OGMP 2.0 METHANE EMISSIONS REPORTING; THE DUTCH APPROACH

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Abstract:

Introduction

In 2020, the six Distribution Grid Operators (DSOs) in the Netherlands: Coteq Netbeheer, Enexis Netbeheer, Liander, Rendo Netbeheer, Stedin and Westland Infra Netbeheer, decided to join the Oil & Gas Methane Partnership 2.0 (OGMP 2.0). OGMP 2.0 is the only comprehensive, measurement-based methane emissions reporting framework for the oil and gas industry with over 140 companies from the oil and gas sector. Every year these DSOs report about all possible sources of methane emissions in their network, whereby all assets are taken into account: mains, service lines and stations. Various emissions are mapped: regular leaks, emissions during maintenance and activities (venting and flaring), emissions caused by third party damage and emissions due to emergencies or warning calls.

Body

The DSOs in the Netherlands work close together and combine efforts to reach compliance with the OGMP 2.0 requirements. These requirements are:

- Define & disclose 5 years methane reduction targets;
- Submit implementation plans on pathway to Gold Standard;
- Report annually on methane emissions from operated & non-operated assets;
- Compare source-level (Level 4) inventories with independent site-level measurements to produce Level 5 asset emissions estimates.

In this paper the significantly grown insights are explained by presenting the efforts and progress that has been made since 2020. The context of the paper is the current approach of the DSOs in the Netherlands, i.e. reporting all methane emissions at least at Level 4 by performing company specific source-level quantification per asset. The paper also indicates which sources are material and which are not. The aggregated results are presented at a national level. Mains account for 64,7% of all emissions, services lines for 34,9% and stations for 0,5%. Mains and service lines are material, stations are not. The largest sources for both the mains and the service lines are fugitive methane emissions as derived from systematic survey (leak detection and repair) and third party damages (TPD). The efforts that were made to report at Level 5 are also presented. This was done by comparing source-level (Level 4) inventories with independent site-level measurements by car for reconciliation, to produce Level 5 asset emissions estimates.

Conclusions

The paper presents an overall impression of the efforts for the six Dutch DSOs made so far to ensure that they all comply the OGMP 2.0 Gold Standard Reporting requirements.

Keywords: Methane emissions; OGMP 2.0 reporting; Distribution System Operators; the Netherlands

1. Introduction

In 2020, the six Dutch Distribution Grid Operators (DSOs): Coteq Netbeheer, Enexis Netbeheer, Liander, Rendo Netbeheer, Stedin and Westland Infra Netbeheer, decided to join the Oil & Gas Methane Partnership 2.0 (OGMP 2.0). In Fig. 1 an overview of these six DSOs is given per region.

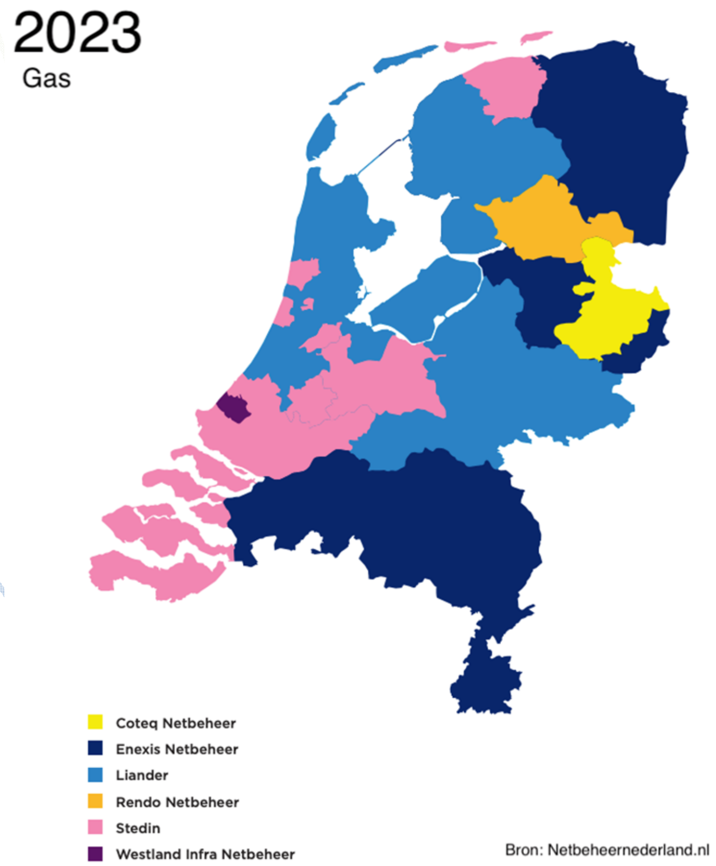

Fig. 1. Overview DSOs in the Netherlands per region

The Netherlands has a strong culture of cooperation. The Dutch DSOs share the same suppliers for e.g. pipelines and gas stations, share their knowledge and seek cooperation when challenges arrive. This means that, from a technological point of view, the grids of the Dutch DSOs are very comparable. Since 1990 there is a yearly operation in the Netherlands to report methane emissions from the gas distribution grids. This report for the authorities was an early example of the joint effort of the DSOs in the Netherlands. At the 23rd World Gas Conference in Amsterdam in 2006 a paper was presented about the improvement in the determination of these methane emissions from gas distribution mains in the Netherlands [1].

The OGMP 2.0 Partnership is a voluntary international collaboration between the United Nations (UN) and companies from the entire oil and gas sector (down-, mid- and upstream). OGMP 2.0 is the only comprehensive, measurement-based methane emissions reporting framework for the oil and gas industry with over 140 companies joining from the oil and gas sector. This program sets requirements for the way in which methane emissions are determined. For DSOs, the OGMP 2.0 methodology includes all sources of methane emissions for all groups of assets (mains, service lines and stations). Methane emissions from all possible sources (fugitives emissions, venting and flaring) are being quantified. OGMP 2.0 reporting, includes also the submission of an implementation plan every year for each DSO, describing the steps to be taken to improve the quality of the underlying data. In Table 1 an overview is given of the sources of methane emissions that OGMP 2.0 participating DSOs have to report conforming to the OGMP 2.0 Mid and Downstream Reporting Template.

Table 1. Sources of methane emissions to be reported by DSOs conforming to the OGMP 2.0 Reporting Template

4	ASSET - TOTAL EMISSIONS
4.1.	Mains
4.1.a.	Fugitives
4.1.a.1.	Permeation
4.1.a.5.	Leaks derived from systematic survey
4.1.b.2.b	Odour call warnings
4.1.b.	Vents
4.1.b.1.	Operational emissions / Maintenance
4.1.b.2.	Incident / Third party damages (incl. repair)
4.1.c.	Incomplete combustion
4.2.	Service lines
4.2.a.	Fugitives
4.2.a.1.	Permeation
4.2.a.2.	Leaks derived from systematic survey
4.2.b.2.b	Odour call warnings
4.2.b.	Vents
4.2.b.1.	Distribution - Operational emissions / Maintenance
4.2.b.2.	Incident / Third party damages (incl. repair)
4.2.b.3.	Change/Removal installation of Gas meters
4.3.	Stations
4.3.a.	Fugitive Emissions
4.3.b.	Vents
4.3.b.1.	Operational emissions / Maintenance
4.3.b.4.	Incident / Emergency vents
4.3.c.	Incomplete combustion
Level5	ASSET - TOTAL EMISSIONS L5

All fugitive emission sources from mains and service lines are unintentional sources. Permeation from plastic pipes is a property of the material and it is not an unexpected source.

Leaks are unintentional 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. Odour call warnings are unintentional 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.

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. Incidents and third party damages (TPD) are unintentional and 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.

Methane emissions are no longer reported based on generic nationwide emission factors (Level 3), but are based on company specific source-level quantification per asset (Level 4). Most effort has been put into the quantification of the sources that account for a minimum of 70% of the methane emissions from each asset, the so-called material sources. Also initial steps were taken towards Level 5 reporting. This was done by comparing source-level inventories with independent site-level measurements by car for reconciliation, to produce Level 5 asset emissions estimates. These steps will also be described.

2. Materiality

Last year, the OGMP Mid and Downstream Reporting Template has been filled in completely with Level 4 data for all material sources. In Fig. 2, the national result of the 2023 materiality for the Dutch DSOs as a graphic in percentages is given.

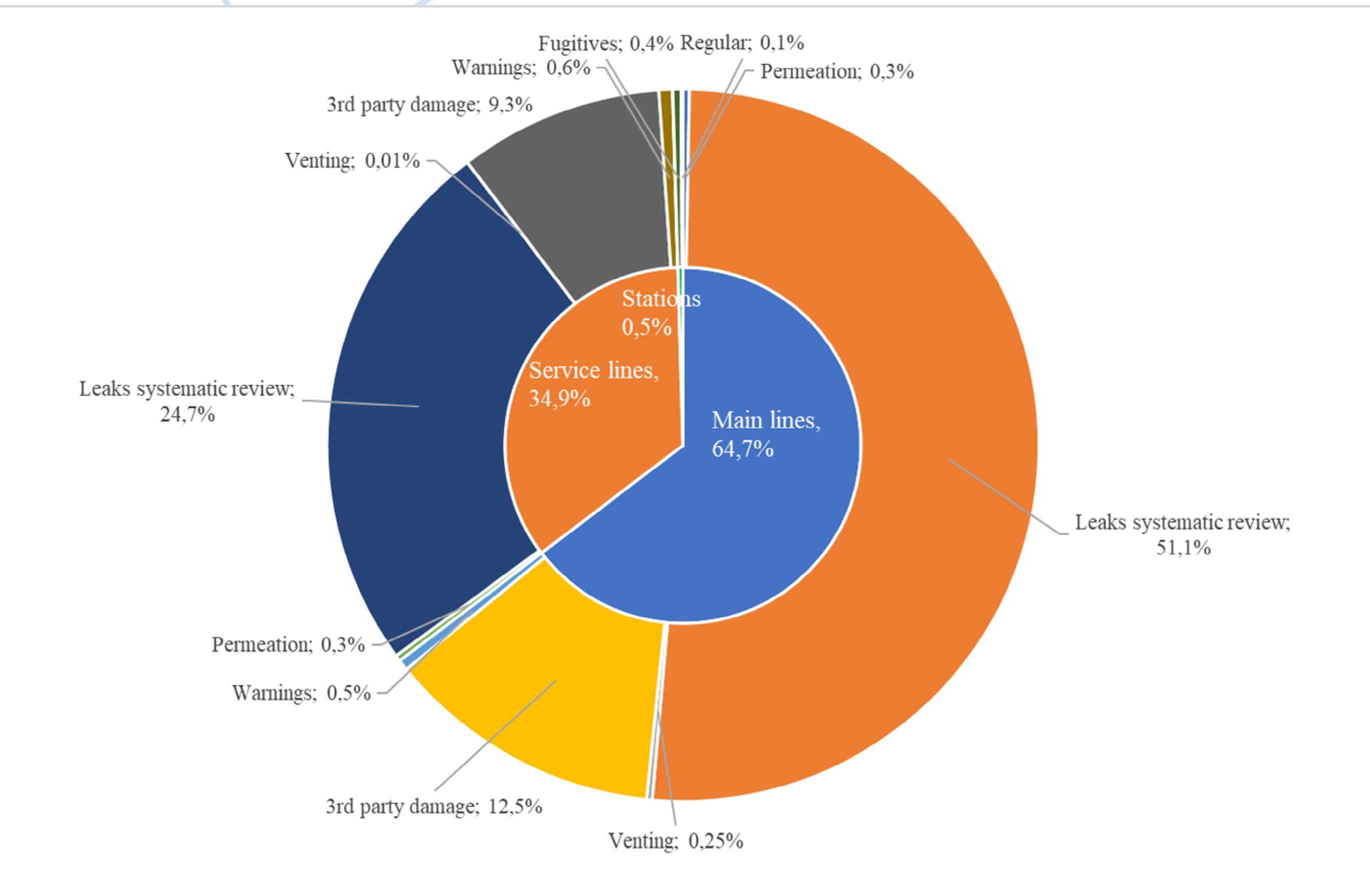

Fig. 2. Materiality in 2023 for the Dutch DSOs as a graph

The overall contribution of permeation to the methane emissions for both mains and service lines is relatively low, 0,6% of the total methane emissions, and therefore in all known cases a non-material source of methane emissions.

The calculated quantity of methane emitted for venting and flaring due to operational emissions and maintenance (replacements, removals, repairs and new construction) for mains, service lines and stations amounts about 0,4% of the total methane emissions. Therefore, these company-specific methane emissions from venting and flaring are non-material.

The inner circle of the graph shows the distribution of emissions between asset groups. Mains account for 64,7% of all emissions, services lines for 34,9% and stations for 0,5%. The outer circle shows the distribution of emissions between sources. The largest material methane emission sources for both mains and service lines are fugitive methane emissions as derived from systematic review (leak detection and repair) and third party damages. Non-material sources within both the mains and the service lines are permeation, vented emissions, odour call warnings and meter changes. Stations do not contain any material methane emission sources, as the regular operation, maintenance and incidents for stations are all non-material.

The methane emissions from odour call warnings for mains and service lines amount 0,5% and 0,6% respectively. These emissions are calculated based on a computer model and dataset for the determination of the average time until a smellable gas leak is reported. This so-called passing frequency, depends on the number of people who come sufficiently close to the leak within a certain time.

The calculated emissions of both incidents (0,0%) and fugitive methane emissions of stations (0,4%) are non-material. Finaly, the methane emissions for the installation, change or removal of gas meters turned out to be negligible.

In the following paragraphs the currently used methodologies for both mains and service lines are described for the material Level 4 sources; leaks derived from systematic survey and TPD.

3. Mains

In the Netherlands a large infrastructure (30 mbar to 8 bar) is build to transfer natural gas from the transmission grid to the end users. The total length of the gas distribution grids throughout the Netherlands expanded up to almost 125.000 km in 2023.

Fugitive emissions from mains can be detected in a LDAR program. Reporting conforming to a Level 4 approach of these leaks derived from systematic survey, relies on activity data, typically the length and operating pressure of the pipelines, and on company specific emission factors considering the material of the pipes. These emissions are being quantified using measurement-based emission factors. The main underlying formula to determine emissions from mains is given in equation 1:

$$\boldsymbol{EF = 8760 * \frac{R}{1000} * N * F * \frac{J+j}{2}} \quad (1)$$

With:

EF Emission factor (m^3 methane/km/year)
8.760 Hours per year
R Flow rate leak per leak (liter natural gas/hour), divided by 1.000 to convert from liter to m^3
N Number of leakages per km per year (separate values for each type of material and each type of pressure These are determined as a weighted average of the past 5 years (for each material/pressure and each DSO) [= Total found leakages / (∑ leak surveying frequency (Y) * km surveyed)]
F Percentage methane in Dutch natural gas (81,3%)

J Leak surveying frequency last year (could be different per material, based on the policy of the DSO)
j Maximum time between discovery of leak and repair. Assumption 0,5 year (maximum allowed according to current Dutch Regulation)

The leak surveying data from each DSO for each material and pressure combination has been calculated using the above-mentioned equation. This means that if one DSO in the Netherlands has fewer leakages per kilometre than its counterparts, it will be reflected in the emission factors. It is considered that this is a Level 4 method, as it is based on company specific data.

A total of 65 so-called suction measurements are used to determine the average leak flow rate *R* for low pressure leakages (up to and including 200 mbar), high pressure leakage (up to and including 8 bar) and low-pressure grey cast iron leakages. An animation explaining the suction method can be found on the GERG website [2].

Three parameters are crucial for determining the methane losses for leaks derived from TPD; the number of times excavation damage occurs, the average gas flow and the time between the occurrence of the leak and repair. Information on the number of TPDs in the Netherlands has been obtained from incident registration database Nestor. Knowing the amount of TPDs per DSO, per pipe pressure and per diameter and having assumptions on the leak size opening, based upon pictures of typical damages on pipelines that are registered, the gas flow can be calculated. The duration of outflow is based on estimations of the time between the start of a fault and the time of end to interruption. Equations from the MEEM report were used to determine the gas flow in m^3/h [3].

Kiwa Technology has analysed about 30 photos of excavation damages to measure the opening of the leak. Knowing the diameter of the pipeline, it is possible to find the scale of the picture and measure the size of the leak. In Fig. 3 an example of a photo taken during the excavation of a third party damage is given.

Fig. 3. Example of a photo taken during the excavation of a third party damage

For mains the distinction that is presented in Table 2 was assumed to be valid based on the photo analyses.

Table 2. Typical leak openings from third party damage for mains

Type of damage	High pressure (>200 mbar up to 8 bar)	Low pressure (≤200 mbar)
Rupture	10%	20%
Average: Ø 60 mm	45%	40%
Small: Ø 10 mm	45%	40%

4. Service lines

Service lines are the assets between the main pipeline and the customer. In the Netherlands it is standard that the meter is positioned inside the building for the lower pressures (≤ 200 mbar). The material used depends on the year of installation and the situation.
The total amount of fugitive emissions are quantified in a similar way as for mains. This is done by performing periodically inventories of the number of leaking services per population of services of the same materials in use and an estimation of the mean duration of these leakages. By combining these data with the value for the amount of leakage per service line, a reliable assumption can be made of the total amount of fugitive emissions of services.

A crucial parameter for determining the leakages per service line, is the leak rate per leak. Pressure reduction measurements were chosen as the preferred quantification method for the determination of the amount of leakage per service line. This has proven to be a reliable method for quantifying the amount of leakage per service line. For the execution of pressure reduction tests, the leak tightness of the service line is tested with the main valve closed by a pressure test for 5 minutes according to guideline G12 [4]. The total internal volume of the pressure tested service line can be calculated using the accurate measured total lengths of these 2 parts of the service line. The amount of leakage for a pressure reduction test can be calculated as follows according to Equation 2 below:

$$\Delta P * V * 12 = L \quad (2)$$

With:
ΔP = pressure drop in bar
V = internal volume of the service line in liter
12 = 12 * 5 minutes is 1 hour
L = leakage in liter/hour

TPD for service lines has been determined in the same manner as described earlier for mains. When a service line is hit, that leads in most cases to a full diameter rupture. Therefore all calculations were based on full diameter rupture.

5. Level 5 reporting

Developments to enable Level 5 reporting in the future are also being assessed within the DSOs in the Netherlands. In 2023, DSO Liander executed a pilot with a leak survey car on 439 km of Liander network in a city representative for the Netherlands. This pilot compared to circa 0,4% of the total gas grids of the DSOs in the Netherlands. The pilot was underpinned by highly sensitive equipment on a vehicle capturing gas readings as low as 'parts per billion' and the use of data analytics to quantify the methane emissions from natural gas leaks and to highlight major methane emissions hotspots. The data from this pilot has been used to verify currently reported OGMP 2.0 Level 4 emissions. The lessons learned are input for a second pilot on a larger scale.

The Dutch DSOs reported an overall emission of 9,2 kt methane emissions over the year 2023 for OGMP 2.0. One can roughly compare that to the emissions in the first Liander pilot of 63 t/yr. Extrapolation of this amount of methane emissions to 100% results in 15,8 kt/y which is about 1,7 times higher than reported in the OGMP 2.0 update for 2023. The factor 1,7 indicates that the used methodology to quantify the emissions by the DSOs in the Netherlands and the reported emissions by a leak survey car are not that different. However, more extensive research will be conducted into these differences in the near future.

6. Conclusions and further future steps

The paper gives an overall impression of the efforts that the six Dutch DSOs have made so far to ensure that they comply the OGMP 2.0 Gold Standard Reporting requirements. In 2023 a comparison started with Level 5 measurements based on the first Liander pilot results. A continuation of this work will enable the DSOs a path towards reporting at Level 5 in the next coming years, including uncertainty calculations.

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