable gas producers (i.e. biomethane and hydrogen) to the end users, and vary greatly in size and pressure, depending on the use and the volume of gas distributed. Pipes can be made from a variety of materials such as cast iron, cathodically protected and unprotected steel, ductile iron, copper, and plastic/polymer. Although methane is an odourless and colourless gas, in distribution grids gas is odourised to make it detectable.

Scope boundaries

This TGD covers **all methane emission sources and components and equipment from main lines, service lines and stations**, both aboveground and underground.

Main lines are the network of pipelines (typically underground) that move gas through a gas distribution service area from city gate stations to connected service lines. Main lines are generally placed in public domain. They operate at different pressure levels and they are typically made of steel or various types of plastic and sometimes also of ductile iron or grey cast iron (with lead yarn joints).

Services lines transfer the gas from a main line to the customers (households/ industry) and can be installed under or above the ground.

Pressure Regulating and Metering Station regulates (in one or more stages) the network pressure to a lower pressure level which is necessary for the connected customers. Depending on the type of station, different equipment will be installed (e.g. measurement equipment to measure the gas quantity and/or gas quality). City gate stations are metering and pressure regulating facilities located at the custody transfer points where natural gas is delivered from transmission pipelines into the high-pressure lines of a local distribution company. They typically contain metering equipment as well as pressure regulators, that reduce the transmission line pressure to a suitable pressure for the distribution system. If necessary, they also contain preheating systems.

In general, the upstream boundary of responsibility and/or property for a DSO is the city gate station where gas is delivered by the TSO. The downstream boundary can differ according to national legislation but is generally either the gasmeter of the end-user or a valve on the service line somewhere between the main line and the gasmeter.

Methane sources from these subsystems of the Natural Gas Distribution Network can be classified as follows (in line with the methane sources of the OGMP 2.0 reporting template):

Unintentional: Fugitive emissions:

These are unintentional emissions that occur naturally in the system, either due to material properties, due to chemical-physical phenomena acting on the system, or in consequence of equipment defects or failure. Depending on the nature of the source and the way it is detected, a fugitive emission can be further classified into three main categories:

- Permeation from plastic pipes is a property of the material and it is not an unexpected source of methane emissions. They are in all known cases a non-material source of methane emissions.
- **Leaks derived from systematic surveys** are releases of gas to the atmosphere which can be caused by corrosion, material defects, loss of tightness and fitting defects or failures. Leaks are detected through a robust Leak Detection and Repair (LDAR) survey carried out by -or on behalf of- the Distribution System Operator.
- **Third party warnings** are releases of gas to the atmosphere which can be caused by corrosion, material defects, loss of tightness and fitting defects or failures. They are detected thanks to the odour call warnings from people.

Unintentional: Vents:

- **Incident / Emergency vents / Third party damages (incl. repair):** Incidents and third party damages are unplanned events/venting which are not part of routine operations. They can be due to equipment failure, over pressurization beyond control valve limits, human error/damages or other causes, such as extreme weather events or acts of sabotage.

Intentional emissions: Vents:

- **Operational emissions / Maintenance venting** is the intentional release of gas to the atmosphere, typically required by the design, operation, construction and (de-)commissioning, or maintenance of the equipment.
- **Change/Removal installation of Gas meters** is the intentional release of methane emissions due to the change, removal or installation of gas meters.

Members are responsible for ensuring that all vented emissions sources are recorded, quantified and reported.

Intentional: Incomplete combustion:

This source of methane emissions refers to the slip of unburned methane in flared or heat generation units in the natural gas distribution system:

- **Incomplete combustion in main lines:** Portable flares are frequently used to avoid operational and maintenance vents. When a flare is operating properly, the combustion efficiency is lower than 100% and a small share of the gas is typically not combusted and released to the atmosphere (i.e. incomplete combustion).
- **Incomplete combustion in stations:** Energy and heat generation processes are required in some distribution stations. When gas is burned, the entirety of the fuel is not transformed to CO₂. Due to the incomplete combustion, some methane is released into the atmosphere from the equipment exhaust stack.

Table 1: Reporting levels and summary of main sources of methane emissions

Level 1 reporting		Level 2 reporting	Level 3 / Level 4 reporting		Quantification - Level 4 Reporting (most frequent method)
Distribution Grid	Main lines	Fugitives	Permeation	Unintentional (Property of the material)	Non-material / Level 3 reporting based on generic EFs
			Leaks derived from systematic survey	Unintentional	Measurements / Measurement based EFs
			Odour call warnings	Unintentional	Detailed Engineering Calculations or measurement based EFs
		Vents	Operational emissions / Maintenance	Intentional	Detailed Engineering Calculations
			Incident / Third party damages (incl. repair)	Unintentional	Detailed Engineering Calculations
		Incomplete Combustion	Intentional (portable flare to avoid vents)	Detailed Engineering Calculations + DRE of portable flare (98%)	
	Service lines (Underground and aboveground)	Fugitives	Permeation	Unintentional (Property of the material)	Non-material / Level 3 reporting based on generic EFs
			Leaks derived from systematic survey	Unintentional	Measurements / Measurement based EFs
			Odour call warnings	Unintentional	Detailed Engineering Calculations or measurement based EFs
		Vents	Operational emissions / Maintenance	Intentional	Detailed Engineering Calculations
			Incident / Third party damages (incl. repair)	Unintentional	Detailed Engineering Calculations
			Change/Removal installation of Gas meters	Intentional	Detailed Engineering Calculations or Measurements based EFs (representative sample considering component type, environmental and operating conditions)
	Stations	Fugitives		Unintentional	Measurements / Measurement based EFs
		Vents	Operational emissions / Maintenance	Intentional	Detailed Engineering Calculations

			Incident / Emergency vents	Unintentional	Detailed Engineering Calculations
		Incomplete combustion		Intentional	Measurements / Measurement based EFs

Methane sources described above need to be assessed to evaluate the total emission of the Natural Gas Distribution Network. According to OGMP2.0 Standards the emission assessment of an asset can achieve up to 5 levels of robustness.

Level 1

Asset level reporting is the lowest reporting level for the OGMP 2.0. Reporting at Level 1 is reserved for assets where a company has very limited information on the operations and methane emissions situation. Reporting at this level involves the reporting of a single consolidated emission number representing the emissions from a reporting unit.

Emissions reported at this level can be quantified using high-level standard factors, which may be based upon the assumption that emissions for a specific asset are similar to those for a comparable asset for which more data is available.

Members are encouraged to use emission factors that best characterize their facilities. A few examples include (non-exhaustive list):

Table 2: Emission Factor Examples

Reference	Country/Region		Value
IPCC	Global	Less than 50% plastic pipelines, or limited or no leak detection and repair programs	2.92 Tonnes/ million cubic meter gas consumption
			1.17 Tonnes/kilometer of pipeline
		Greater than 50% plastic pipelines, and leak detection and repair programs are in use	0.62 Tonnes/ million cubic meter gas consumption
			0.23 Tonnes/kilometer of pipeline
MARCOGAZ ¹	Europe		660 kg CH ₄ /(km year) (more detailed EFs available)

The following formula is a general formula which allows to calculate methane emissions based on an emission factor:

$$E_i = EF_i * AF_i$$

Where:

¹ MARCOGAZ, *SURVEY METHANE EMISSIONS FOR GAS DISTRIBUTION IN EUROPE - Update 2017* (2017), <https://www.marcogaz.org/wp-content/uploads/2021/04/WG-ME-17-25.pdf>.

E_i Methane emission related to asset i

EF_i Emission factor related to asset i

AF_i Asset production/throughput activity factor i

Level 2

Reporting at OGMP 2.0 Level 2 builds on Level 1 reporting by adding additional granularity around major source categories of methane emissions for each asset. For mid- and downstream (as defined by Marcogaz) the reporting will be according to 3 different emission categories:

- Fugitives
- Vents
- Incomplete combustion

Marcogaz, Assessment of methane emissions for gas Transmission and Distribution system operators (2019), provides more details on emission categories.

Emissions reported in each of these categories are typically quantified using generic emission factors, though more advance forms of quantification may also be used. Quantification methodologies, prescribed by local regulations, can also be used to determine methane emissions at Level 2, provided they follow the emission categories presented above.

In lack of granular information about a specific network, emission reporting at Level 2 can be built starting from Level 1 reporting data and allocating the total emission across its different subsystems and emission categories using average emission shares across subsystem types and categories across OGMP2.0 DSO members:

$$\text{Level 2 Emissions} = \text{Level 1 Activity data} * \text{Level 1 EF} * \overline{\text{subsystem share}} * \overline{\text{category share}}$$

In case the 2023 data reported to OGMP2.0 in 2024, this would result in the following shares:

Table 3: Example of level 2 quantification based on the OGMP 2.0 data

Emissions category		Example quantification formula based on the OGMP 2.0 data
Main Lines	Fugitives	Level 1 Activity data * Level 1 EF * 37% * 80%
	Vents	Level 1 Activity data * Level 1 EF * 37% * 19%
	Incomplete combustion	Level 1 Activity data * Level 1 EF * 37% * 1%
Service Lines	Fugitives	Level 1 Activity data * Level 1 EF * 55% * 83%
	Vents	Level 1 Activity data * Level 1 EF * 55% * 17%
Stations	Fugitives	Level 1 Activity data * Level 1 EF * 8% * 82%

	Vents	Level 1 Activity data * Level 1 EF * 8% * 12%
	Incomplete Combustion	Level 1 Activity data * Level 1 EF * 8% * 6%

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. Members are encouraged to use emission factors that best represent conditions and operations 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.

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. An explanation of why the specific estimates has been selected (e.g., similar network composition) should be included in the Implementation Plan.

Permeation of plastic pipes

Permeation is a property of plastic pipes. They are in all known cases a non-material source of methane emissions which is not possible to be measured in the field because it is below the minimum detection limit of the available technologies. Emission factors are based on literature on permeation coefficients². As permeation is dependent on the pipeline pressure, three different emission factors are used:

- 0.41 kg/km/year for pipelines up to and including 200 mbar,
- 1.88 kg/km/year for pipelines up to and including 4 bar, and
- 3.37 kg/km/year for pipelines up to and including 8 bar.

² [1] L. K. Massey, Permeability Properties of Plastics and Elastomers, Second Edition, PDL, 2003.

[2] F. Scholten, „Methane permeation through advanced high-pressure plastic and composite pipes,” Kiwa, Apeldoorn, 2008.

[3] W. Takens, „De diffusie van waterstof door plastieken gasbuizen,” GAS, September 1975.

Pipeline pressure, materials and length are known from company specific data. This methodology is acceptable as Level 4 for permeation.³

As permeation is an intrinsic characteristic of plastic/polymer pipes, this type of fugitive emission is always present, the rate of emissions might vary over time due to changes in operating pressure.

Leaks derived from systematic surveys and odour calls

Level 3 quantification for fugitive emissions from distribution pipes relies on activity data, typically the length and operating pressure of the pipelines, and emission factors considering the material of the pipes. Measurement of emissions from individual leaking components or plastic pipes may be considered but is not required at Level 3.

Some examples which may be used as references for emission factors are:

- Marcogaz, *Survey Methane Emissions for Gas Distribution in Europe*, 2017. [Link](#)
- EPA. *Greenhouse Gas Reporting Rule*. Title 40, Part 98 Subpart W-Petroleum and Natural Gas Systems. February 6, 2017. For distribution, Table W-7. [Link](#)
- Methane Emissions from the Natural Gas Industry, co-sponsored by the Gas Research Institute and EPA (June 1996); Volume 9 Underground Pipelines, Tables 9-1 Distribution, 9-3 Transmission, 8-3 Gathering and Processing, and 9-4 Production. [Methane Emissions from the Natural Gas Industry, Volume 9: Underground Pipelines \(epa.gov\)](#)
- Marcogaz, [Assessment of methane emissions from gas transmission and distribution operators, 2019](#)

Note: Emission factors may include emissions both from leaks/permeation and incidents. Companies may need to adjust these values to separate the emissions from leaks/permeation and the emissions from incidents.

Activity data for distribution pipes typically consider the length of the pipe or the pipeline network. Activity data should be collected, in line with the selected emission factors (length of pipes of a certain material, pressure).

Vents

Simple engineering calculations

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

Activity data

³ For permeation specifically, Marcogaz, *Assessment of methane emissions from gas transmission and distribution operators*, section 6.4.1 and annex A and B, 2019 https://www.marcogaz.org/wp-content/uploads/2021/04/WG_ME-485-Assessment-of-methane-emissions-for-gas-Transmission-and-Distribution-system-operator.pdf

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 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.

Incomplete combustion

Accepted emission factors need to be specific for the type of equipment and consider fuel quantity (flow), methane content of the fuel (composition), and destruction efficiency.

Portable flares

The following are considered as providing Level 3 estimates:

- Gas flow to the flare - Directly measured or detailed engineering calculations.
- Gas composition - In cases where the methane content can be assumed to meet a regulated specification (e.g. underground gas storage, gas transmission, gas distribution and LNG terminals), the gas specification compositions may be applied.
- Destruction efficiency - Assume annual average 98% destruction efficiency – i.e. 2% of methane passes through to atmosphere.

Combustion equipment

Some generic emission factors provide methane emissions estimates that take into account the fuel composition and the destruction efficiency for different types of fuel and combustion equipment. The following non-exhaustive list provides some examples of such emission factors:

Example emission factors from <i>API, Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry, 2009</i>				
Emission source (natural gas)	Emission factor	Emission factor - converted	Emission factor - converted	Reference
Boilers/Furnaces/heaters	2.3 lb/10 ⁶ scf	0.0009 kg/10 ⁶ Btu (HHV)	3.1 kg/ GWh	Table 4-7

If available, methane emission factors presented in manufacturer documentation can be used to estimate combustion efficiency, provided they are specific for the type of equipment provided by the manufacturer.

Level 4 Quantification Methodologies

Operational emissions / Maintenance and Incident / Third party damages (incl. repair)

Engineering calculations and models can be considered as Level 4 quantification methodologies for incidents and third party damages. For example, emissions from depressurization of pipelines can be calculated using durations of the event, physical volume, pressure drop and temperature data, specific to the 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_f = Temperature of the gas after being released (generally, atmospheric temperature) (kelvin)

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

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).

Incomplete combustion

Direct measurement and Measurement-based Emission factors

Measurements (including continuous or periodic monitoring), or the use of emission factors developed from representative measured emissions (including predicted emissions) are considered Level 4 emissions quantification. When quantifying methane emissions resulting from incomplete combustion using direct measurement and measurement-based emission factors, measurements must be taken that consider the mass or volume and methane content of the exhaust gases.

The following are considered as providing Level 4 estimates:

Parameters	Continuous or Intermittent Combustion
Mass of exhaust gases	Direct measurement or calculated based on fuel quantity and inlet air flow (where relevant) measurements, or volume of exhaust determined through the application of correlations based on representative sampling
Methane content of exhaust	Measurement-based methane content in the exhaust gas or methane content determined through the application of correlations based on representative sampling

Normally this is not a material source in distribution grids. Additional information can be found in the *Incomplete Combustion TGD*.

Quantification of leaks from odour call warnings

All odour calls leading to the release of methane must be recorded by the operator to quantify and report the emissions. Emissions from this source will be quantified based on detailed engineering calculations. In the case that measurement-based emissions factors are used to report this source, the method and explanation of how the emissions factors were derived (based on measurements on a representative sample considering component type, environmental and operating conditions) will be provided in the implementation plan.

For emissions detected via odour calls, the duration should be determined based on

- the time between the estimated start of the leak till the odour call (T1)⁴
- the time between the odour call and the repair of the leak. (T2)
- The start estimation can be based on the specificities of the leak such as:
 - type of component,
 - location (including proximity of population),
 - soil density,
- additional information given by the person signaling the odour call

Specificities that make the odour detection more probable allow for a shorter estimation of T1. Specificities that make the odour detection less probable demand a longer estimation of T1.

Details on the quantification of odour calls and duration estimations should be provided in the implementation plan.

Quantification of leaks derived from systematic surveys

Emissions from leaks derived from systematic surveys in main lines, service lines and stations⁵ can be quantified using different methodologies: direct measurement, measurement-based emission factors, engineering calculation, or a combination of the three.

⁴ According to the current practice of OGMP2.0 members, T1 ranges between 1 hour and 1 month.

⁵ In some cases stations represent a very small portion of the emissions of the distribution grid and are immaterial.

Leaks derived from systematic surveys - Direct measurement and Measurement-based Emission factors

Emission factors are based on measurements on a representative sample of the leaking components present in the system. Details and justification of the sampling strategy will be included in the implementation plan. A possible starting point for the design of a sampling strategy can be to use existing available data to simulate the expected trade-off between uncertainty of the results and sampling effort. More information can be found in the *Uncertainty & Reconciliation Guidance*⁶.

Below some measurement technologies that could be used to quantify leaks from distribution systems:

- Bagging
- High flow sampling
- Suction method
- Advance Mobile Leak Detection (AML²D)⁷

The latter point (AML²D) originates from a site-level concept but has proved to have a spacial resolution sufficient to inform the source-level inventory. For more details, please refer to the section of this document named *OGMP 2.0 downstream operators experience in approaching site-level measurements*.

⁶ United Nations Environmental Programme (UNEP) and Oil and Gas Methane Partnership 2.0, *Guidance Document: Reconciliation and Uncertainty (U&R) in Methane Emissions Estimates for OGMP2.0* (2022).

⁷ For areas non-accessible by vehicles, it will be combined with other approaches.

The following formula can be used to develop emission factors for leaks from distribution systems:

$$EF_{Type} = L_{Type} * N_{Type} * D_{Type}$$

Where:

- EF_{Type} = Methane emission factor per length unit of pipes of a certain type (for example, material, thickness or pressure) or for components of a particular type
- L_{Type} = The average leak rate of leaks for pipes or components of a certain type
- N_{Type} = The average number of leaks per length unit of pipes or component of a certain type
- D_{Type} = The average duration of leaks from pipes or components of a certain type

Alternatively, other more refined statistical/probabilistic approaches that take into account the population of observed and measured events can be taken into account to derive emission factors⁸.

- Sampling strategy for measurement-based emission factors

Level 4 emission factors should be based on measurements conducted on a representative sample. Pipeline type, component type, environmental and operating conditions (e.g. material, thickness, age, pressure, frequency of leak surveys, soil characteristics) may be considered in determining 'like' systems that carry a common emission factor. Each section of pipe that is not 'like' will require determination of a separate emission factor for that system based on the appropriate measurement studies. Members will provide details on their sampling strategy and representativeness of the measurements in the implementation plan.

When measurements are used to determine emission factors for 'like' systems within a DSO or within more than one DSO in the same country with a 'like' distribution gas infrastructure, the emission factor may be applied to all 'like' systems.

Emission factors may vary over time, so as additional measurements are performed they should be integrated to refine calculated emission factors.

- Duration

Leaks randomly occur throughout a gas distribution system and it can be challenging to identify precisely what is leaking and when each one started to emit.

⁸ Brian K. Lamb et al., "Direct Measurements Show Decreasing Methane Emissions from Natural Gas Local Distribution Systems in the United States," *Environmental Science and Technology* 49, no. 8 (2015): 5161–69, <https://doi.org/10.1021/es505116p>.

Times between the occurrence and detection and between detection and repair can be considered to determine the average time to establish emission factors. Several leak duration quantification methodologies exist and can be used to estimate leak duration, provided the methodology can be explained and justified:

- a leak can be considered to have started emitting from the previous detection campaign when it was not detected (as a conservative approach),
- from half-time since the previous survey,
- from the start of the reporting period for immaterial sources, or
- using other justified leak duration estimate methodology.

In case local regulations related to budgetary constraints and annual reporting principles established a different duration, this should be explained in the implementation plan of the company.

Examples of ways to account for the leak duration are presented in the [Leaks-TGD-Final-SG-Approved.pdf](#).

Engineering calculation

Engineering calculations can be used to quantify methane emissions from distribution network leakage based on detailed data over the system itself and its operative conditions integrated into a physical model. For example, using the nozzle-theory⁹ to estimate the equivalent diameter of the rupture and the pressure drop across the rupture (pressure difference between pipeline pressure and ambient pressure), or via more complex modelling and simulation tools. These calculations can be supported by measurements when technically possible to validate that the underlying hypotheses required by the theoretical model hold on the real system under analysis.

INTERIM SOLUTION: Site-level Measurements in Distribution Grids & Gold Standard Reporting

Background information on Gold Standard in OGMP 2.0 guidance

OGMP 2.0 requires the creation of a measurement-based inventory for the material assets. This inventory is primarily based on source-level measurements (Level 4) complemented by site-level measurements. Site-level measurements should provide an overview of the emissions and

⁹ Bosch, C.J. H. van den, R.A.P.M. Weterings, N.J. Duijm, Bakkum E.A., Mercx W.P.M., van den Berg A.C., Engelhard W.F.J.M., van Doormaal J.C.A.M., van Wees R.M.M. (2005) Methods for the Calculation of Physical Effects Due to Releases of Hazardous Materials (Liquid and Gases) - Yellow Book.

support characterization of the full emissions distribution¹⁰. The purpose of the reconciliation between source-level inventory-based emissions and site-level measurements is to ensure that all potential sources have been detected, clearly attributed to the gas distribution network and included in the inventory. A reconciled emission inventory is considered L5. Reconciliation is an iterative process of investigation, year on year, and should not be viewed as a one-off comparison of two independent values.

Site-level measurements are carried out by measuring enhancements in the atmospheric methane mole fraction and uses them to estimate the strength of methane sources in an area (site) by means of empirical and/or physical models that describe the relationship between the emissions from a site and the resulting changes in atmospheric methane distribution around the site itself.

OGMP 2.0 downstream operators experience in approaching site-level measurements

Since the OGMP 2.0 was launched, the majority of the distribution system operators have tested advanced mobile leak detection (i.e., detection and quantification of leak indications by means of vehicle-mounted sensors), some DSO also tested this method as site-level technology.

Vehicle-based measurement systems can:

- calculate the flow rate of leaks,
- cover large areas in a short time, and (in direct consequence of the first point)
- show emissions changes across multiple reporting years, quantitatively proving mitigation efforts over time.

Brief description of AMLD (Advanced Mobile Leak Detection)

A vehicle-based measurement system suitable for AMLD is made by a vehicle(s), equipped with GPS and one or more methane-ethane analysers able to resolve methane enhancements in the atmosphere at street level caused by leaks in the network. The core concept is that the vehicle is driven in the areas where pipelines are installed (e.g., a DSO served by the DSO), the methane analysers continuously sample the methane mole fraction in the atmosphere and the GPS tracks the position of each sampled point in space. In previous OGMP 2.0 reporting years, Advanced Mobile Leak Detection backed up by a follow-up investigation with hand-held devices to identify leaks, has been demonstrated to provide sufficiently space-resolved information to inform the source-level quantification for leaks (Level 4).

¹⁰ United Nations Environmental Programme (UNEP) and Oil and Gas Methane Partnership 2.0, *Guidance Document: Reconciliation and Uncertainty (U&R) in Methane Emissions Estimates for OGMP2.0*.

Reconciliation

OGMP 2.0 DSO members have faced some challenges during their reconciliation journey when testing AMLD method as site level measurements:

- Vehicle-based measurement systems will measure mainly leaks in distribution networks. They will not cover some of the frequent material methane emissions sources (e.g. third-party damages, operation & maintenance vents, odour call warnings). Non-covered sources must be identified, quantified properly, and included in the annual measurement-based inventory.
- Reconciliation process may present a labour-intensive and impractical approach due to the size of the distribution system (typically thousands of kilometres and the sparsity of leaks). Some members have tried to reconcile the results of the vehicle-based measurements with the source-level quantification of leaks, finding high discrepancies due to the uncertainty associated with the measurements and limitations in comparing the quantification of multiple technologies at both source and site level.
- Discrepancies between source attributions and leak indications. A vehicle-based measurement campaign could indicate emissions sources outside of the material portfolio, such as agricultural emissions or emissions from customer piping. There is also the potential for two or more leaks in close proximity appearing as one emission from the measurement campaign¹¹. Source attributions are very important to accurately associate material emissions and to inform mitigation strategies, but they can become time-consuming given the size and complexity of distribution networks¹².

For these reasons the reconciliation of source-level inventories (Level 4) with independent site-level measurements, has proven to be extremely challenging or even not feasible for distribution systems due to technology limitations and constraints.

OGMP 2.0 interim solution recognized as Level 5

In light of the OGMP 2.0 members' experience, the available scientific literature, and the current technology limitations and constraints, and until other solutions are implementable for this segment, the OGMP 2.0 recognizes the following approach as level 5 Reporting for distribution grids:

- Vehicle-based measurement systems, covering a representative sample of the distribution system, can be used to report leaks and as site-level technology. Measurements will be followed by an attribution of emissions to individual sources.

¹¹ OGMP2.0 members data show that about 9% of indications in a distribution system may have multiple sources.

¹² Distribution Segment: Source-Level Measurement and Reconciliation Protocol; GTI Energy's Methane Emissions Measurement + Verification Initiative: An alternate approach consistent with OGMP 2.0; GTI February 2024

Reconciliation, in this case, would be based on each measurement at the site-level being attributed to one or occasionally a few specific sources through directed investigations. Dedicated detection hand-held instruments would then provide source attribution, confirming the leak indication of the site-level measurement.

The results need to be properly extrapolated to the entire distribution system.

- Non-captured sources with the site-level technology (e.g. third-party damages, operation & maintenance vents, odour call warnings,...) will be identified, properly quantified, and included in the annual measurement-based inventory according to source-level quantification (direct measurement or detailed engineering calculations), without the need for a separate and independent site-level assessment.

In the case that the OGMP 2.0 member demonstrates test efforts to perform emissions quantification with the advanced mobile leak detection in an appropriate sample of the distribution system, but the results cannot be incorporated into the annual reporting of emissions, the operator:

- will share its analysis and provide information on the learnings that informed changes to the measurement campaign design,
- will justify why it was not possible to use the site-level measurements to improve confidence in reported emissions,
- will estimate the leaks according to the best available source-level information (number of leaks and measurement-based Emission Factors or detailed-engineering calculations).

If the three requirements are met, the asset will be recognized at Level 4, but the company will achieve Gold Standard Reporting.

In the case that members are testing other approaches, they are required to analyse the results and discrepancies (e.g., number of leaks detected, amount of emissions quantified with other methods). Details and analysis should be well-documented in the implementation plan.

As additional site-level methods and technologies are identified and proven to be fit-for-purpose for this segment, this document will be reviewed to incorporate them.

Implementation Plan – Supporting templates and tables specific for distribution grids

Please provide details in the implementation plan on the site-level measurement campaign(s) and follow-up investigation for each Asset and each site-level technology. The following table provides an example of how to convey the expected site-level measurement information:

Site-level mode of measurement (i.e. vehicle, drone, etc.).	
Site-level measurement technology/sensor	
Purpose/justification of site-level measurement technology selection	
Technology provider (optional)	
Methane analyser – please provide: Sampling frequency: Inlet/close path based or open path laser: Residence Time (if close path): Lower detection limit: (optional methane instrument model) Please provide information about how the system is set (e.g., upwind area covered, minimum flowrate that can generate a signal)	
Ethane measurement made (Y/N) If not, please provide an explanation (e.g. mainly distributing biomethane, low calorific gas)	
GPS (Y/N)	
Anemometer (Y/N)	
Number of transects when a leak is identified	
Sampling – Were all types of stations, pipelines materials, operating pressures, and equipment measured during the site-level measurement campaign? Please provide: <ul style="list-style-type: none"> • Main lines: km measured and total km of pipelines (if possible, please provide this disaggregated by material and operational pressure ranges) • Service lines: km measured and total km of pipelines or number of service lines measured and total number of service lines (if possible, please provide this disaggregated by material and operational pressure ranges) • Stations: number of stations measured and total number of stations (if possible, please provide details on the different types of stations) How many sites were measured (or how many measurements were taken, if site definition is not applicable)? Which days were these measurements taken on, and were there any repeated observations? Please justify and provide details.	
Were the site-level measurements followed by an attribution of emissions to individual sources? <ul style="list-style-type: none"> • If so, how many individual sources were sampled 	
Please provide details on the main sources of emissions that were found (e.g. valves, inlets, joints, etc), and if possible the percentage of sources above and underground.	
Please provide details on the hand held device used for the source attribution and confirmation of the leak indication (i.e. equipment, minimum detection limit, etc)	
Was it possible to use the data gathered during the site-level campaign for the annual reporting of emissions? Please explain	
Was it possible to set measurement based emissions factors based on the data gathered during the measurement campaign?	

Please provide the number of leaks confirmed per km of pipe material and operating pressure and the main sources/equipment leaking (inlets, valves).	
Please provide information on the challenges (if any) you have faced during the site-level campaign and attribution of emissions to individual sources.	
Please list conclusions, any reasons for discrepancies, or relevant learnings	
Will you follow the same approach to design the next year measurement campaign? If no, please provide details (i.e. change site-level technology, modify sampling strategy, change handheld device for attribution, ...)	

Please provide details in the implementation plan on the source level quantification method for material sources other than leaks. Please consider using the following tables:

Operational emissions / Maintenance

Do you track and record all operations and maintenance events that happen during the year?	
Do you quantify emissions from each event individually? (Y/N) if no, please describe the method.	
Do you have a system in place to track and record the events, as well as the activity parameters (i.e. pressure, pipe length, diameter...)? Please provide a short description	

Incidents / Third party damages (incl. repair)

Do you track and record all incidents, emergencies and third party damages that happen during the year?	
Do you quantify emissions from each event individually? (Y/N) if no, please describe the method.	
Do you have a system in place to track and record the events, as well as the activity parameters (i.e. pressure, pipe length, diameter...)? Please provide a short description	

Odour calls warnings

Do you track and record all odour call warnings that happen during the year?	
Do you have a system in place to track and record odour call warnings? Please provide a short description	
Do you quantify emissions based on detailed engineering calculations or measurement based emission factors?	
If detailed engineering calculations are used, please provide a brief description.	
If measurement based emissions factors are used, please explain how the emission factors were derived.	
If possible, please provide your emission factors (considering component type, environmental and operating conditions).	
Please provide the time(s) between the estimated start of the leak and the odour call (T1) that your company is using. If more than one, please explain	
Please provide information on how you consider the time between the odour call and the repair of the leak (T2) to quantify emissions.	

END