



Highwood Emissions
Management

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Technical Report

OGMP 2.0 Gap Assessment using Veritas

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Acronyms

| | |
|----------|---|
| AGI | Aboveground Installation |
| CCAC | Climate and Clean Air Coalition |
| CNG | Compressed Natural Gas |
| DPLA | Digital Platform for Leakage Analytics |
| GHGI | Greenhouse Gas Inventory |
| HP | High Pressure |
| IMEO | International Methane Emissions Observatory |
| IP | Intermediate Pressure |
| LNG | Liquified Natural Gas |
| LTS | Local Transmission System |
| NTS | National Transmission System |
| SLM | Shrinkage and Leakage Model |
| O&M | Operation and Maintenance |
| OGMP 2.0 | Oil and Gas Methane Partnership 2.0 |
| PRS | Pressure Reduction Systems |
| SCFH | Standard cubic feet per hour |
| SCMH | Standard cubic meters per hour |
| UNEP | United Nations Environmental Program |
| US CFR | United States Code of Federal Regulations |
| US EPA | United States Environmental Protection Agency |

Executive Summary

The goal of this project was to review and provide feedback on Cadent's approach to estimate emissions using the Digital Platform for Leakage Analytics (DPLA) to determine if it can be leveraged for the Oil and Gas Methane Partnership 2.0 (OGMP 2.0) reporting in the case Cadent considers joining it. An in-depth analysis of all emissions sources within Cadent's system was carried out to elaborate a materiality analysis and determine which facility types contribute more to total emissions. The analysis was based on the emission sources that need to be reported under OGMP 2.0 for the downstream. Emissions from main lines and service lines and reducing/metering stations represent 95.4% of total emissions in Cadent's portfolio. The results confirmed Cadent's expectations on which are the highest contributors within those facility types: fugitives from main lines and service lines, and fugitives and operational and maintenance venting from offtake and pressure reduction systems (PRS) aboveground installations (AGIs).

Sampling requirements according to OGMP 2.0 Uncertainty and Reconciliation Guidance were developed (section 3.3). For main lines and service lines, current practices in Cadent fulfill the requirements of OGMP 2.0. In the case of AGIs, additional equipment needs to be procured to meet minimum sampling requirements. Table 1 presents the minimum number of facilities to be covered and the number of fixed sensors needed, assuming 4 sensors are needed per facility based on pilot implementation of continuous monitoring systems in Cadent. Further measurement campaigns are needed to develop source-level estimates for AGIs using Distran acoustic sensors. Assuming 2 surveys per week are conducted and considering the size of Cadent's network, a total of 14 Distran acoustic sensors are needed to cover enough AGIs to meet sampling requirements described in in Table 1.

Table 1. Sampling requirements for AGIs

| Facility type | Count | Assets to cover | Fixed sensors needed |
|-----------------|-------|-----------------|----------------------|
| Offtakes | 48 | 24 | 96 |
| Above 7 bar PRS | 609 | 61 | 244 |

The analysis of mobile survey measurements has been documented in the Cumulative Statistics document. A roadmap for reaching Level 5 has been outlined: if Cadent joins OGMP 2.0 in 2025, Level 5 should be achieved by 2027 to enable reporting for the 2028 submission and attainment of Gold Standard in line with UNEP's timeline. The key point from the roadmap is that continuous monitoring systems alone are not accepted for site-level measurements. A proposal plan for UNEP is under consideration as follows:

1. The continuous monitoring system can quantify.
2. Source-level measurements exist.
3. Leaks detected by the continuous monitoring systems are investigated as part of the reconciliation and measured with a handheld to confirm.

Lastly, differences in OGMP 2.0 reporting and Veritas reporting are provided. In general, the OGMP 2.0 Implementation Plan is more detailed in the questions to answer around uncertainty (measurement error, extrapolation, etc.). A company that is an OGMP 2.0 signatory is not required to develop a public Veritas report, since UNEP would act as the reviewer for that company. As an OGMP 2.0 signatory, a company must disclose its total emissions and emissions reduction target.

1. Background

Cadent Gas is at the forefront of natural gas distribution companies in obtaining emissions estimates from measurements. To do so, the Digital Platform for Leakage Analytics (DPLA) has been developed. The DPLA has capabilities to obtain emissions for underground assets at the system, Shrinkage and Leakage Model (SLM) category, and individual asset level. Cadent aims to achieve regulatory emissions reporting based on measurement rather than on generic emission factors obtained from the SLM. The goal of this project was to review and provide feedback on the approach take in DPLA to determine if it can be leveraged for the Oil and Gas Methane Partnership 2.0 (OGMP 2.0) reporting in the case Cadent considers joining it.

The subsections below provide an overview of OGMP 2.0, Veritas, and Highwood Emissions Management.

1.1. OGMP 2.0

OGMP 2.0 is a comprehensive framework developed by the United Nations Environment Programme (UNEP) and its Climate and Clean Air Coalition (CCAC) in 2020 to help oil and gas companies measure, report, and reduce methane emissions across the entire value chain. It builds on the original OGMP initiative (launched in 2014) but significantly expands its scope and rigor. The International Methane Emissions Observatory (IMEO) plays a central oversight and data integrity role in the OGMP 2.0 framework. Established by UNEP in 2021, IMEO was created specifically to support the goals of OGMP 2.0 and enhance global transparency and accountability in methane emissions from the oil and gas sector. Figure 1 shows the relation between UNEP, OGMP 2.0 and IMEO.

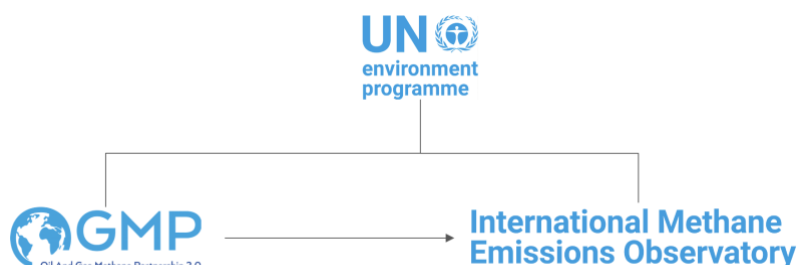


Figure 1. UNEP, OGMP 2.0 and IMEO structure

The goal of OGMP 2.0 is for the oil and gas industry to reduce emissions and to be able to prove so. It provides a credible and transparent standard for methane emissions reporting, which enables investors, regulators and the public to know the companies that are making progress towards their targets. These features facilitate investment decisions aligned with sustainability metrics and encourage technology innovation in methane detection and mitigation.

The main features of OGMP 2.0 are:

- Companies joining OGMP 2.0 need to have methane emissions reduction targets, either absolute or intensity based.
- Reporting at five levels (Figure 2), from Level 1, reporting a single number based on a percentage of production or throughput, to Level 5, using source-level

measurements and site-level measurements to reconcile the final emissions estimate.

- Covering the full oil and gas value chain (upstream, midstream, and downstream).
- Requires reconciliation to reach the Gold Standard of reporting.
- Required annual reporting of emissions, which is validated by IMEO.

| LEVEL 1 | LEVEL 2 | LEVEL 3 | LEVEL 4 | LEVEL 5 |
|---|--|--|--|---|
| Venture/Asset Reporting | Emissions Category | Generic Emission Source Level | Specific Emission Source Level | Level 4 + Site Level Measurement Reconciliation |
| <ul style="list-style-type: none"> • Single, consolidated emissions number • Only applicable where company has very limited information | <ul style="list-style-type: none"> • Emissions reported based on IOGP and Marcogaz emissions categories • Based on generic emissions factors | <ul style="list-style-type: none"> • Emissions reported by detailed source type • Based on generic emissions factors | <ul style="list-style-type: none"> • Emissions reported by detailed source type using specific emissions and activity factors • Based on direct measurement or other methodologies | <ul style="list-style-type: none"> • Level 5: Integrating bottom-up source-level reporting (L4) with independent site-level measurements. • Site-level measurements: direct measurement technologies at a site or facility level on a representative sample of facilities |

Figure 2. OGMP 2.0 reporting levels

1.2. Veritas

Veritas is a science-based methane emissions measurement and verification framework developed by GTI Energy, Highwood Emissions Management and SLR Consulting. It was launched in 2022 through collaboration with industry, environmental organizations, and academic institutions.

The Veritas protocols provide standardized methodologies for quantifying methane emissions using direct measurements, reconciling measured data with inventory-based estimates, and comparing performance across operators and supply chains. The protocols also cover the value chain, and there are specific protocols for upstream, midstream, and downstream.

Veritas is not a reporting program, but the results obtained from its implementation can feed into other voluntary frameworks such as OGMP 2.0. Veritas provides how-to guidance for measurement and reconciliation. It acts as a technical backbone for companies aiming to meet OGMP 2.0 Level 4 and 5. Veritas source-level protocols are consistent with OGMP 2.0 Level 4 requirements.

1.3. About Highwood Emissions Management

Highwood Emissions Management Inc. is based in Calgary, Alberta, with representation in Europe. Working with industry, government, and innovators, we leverage data, analytics, knowledge, and experience to optimize greenhouse gas (GHG) emissions management. Our mission is to collaborate, innovate, and educate the path to a world with effective and affordable emissions management solutions.

One of our guiding principles is that effective decision-making in emissions management lies at the intersection of knowledge and data. Highwood's services have led to several impactful projects for our partners. Our team is uniquely suited to combine leading analytical methods with detailed, nuanced interpretations from field experts.

Highwood staff have contributed both to the writing of the Veritas protocols and their implementation with other distribution companies, as well as guided organizations in reaching OGMP 2.0 L5. In addition, Highwood analysts and research and development team members all possess experience applying the necessary statistical processes, technology expertise, and thorough understanding of the Veritas protocols to ensure comprehensive and actionable guidance is provided.

The following list describes additional experience from Highwood:

- Leading expertise in the understanding, evaluation, and deployment of both bottom-up and top-down methane detection and quantification systems in upstream oil and gas. We have a proprietary database with over 180 commercially available methane measurement solutions and work with dozens of stakeholders in the methane detection and quantification space. We are recognized as global leaders through peer reviewed publications evaluating different technologies (e.g., see [here](#) and [here](#)) as well as teaching the world's only methane detection and quantification technology [course](#).
- Recognized thought leadership on emissions reduction equivalency and demonstration of technology performance. We have worked for years at the interface of regulators, industry, and innovators to streamline the approval of novel methane measurement technologies as an alternative to regulatory-approved methods. Highwood's President led [important work](#) on technology approval that has been adopted by regulators across North America and endorsed by industry, innovators, academics, and regulators.
- We have worked closely with diverse international clients to understand how to deploy methane detection and quantification technologies. Examples include the Government of British Columbia, MiQ, Colorado Oil and Gas Association, GTI Energy, Environmental Defense Fund, and a broad range of O&G companies and technology vendors. We led Canada's first regulatory approval, using LDAR-Sim, of a continuous measurement system for two producers. We have also worked closely with various organizations on Colorado Alternative Approved Instrument Monitoring Method (AIMM) and U.S. Environmental Protection Agency (EPA) Alternative Means of Emissions Limitation (AMEL) regulatory applications.
- Global expertise in bottom-up inventory data management and calculations across diverse production types, companies, and regions. Experience using and implementing world-leading inventory management, quantification, and reporting software. Experience working with diverse oil and gas companies to build inventories, perform quantifications, and lead regulatory and non-regulatory (e.g., ESG) reporting.

2. Project Goals

Cadent Gas wants to:

1. Leverage existing internal process to comply with the Veritas source-level protocols and achieve OGMP 2.0 Level 4.
2. Develop a roadmap to eventually reach OGMP 2.0 Level 5.

The team at Highwood Emissions Management has reviewed Cadent's current processes to measure methane emissions and obtain system-wide annual estimates.

2.1. Documentation Reviewed

The Highwood team reviewed the following DPLA documents:

- Cumulative Statistics
- DPLA Veritas Protocols Implementation Plan
- DPLA Product Overview
- Snapping Documentation

3. Gaps for OGMP 2.0 Level 4

3.1. Sources of emissions

Confirmed that all sources of emissions are included in the materiality assessment, even if there are no plans to estimate them at Level 3 or Level 4. Table 2 presents all the sources that are in scope for OGMP 2.0 for the downstream or distribution segment and are present in Cadent's system.

Cadent does not own customer meters and is not responsible for maintaining or replacing them. Their emissions are not in scope for Cadent. Methane emissions from utilization/end-users, oil product manufacturing (i.e. refineries and chemical plants), biogas/biomethane production and upgrading plants, CNG/LNG fueling stations, waste management sites, etc., are not considered in the scope of the OGMP 2.0 reporting framework. CNG stations, including compressors and up to the outlet of the meter, are part of the scope for Veritas. Cadent does not own any CNG stations.

Table 2. Sources in scope for OGMP 2.0

| OGMP Asset Type | OGMP Facility Type | Source category | Source subcategory | Present in Cadent's system |
|---------------------------------|------------------------------|-----------------------|---------------------------|----------------------------|
| Distribution – Lines & Stations | Main lines and service lines | Fugitives | Leaks | Yes |
| | | | Permeation | Yes |
| | | | Odour calls | Yes |
| | | Vented | O&M | Yes |
| | | | Dig-ins | Yes |
| | | | Meter change/removal | No |
| | | Incomplete combustion | Flaring of vented methane | No |
| | IP/HP Pipelines | Fugitives | Leaks | Yes |
| | | | Permeation | Yes |
| | | | Odour calls | No |
| | | Vented | O&M | Yes |
| | | | Dig-ins | Yes |
| | | | Meter change/removal | No |
| | | Incomplete combustion | Flaring of vented methane | No |
| | | Fugitives | Leaks | Yes |

| | | | | |
|---------------------------------------|-----------------------------------|-----------------------|----------------------------|-----|
| | Reducing and/or metering stations | Vented | O&M | Yes |
| | | | Incidents/ Emergency vents | No |
| | | Incomplete combustion | Heaters, boilers | Yes |
| | Valve stations | Fugitives | Leaks | Yes |
| | | Vented | O&M | Yes |
| | | | Incidents/ Emergency vents | No |
| | Injection stations | Fugitives | Leaks | Yes |
| | | Vented | O&M | Yes |
| | | | Incidents/ Emergency vents | No |
| | | Incomplete combustion | Heaters, boilers | Yes |
| Distribution – LNG Satellite stations | LNG satellite stations | Fugitives | Leaks | No |
| | | Vented | O&M | No |
| | | Incomplete Combustion | Boilers | No |
| Distribution – Compressors | Compressors | Fugitives | Leaks | Yes |
| | | Vents | O&M* | Yes |
| | | Incomplete Combustion | Turbines, engines | No |

Main lines and service lines

Table 3 and Table 4 present the source subcategories for fugitive and vented emissions respectively in main lines and service lines. District and services governors were included under the same facility type as main lines and service lines because they are embedded within the distribution network. Their fugitive emissions have been separated for the source subcategory materiality analysis per facility type, and their emissions are not material. However, it is likely that their emissions will be captured when surveying mains and services with mobile measurements. For each of the subcategories, the tables contain:

- Requirements for OGMP 2.0 Level 3 and Level 4.
- Cadent state in estimating emissions at the time of Highwood's assessment.
- Activities required to reach Level 4.

Table 3. Fugitive sources in main lines and service lines

| Fugitives | | | |
|--------------------|--|--|---|
| Source subcategory | OGMP 2.0 | Cadent State June 2025 | Gaps for Level 4 |
| Leaks | Level 3 Generic emission factors (e.g.: SLM) and activity data (km of pipeline) | Deployment of vehicle-based measurement systems or mobile surveys in North London. | Ensure enough kilometers are covered to meet minimum sampling requirements. |

| | | | |
|--------------------|---|---|--|
| | Level 4 Measurements or emission factors developed based on representative measured emissions. | Limited trials in West Midlands. Following up on leaks based on thresholds (emission rate, risk...). | |
| Permeation | Level 4 Engineering calculations | Gathering data on PE pipe thicknesses and partial pressures to calculate estimate. | [Completed] Need to calculate emission source. [Completed] Need to obtain #services/km and average service length to estimate permeation of services. |
| Odor call warnings | Level 3 Generic emission factors and activity data (km of pipeline) Level 4 Company-specific activity and emission factors developed based on representative measured emissions. | Records of odor call warnings are available. Duration of leaks from odor call warnings established at 2 weeks. | [Completed] Need to obtain average emission factor from mobile measurements to assign to odour calls. |

Table 4. Vented sources in main lines and service lines

| Venting | | | |
|----------------------------|--|--|--|
| Source subcategory | OGMP 2.0 | Cadent State June 2025 | Gaps for Level 4 |
| Operations and Maintenance | Level 3 Generic emission factors (e.g.: US EPA's GHGI ¹) and activity data (km of pipeline) Level 4 Engineering calculation specified in OGMP 2.0 Purging and Venting Technical Guidance Document | Not tracking venting events related to commissioning/decommissioning of pipes or over pressurization events. | [Completed] Need to include and assess materiality. If not material, asset can stay at Level 3. If material, need to track events and estimate emissions according to Level 4. |
| Damages (dig-ins) | Level 3 Generic emission factors (e.g.: US EPA GHGI) and activity data (km of pipeline) Level 4 Engineering calculation based on sonic/subsonic conditions, pipeline pressure, size of the hole and duration. | Calculated using company inventory and emission factor. | [Completed] Need to include and assess materiality. If not material, asset can stay at Level 3. If material, need to track events and estimate emissions according to Level 4. |

¹ EPA GHGI, Table 3.6-2 of the Annex 3.6, <https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systems-ghg-inventory-additional-information-1990-2022-ghg>

OGMP 2.0 requires splitting emissions between main lines and service lines. Differentiating leaks and odor call warnings originated at mains and leaks originated at services is challenging. In a submission for OGMP 2.0 it could be justified that fugitive emissions from leaks and odor calls from underground assets are all accounted under the same category. Veritas does not require to differentiate between main lines and service lines.

Details on the subcategories from mains and service lines that should be included in the Veritas report to be compliant with OGMP 2.0 are presented below:

- Permeation through plastic pipe: OGMP 2.0 specifically calls for including permeation of methane through pipe walls. The [Technical Guidance Document for Underground Pipelines](#) provides an equation to do so (Figure 3).

$$V_g = P * \frac{\pi * ID * L * p * d}{t}$$

Where:

V_g = Volume of gas emitted (cm^3 – normal temperature and pressure, i.e. 1 bar at 23°C)

P = Permeation coefficient (e.g. For PE100 = 0.056) ($\text{cm}^3 / \text{m} * \text{bar} * \text{day}$)

ID = nominal internal diameter (mm)

L = length of pipeline (m)

p = Partial pressure of the gas in the pipe (bar)

d = duration (days)

t = nominal thickness of the pipe (mm)

Figure 3. Snapshot of equation to determine volume of gas permeated through plastic pipe.

- Odor call warnings: records are kept, the emission rate could be assigned as the average emission rate measured by mobile (μ).
- Operational and Maintenance (O&M) vents: operational venting refers to pressure relief valves opening due to increased pressure in the system caused by, for example, decrease in demand. Maintenance includes venting when gas is emitted due to commissioning and decommissioning pipelines, construction projects, pipeline repairs, etc. Figure 4 shows the example extracted from OGMP 2.0 [Purging and Venting Technical Guidance Document](#) to calculate the volume of gas released during a maintenance event.

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

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)

V_f = Volume of gas released (scm)

Figure 4. Engineering calculation for blowdowns.

- Third-party damages (dig-ins): Cadent has an inventory of damages that can be leveraged to provide an initial estimate of emissions from this source category. If the source becomes material, some companies have opted for assuming the hole created during the incident is half of the internal diameter. In the case of damages, Level 4 estimates can be obtained from sections 3.2.5.1.1 and 3.2.5.1.2 in GERG's [Methane Emission Estimation Method for the Gas Distribution Grid \(MEEM\)](#).

Intermediate Pressure (IP) and High Pressure (HP) Pipelines

Intermediate and high-pressure pipelines are not explicitly separated by OGMP 2.0. Within Cadent's system, these assets have sufficiently different characteristics, such as being located rural areas, transporting higher pressure gas, and not having connections to service lines, that can be considered a different type of facility. Odor call warnings were not included as a source subcategory because these assets are isolated in rural areas. It is expected that this asset is not material once the analysis is completed. Table 5 and Table 6 contain:

- Requirements for OGMP 2.0 Level 3 and Level 4.
- Cadent state in estimating emissions at the time of Highwood's assessment.
- Activities required to reach Level 4.

Table 5. Fugitive sources in IP and HP pipelines

| Fugitives | | | |
|--------------------|--|--|--|
| Source subcategory | OGMP 2.0 | Cadent State June 2025 | Gaps for Level 4 |
| Leaks | <p>Level 3 Generic emission factors based on pressure (e.g.: US CFR Subpart W²) and kilometers of pipeline.</p> <p>Level 4 Measurements or emission factors developed based on representative measured emissions.</p> | Development of probabilistic model to determine appearance of leaks and emission rates based on historical data. | <p>[Completed] Need to include and assess materiality using published factors.</p> <p>If not material, asset can stay at Level 3. The probabilistic model can inform this estimate once validated.</p> |

² Population Emission Factors—Transmission Pipelines, Gas Service in Table W-5 to Subpart W of Part 98, Title 40, <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-W/appendix-Table%20W-5%20to%20Subpart%20W%20of%20Part%2098>

| | | | |
|------------|-------------------------------------|--|--|
| | | | If material, need to track events and estimate emissions according to Level 4. |
| Permeation | Level 4 Engineering calculations | Gathering data on PE pipe thicknesses and partial pressures to calculate estimate. | [Completed] Need to calculate emission source. |

Table 6. Vented sources in IP and HP pipelines

| Venting | | | |
|----------------------------|--|--|--|
| Source subcategory | OGMP 2.0 | Cadent State June 2025 | Gaps for Level 4 |
| Operations and Maintenance | Level 3 Generic emission factors (e.g.: US EPA's GHGI ³) and activity data (km of pipeline) Level 4 Engineering calculation specified in OGMP 2.0 Purging and Venting Technical Guidance Document | Not tracking venting events related to commissioning/decommissioning of pipes or over pressurization events. | [Completed] Need to include and assess materiality. If not material, asset can stay at Level 3. If material, need to track events and estimate emissions according to Level 4. |
| Damages (dig-ins) | Level 3 Generic emission factors (e.g.: US EPA GHGI) and activity data (km of pipeline) Level 4 Engineering calculation based on sonic/subsonic conditions, pipeline pressure, size of the hole and duration. | Calculated using company inventory and emission factor. | [Completed] Need to include and assess materiality. If not material, asset can stay at Level 3. If material, need to track events and estimate emissions according to Level 4. |

Reducing and/or metering stations (AGI)

Cadent refers to this type of facility type as Aboveground Installation (AGI) sites. Table 7 through Table 9 refer to each subcategory in AGI sites. Incomplete combustion refers to unburnt methane present in the exhaust gases from heaters, boilers, turbines, engines and other combustion equipment that run on natural gas. As in the previous section, the tables contain:

- Requirements for OGMP 2.0 Level 3 and Level 4.
- Cadent state in estimating emissions at the time of Highwood's assessment.
- Activities required to reach Level 4.

³ EPA GHGI, Table 3.6-2 of the Annex 3.6, <https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systems-ghg-inventory-additional-information-1990-2022-ghg>

Table 7. Fugitive sources in AGI sites

| Fugitives | | | |
|--------------------|--|---|---|
| Source subcategory | OGMP 2.0 | Cadent State June 2025 | Gaps for Level 4 |
| Leaks | Level 3 Generic emission factors (e.g.: SLM) and activity data (counts) | Testing and selection of continuous monitoring providers. | Measure enough sites to meet OGMP 2.0 sampling requirements. |
| | Level 4 Company-specific emission factors developed through measurements. | In the process of securing funding to deploying continuous monitoring at 5% of the AGI. Distran Ultra Pro to quantify individual emission rates. | Separate fugitive emissions from vented emissions in continuous monitoring results. |

Table 8. Vented sources in AGI sites

| Venting | | | |
|----------------------------|---|---|--|
| Source subcategory | OGMP 2.0 | Cadent State June 2025 | Gap for Level 4 |
| Operations and Maintenance | Level 3 Generic emission factors (e.g.: SLM) and activity data (counts) | Testing and selection of continuous monitoring providers. | Measure enough sites to meet OGMP 2.0 sampling requirements. |
| | Level 4 Engineering calculations specified in OGMP 2.0 Purging and Venting Technical Guidance Document or measurements.. | In the process of securing funding to deploy continuous monitoring at 5% of the AGI. Distran Ultra Pro to quantify individual emission rates. | Separate fugitive emissions from vented emissions. Differentiate between O&M and incidents/emergency vents. |
| Incidents/Emergency vents | Level 3 Generic emission factors (e.g.: SLM) and activity data (counts) | Testing and selection of continuous monitoring providers. | Measure enough sites to meet OGMP 2.0 sampling requirements. |
| | Level 4 Engineering calculation specified in OGMP 2.0 Purging and Venting Technical Guidance Document or measurements. | In the process of securing funding to deploying continuous monitoring at 5% of the AGI. Distran Ultra Pro to quantify individual emission rates. | Separate fugitive emissions from vented emissions. Differentiate between O&M and incidents/emergency vents. |

Table 9. Incomplete combustion sources in AGI sites

| Incomplete combustion | | | |
|-----------------------|--|--|---|
| Source subcategory | OGMP 2.0 | Cadent State June 2025 | Gap for Level 4 |
| Incomplete combustion | Level 3 Using emission factors provided in Incomplete | Estimate based on educated guess, i.e.: one heater per | Accurate counts in the system are needed. |

| | | | |
|--|---|--|---|
| | Combustion UNEP Guidance Level 4 Measurements of mass of exhaust and methane content in the exhaust | AGI, and emission factors references by UNEP. Working to determine how many boilers and heaters and in AGI sites. | This source is not expected to be material at the facility level, so it can be reported at Level 3. |
|--|---|--|---|

The United Nations Environment Programme (UNEP) is ambiguous on accepting continuous monitoring as a valid Level 4 emissions quantification method. In the [Purging and Venting Technical Guidance Document](#) as well as in the [Leak Technical Guidance Document](#), it is indicated that the continuous monitoring is considered Level 4, provided that the system must be able to differentiate between fugitive and vented sources, for example, by duration of the emission (venting events typically have short duration while fugitives remain active until fixed) or by identifying the component emitting. In April 2024, UNEP published the [Continuous Monitoring Recommendations](#) where limitations were outlined for fixed sensors and stated that “Continuous monitoring systems are a good tool to be part of a multi-tiered monitoring approach [...] however, they are insufficient as a single technology for site-level measurements”.

Injection and valve stations

Injection stations refer to stations injecting methane from other parts of the natural gas system such as storage fields or biogas plants. Odorizers are not considered injection stations.

Valve stations refer to installations with one or more block valves and equipment allowing operators to stop, start, or reroute the flow of gas. A single valve aboveground should not be considered a valve station. Both type of stations may include block or isolation valves (manual or automatic), piping and fittings, bypass lines (optional), pressure and temperature sensors, actuators (electric, pneumatic, or hydraulic), control systems (SCADA or local), access roads and fencing (for safety and inspection). The emissions from these facilities are expected not to be material in Cadent’s portfolio. Due to their low count, it is suggested that emissions for injection and valve stations are estimated based on SLM factor for Pressure Regulating Stations above 7 bar. In the case emissions from these facilities become material, they should be included in the sampling plan for AGI sites.

In the case of individual block valves, which typically are a single valve above ground, their emission could be calculated based on leaker factors in US Subpart W for block valves in Transmission-Distribution Transfer Stations.⁴ A conservative approach would be to consider that all valves are leaking by applying the lowest emission factor (0.0479 SCMH) to all valves. If these valves are surveyed with an acoustic detector, i.e.: Distran, Subpart W considers that when an indication of 3.1 scfh (0.0878 SCMH) is found, it is considered a leak and an emission factor of 0.0782 SCMH should be applied to the leaking component.

Compressors

UNEP provides an exhaustive list of source subcategories from venting in compressors in distribution: purging & venting (maintenance, process, commissioning and decommissioning), pneumatic devices, gas analyzer, seals of the compressor units,

⁴ Table W-6 to Subpart W of Part 98, Title 40, <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-W/appendix-Table%20W-6%20to%20Subpart%20W%20of%20Part%2098>

reciprocating compressor rod packing, start/stop vents, incident / emergency vents, others. Since Cadent only owns one compressor and it is expected that it does not contribute to materiality, it is proposed that emissions are estimated at the category level. Table 10 provides the following information:

- Requirements for OGMP 2.0 Level 3 and Level 4.
- Cadent state in estimating emissions at the time of Highwood's assessment.
- Activities required to reach Level 4.

Table 10. Sources in compressors by category

| Compressors | | | |
|-----------------|---|---|--|
| Source category | OGMP 2.0 | Cadent June 2025 | Gap for Level 4 |
| Fugitives | <p>Level 3 Determine counts of components in the compressor and apply population emission factors.</p> <p>Level 4 Quantification of emissions and development of company-specific emission factors for each component.</p> | Fugitive emissions for the compressor in Cadent's system have not been estimated. | <p>Estimate emissions at Level 3 since compressors are expected not to be material in the portfolio.</p> <p>Obtain counts of components (connections, open ended lines, blow-down open ended line, valves, pressure relief valves, others) as defined in UNEP Leaks Technical Guidance and use appropriate emission factors from referenced there.</p> |
| Vents | <p>Level 3 Apply corresponding emission factors referenced by UNEP guidance based on the compressor type (reciprocating or centrifugal).</p> <p>Level 4 Obtain direct measurements and measurement-based emission factors as defined in the guidance to estimate emissions by source subcategory.</p> | Vented emissions for the compressor have not been estimated. | <p>Estimate emissions at Level 3 since compressors are expected not to be material in the portfolio.</p> <p>Determine the type of compressor and apply appropriate emission factors.</p> |

3.2. Portfolio materiality and open gaps

Based on the information provided in section 3.1, Level 3 emissions were calculated for Cadent's emission sources. Table 11 shows the portfolio materiality of emissions. The facility types that are material in Cadent's portfolio are main lines and service lines and reducing and/or metering stations (i.e.: AGIs). Emissions from these facilities represent 95.4% of Cadent's total emissions and are above the 95% required threshold by OGMP 2.0.

When looking at the materiality of emission source subcategories from each facility type, OGMP 2.0 requires that at least 90% of emissions from each facility type are Level 4. In the case of main lines and service lines, fugitives represent 99.38% of emissions, with leaks from mains and services covering more than 90% of emissions from that facility type. In the case of AGIs, leaks and operation and maintenance (O&M) venting represent 99.99% of total emissions from this facility type. Based on this materiality analysis, Table 12 presents the gaps that remain open to reach OGMP 2.0 Level 4.

Table 11. Cadent's portfolio materiality

Table redacted

Table 12. Open gaps to achieve OGMP 2.0 Level 4

| OGMP Asset Type | OGMP Facility Type | Source category | Source subcategory | OGMP 2.0 Level 4 | Reason |
|---------------------------------|-----------------------------------|-----------------------|----------------------------|------------------|--|
| Distribution – Lines & Stations | Main lines and service lines | Fugitives | Leaks - mains and services | Yes | Already surveying enough kilometers and following up on indications. |
| | | | Leaks - governors | Yes | Source subcategory not material for facility type, can stay at L3. |
| | | | Permeation | Yes | Already L4. |
| | | | Odour calls | Yes | Source subcategory not material for facility type, can stay at L3. |
| | | Vented | O&M | Yes | Source subcategory not material for facility type, can stay at L3. |
| | | | Dig-ins | Yes | Source subcategory not material for facility type, can stay at L3. |
| | Reducing and/or metering stations | Fugitives | Leaks | No | Need to perform source-level measurements. |
| | | Vented | O&M | No | Need to perform measurements or engineering calculations. |
| | | | Incidents/emergency | Yes | Source subcategory not material for facility type, can stay at L3. |
| | | Incomplete combustion | Boilers, heaters | Yes | Source subcategory not material for facility type, can stay at L3. |
| | IP/HP Pipelines | Fugitives | Leaks | Yes | Facility type not material at the portfolio level, can stay at L3. |
| | | | Permeation | | |
| | | | Odour calls | | |
| | | Vented | O&M | | |
| | | | Dig-ins | | |
| | Injection stations | Fugitives | Leaks | Yes | Facility type not material at the portfolio level, can stay at L3. |
| | | Vented | O&M | | |
| | | Incomplete combustion | Boilers, heaters | | |
| | Valve stations | Fugitives | Leaks | Yes | Facility type not material at the portfolio level, can stay at L3. |
| | | Vented | O&M | | |
| Distribution – Compressors | Compressors | Fugitives | Leaks | Yes | Facility type not material at the portfolio level, can stay at L3. |
| | | Vents | O&M | | |
| | | Incomplete Combustion | Turbines, engines | | |

3.3. Sampling requirements

Portfolio materiality in Cadent has been established at the facility type level, since Cadent's system is within the same country. OGMP 2.0 requires that 95% of emissions from the portfolio must be considered material. In Cadent's portfolio emissions, the mains and service lines and AGI are material. Within each of those facility types, the emission sources that are material, i.e.: 90% of emissions from each facility type, include:

- Fugitive emissions from main lines and service lines.
- Fugitive and vented emissions from AGI.

Main lines and services

When deciding sampling strategy, OGMP 2.0 is not prescriptive on how to achieve the minimum sampling requirements. Main lines and service lines could be considered as a single asset (Table 13) with a Mega population (>1000) and simple, as defined in an example of the OGMP 2.0 Uncertainty and Reconciliation Guidance. The minimum sampling coverage is greater than 5% of the population. The target would be to cover between 12,446 km and 37,338 km. The total kilometers driven should cover all materials in the system to assure representativeness for the extrapolation, with a focus on plastic pipe since that is the most prevalent material type in the system. Emissions from distribution systems typically have a long tail, so the more system is driven, the higher the chances of capturing the skewness are. The sampling could be divided by material, since this is a facility attribute that determines changes in emissions distribution. In this case, the kilometers per material would be considered individual populations and sampling targets would be determined per material.

Table 13. Sampling of mains and services by facility type

| Facility Type | Population (km) | OGMP 2.0 Population Size | Complexity | Minimum Sampling Coverage | Sampling (km/counts) |
|-------------------------------------|-----------------|--------------------------|---------------|---------------------------|----------------------|
| Main lines and service lines | 123,816 | Mega | Simple | >5% | >6,193 |
| Pit Cast (CI) | 9,186 | Mega | Simple | >5% | >460 |
| Spun Iron (SI) | 5,957 | Mega | Simple | >5% | >298 |
| Ductile Iron (DI) | 4,293 | Mega | Simple | >5% | >215 |
| Plastic (PE) | 100,133 | Mega | Simple | >5% | >5,007 |
| Steel (ST) | 4,247 | Mega | Simple | >5% | >213 |

Reducing and/or metering stations (AGI)

When talking about sites, Level 4 in OGMP 2.0 focuses on source-level measurements. This includes:

- Fugitive sources originating at individual components that have the potential of developing a leak, e.g.: connections, open ended-lines, valves, and which are gathered in the [Leaks Guidance from UNEP](#) and that are measured with hand-held devices (high volume sampler, acoustic sensor, calibrated bag...).
- Venting events.

In Cadent's system offtake installations define the boundary between the National Transmission System (NTS) and the Local Transmission System (LTS), connecting directly to transmission lines and reducing the has pressure to be injected in the distribution network. Above 7 bar installations are pressure reducing stations within the LTS. For measurements, there are two ways of defining populations for establishing sampling requirements:

1. Total counts of fugitive sources by component type (connections, open ended-lines, valves...), which are used for source-level measurements.
2. Site counts, which are used for site-level measurements.

For option 1, the sources required to be covered should be distributed between offtakes and above 7 bar installations to assure representativeness and the individual leak rates would be measured with the Distran. For option 2, since the operating pressures and size between

offtakes and above 7 bar pressure regulating installations are very different, it is recommended to consider them as independent populations. The Distran would also be used to measure the individual sources at the sites selected. For source-level measurements, the OGMP 2.0 template for stations in distribution, does not provide fields to split fugitive emissions by component type (Figure 5). For Transmission stations, the OGMP 2.0 reporting template (Figure 6), provides the option of obtaining emissions for individual subcategories. However, as explained in the [Guidance for Completing Reporting Template for Mid and Downstream](#), reporting emissions to that granularity is optional.

| | |
|----------|-------------------------------------|
| 4.3. | Stations |
| 4.3.a. | Fugitive Emissions |
| 4.3.b. | Vents |
| 4.3.b.1. | Operational emissions / Maintenance |
| 4.3.b.2. | Incident / Emergency vents |
| 4.3.c. | Incomplete combustion |

Figure 5. OGMP 2.0 reporting template for Stations in Distribution

| | |
|-----------|---|
| 1.3 | ASSET - TOTAL EMISSIONS |
| 1.3.a. | Fugitive Emissions |
| 1.3.a.1. | Connections (flanges, seals, joints) |
| 1.3.a.2. | Valves and control valves |
| 1.3.a.3. | Pressure relief valves |
| 1.3.a.4. | BD-OEL (blow-down open ended line) |
| 1.3.a.5. | OEL |
| 1.3.a.6. | Others |
| 1.3.b. | Vents |
| 1.3.b.1. | Purging & venting (maintenance, process, commissioning&decommissioning) |
| 1.3.b.2.a | Pneumatic devices |
| 1.3.b.2.b | Gas analyser |
| 1.3.b.2.c | Others |
| 1.3.b.3. | Incident / Emergency vents |
| 1.3.b.4. | Others |
| 1.3.c. | Incomplete combustion |
| 1.3.c.1. | Gas combustion devices |
| 1.3.c.1.a | Heaters/pre-heating system/boilers, gas dehydration unit |
| 1.3.c.2. | Flaring |

Figure 6. OGMP 2.0 reporting template for fugitives in Transmission

Cadent currently does not have counts of components for fugitive sources. Based on the information available at this time, the sampling requirements for source-level have been obtained using option 2. It is recommended that as these sites are surveyed over time, an inventory of component counts is developed to better design the sampling plan for fugitive emissions. If an inventory of counts of fugitive sources is not developed when joining OGMP 2.0, it is recommended to:

- Include the goal of doing so in the implementation plan submitted to UNEP.
- Record the type of component (flanges, seals, joints, valves, etc.) to determine which components leak as data is collected to determine if there are some component types that emit more and drive abatement actions.

Preliminary continuous monitoring results indicate that there is a large variability of emissions between installations that are supposed to be similar. The data collected so far is not enough to address the differences between AGIs that are part of the same group. Cadent is planning on surveying one of the continuously monitored AGIs with a Distran to compare against the fixed sensors. For this reason, it is suggested that offtakes are considered complex sites at first due to their higher operating pressures and, potentially, the presence of more potential sources of emissions. For PRS above 7 bar and based on

[OGMP 2.0 Uncertainty and Reconciliation Guidance](#), it is suggested that they are considered as simple sites. Since Cadent will develop an understanding of emissions from these sites prior to joining OGMP 2.0, it would be able to determine if the site complexity can remain as suggested or if they need to be changed. Table 14 shows the sampling requirements based on the suggested complexity designation.

Table 14. Minimum sampling requirements for AGI

| Facility type | Count | OGMP 2.0 Population Size | Complexity | Minimum Sampling | Assets to cover |
|-----------------|-------|--------------------------|------------|------------------|-----------------|
| Offtakes | 48 | Medium | Complex | >50% | 24 |
| Above 7 bar PRS | 609 | Large | Simple | >10% | 61 |

Currently, Cadent plans to procure 130 fixed sensors. With each site needing between 3 to 5 fixed sensors, 35 sites could be covered by continuous monitoring (CM), which represent 5% of all sites. Cadent also has Distran Ultra Pro devices to find and quantify emission sources. Highwood recommends covering sampling requirements using a single technology, as the process of combining partial sampling measurements of two technologies is complex. Since continuous monitoring systems will not be available at all the stations required by sampling and UNEP is concerned about limitations of continuous monitoring according to [OGMP 2.0 recommendations](#) they published, Highwood recommends using the Distran Ultra Pro to quantify fugitive sources and engineering calculations to estimate venting. Where continuous monitors are in place, they can support the quantification of emissions profiles. Based on the sampling requirements, the size of the network (i.e.: it is not practical to share all devices across all regions), and assuming 2 surveys per week are conducted, it was estimated that 14 Distran Ultra Pro devices are needed.

3.4. Annual estimates

Both Veritas and OGMP 2.0 reporting require annual estimates of emissions, i.e.: total emissions emitted in a year. For this reason, the process in DPLA must be able to obtain total emission for the reporting year, during the period from January 1st to December 31st.

In doing so, the most recent survey in the reporting period associated with an asset should be used. This would also apply for assets that have been resurveyed more than once in a year. [This document](#) explains the data cleaning process to use the most recent data.

Mains and services

The process to extrapolate emissions from leaks of main lines and service lines measured by mobile survey to unsurveyed areas (spatial extrapolation) is outlined in the [Cumulative Statistics](#) document.

Reducing and/or metering stations (AGI)

The approach to extrapolate from monitored sites to non-monitored sites (spatial extrapolation) can be similar to that of mains and services where:

1. An average annual emission factor is developed per AGI site type per material subcategory (fugitives and vented).
2. The count of sites of that type is multiplied by the emission factor developed to obtain total emissions.

4. Recommendations for OGMP 2.0 Level 4

4.1. Analysis of emission rates measured

Based on the Cumulative Statistics document reviewed on June 20th; the following items are suggested to assure clarity in a Veritas report being reviewed by an external party and increase the chances of a successful OGMP 2.0 submission:

1. Use a formal test, like the Shapiro Wilk, to determine the goodness of fit between emission rates measured and a log-normal distribution.
2. Display log transformed data against a normal distribution on either a probability distribution plot or a Q-Q plot. These types of charts make it easier to visualize for goodness of fit.
3. Develop these plots for each material type.
4. Methane emissions distributions are heavy tailed. If a parametric distribution cannot be fit, bootstrapping can be used to obtain average emission rate.
5. In the case of leaks per km (π_N) where some short asset lengths cause the value to be very high, grouping into length buckets and calculating bucket specific uncertainty would limit some of this variability.
6. Define all terms used in the Veritas or OGMP 2.0 report (ϵ , SAPID, N, indication, marker, PE, SI, CI, DI, ST...)

4.2. Increase continuous monitoring coverage

As mentioned in section 3.3, offtakes and PRS were considered different site types based on the pressure and size of the stations. Additionally, offtakes were considered as complex sites due to the higher pressures handled and equipment present at those sites. For this reason, it is recommended that coverage of offtakes and PRS increases to 10% and 50% respectively, needing continuous monitoring systems at 24 offtakes and 61 PRS (Table 15). The number of sensors needed assumes that, on average, 4 sensors are needed per facility.

Table 15. Sampling requirements for AGIs

| Facility type | Count | Assets to cover | Fixed sensors needed |
|-----------------|-------|-----------------|----------------------|
| Offtakes | 48 | 24 | 96 |
| Above 7 bar PRS | 609 | 61 | 244 |

4.3. Managing changes in portfolio materiality

The materiality assessment confirmed that main lines and service lines and AGIs are the facility types in Cadent's portfolio that need to reach OGMP 2.0 Level 5, with their emissions contributing 95.4% of total emissions, above the threshold of 95%. This analysis was performed using SLM and other generic emission factors. As measurements are conducted, it is possible that emissions from material facilities, especially from main lines and services lines, are lower than anticipated with the generic emission factors. This would make emissions from IP/HP pipelines material in Cadent's portfolio. Vented emissions represent 72.75% of emissions from this facility type. For this reason, it is recommended that emissions from vented emissions in IP/HP pipelines are tracked through engineering calculations to:

1. Know how much it is being emitted and avoid using emission factors. This could bring down emissions from these assets and not make them material.
2. Keep those emissions at OGMP 2.0 Level 4 in case they become material.

Additionally, any emissions mitigation activities, such as recompression and reinjection of displaced volumes of natural gas, should be recorded to justify whether venting from these facilities can be kept at zero or near zero.

If emissions from leaks (source subcategory for fugitives) at main lines and service lines were 30% lower than the estimated emissions in the portfolio materiality analysis, the materiality of main lines and service lines and AGIs would fall 94.4% and total Cadent emissions would reduce by 22%. This change would require a new reassessment in materiality, because:

1. Emissions from main lines and service lines, and AGIs do not reach 95% of total emissions of Cadent's portfolio.
2. There has been a change of more than 20% in total emissions.

According to OGMP 2.0 Frequently Asked Questions:

"Materiality analysis should be reassessed if there are significant changes (e.g., 20% change of emissions within 3 years). The recommendation is to review the materiality analysis every three years unless there is a significant change in the portfolio and/or asset. In the case of significant changes (such as one of the most material assets being divested, implementation of mitigation measures with a massive reduction of emissions...), the company is encouraged to submit the reassessed materiality analysis with the next reporting."

Table 16 shows how materiality changes as emissions from leaks in main lines and service lines change. The columns highlighted in orange correspond to scenarios in which additional facility types become material for Cadent's portfolio. OGMP 2.0 does not require selecting material facilities or sources that contribute more total emissions first. Companies have flexibility to prioritize those sources for which Level 4 is easier to achieve, either because operators already have the data or because less effort is required to obtain the data. For example, in the 30% reduction scenario, bringing injection stations to Level 4, would reach the threshold 95% emissions captured at Level 4. In terms of timelines, when a new source becomes material, a company has one year to achieve Level 4 on it to maintain Gold Standard. More details of OGMP 2.0 timelines and Gold Standard are provided in Section 5. As an example:

- 2026: Measurements are done and emissions for main lines and service lines, and AGIs are estimated at Level 4. Emissions from main lines and service lines are lower, making IP/HP pipelines material.
- 2027: Cadent reports the 2026 results in the OGMP 2.0 submission and provides details in the Implementation Plan on how they are achieving Level 4 emissions estimate for IP/HP pipelines. They implement this plan throughout 2027.
- 2028: Cadent reports emissions from IP/HP pipelines at Level 4 from the 2027 results.

Table 16. Changes in materiality with leaks emission reduction

Table redacted

4.4. Snapping process and validation

The snapping process was developed by Cadent Gas in order to attribute indications found by mobile survey to actual underground assets. This process is leveraged when extrapolating emissions from surveyed areas of the system to unsurveyed areas. For this reason, it is important to provide an explanation of the process and the results that were developed to validate it within the Veritas or OGMP 2.0 report. The following paragraph is suggested as a summary of the DPLA Snapping to include in the Veritas or OGMP 2.0 report.

“In order to inform asset management decisions, Cadent needs to assign each leak indication captured during mobile surveys to individual physical assets. Leak indications have spatial uncertainty. The DPLA assigns or snaps each indication to the assets based on historical leakage, material rank, and intersection length with selected buffer area. These three factors were selected based on a validation study with 324 indications where the pipes were excavated to confirm where the leak was located and checked against the output of the snapping process.”

In the case of total emissions estimated for Veritas and OGMP 2.0, the snapping is used to extrapolate emissions from surveyed areas to unsurveyed areas based on material type. All the underground infrastructure is considered to be part of the same facility type, and emissions are obtained at the aggregate level for mains, services, and governors.

The snapping process cannot assign indications to services or governors. For this reason, when comparing emissions of mains from measurements to emissions of mains from the SLM, the measurements might be overestimating the emissions, as some of the emissions could be originating in services or governors. An adjusted emission rate might be needed for this comparison.

4.5. Stratification

As more data is collected, additional factors can be analyzed to determine how emissions estimates are affected. Region, age/year of installation, pipe diameter, etc. can be attributes that affect the emissions profile. Tests such as Analysis of Variance (ANOVA) for normally distributed datasets or Kruskal-Wallis test for non-parametric datasets can determine if statistical differences exist between the means of three or more groups.

5. Roadmap for OGMP 2.0 Level 5

OGMP 2.0 timelines require operated assets to reach Level 4/5 (Gold Standard) within 3 years, with the year a company becomes an OGMP 2.0 signatory representing year 0 (zero) and the third year after committing to OGMP 2.0 representing year 3. Non-operated ventures, which are not that typical for distribution companies and are added here for completeness, need to reach Gold Standard in year 5.

To meet Gold Standard, companies compare source-level estimates, which can be based on measurements, calculations, or modelling, and site-level estimates obtained from top-down measurements. This comparison is the Level 5 reconciliation, where discrepancies between the two estimates are identified and resolved, with the objective of including all sources of emissions within the inventory. Table 17 below shows an example of the timeline if Cadent was to become an OGMP 2.0 signatory in 2025.

Table 17. OGMP 2.0 timeline to reach Gold Standard.

| Year | OGMP 2.0 Year | Reporting Requirements for Operated Assets | Reporting Requirements for Non-Operated Assets |
|------|---------------|---|---|
| 2025 | Year 0 | Year 0 is a reporting year only with no required actions. | Year 0 is a reporting year only with no required actions. |
| 2026 | Year 1 | Report on 2025 data at Levels 1-3. Provide a credible implementation plan to achieve Gold Standard by Year 3 in operated assets. | Report on 2025 data at Levels 1-3. Provide a credible implementation plan to achieve Gold Standard by Year 5 in non-operated assets. |
| 2027 | Year 2 | Report on 2026 data at Level 3. Optionally, provide a revised implementation plan to achieve Gold Standard by Year 3 in operated assets. | Report on 2026 data at Level 1-3. Optionally, provide a revised implementation plan to achieve Gold Standard by Year 5 in non-operated assets. |
| 2028 | Year 3 | Report on 2027 data at Level 4/5 showing that requirements for Levels 4/5 were met. Gold Standard Achieved. | Report on 2027 data at Level 1-3. Optionally, provide a revised implementation plan to achieve Gold Standard by Year 5 in non-operated assets. |
| 2029 | Year 4 | Report on 2028 data at Level 4/5. | Report on 2028 data at Level 1-3. Optionally, provide a revised implementation plan to achieve Gold Standard by Year 5 in non-operated assets. |
| 2030 | Year 5 | Report on 2029 data at Level 4/5. | Report on 2029 data at Level 4/5. Gold Standard Achieved. |

To become a signatory, Cadent would need to provide the following information:

- Company description and logo.
- Complete list of operated and non-operated assets.
- Company methane emissions reduction target on an intensity or absolute basis for operated assets to reach no later than the 5th year. For example, a company joining in 2025 should set a target for 2030. Reduction targets for non-operated assets are encouraged but not mandatory.
- Complete the portfolio materiality template by facility type.

A company may be able to reach Gold Standard before Year 3, as it already happened for one company in 2024. Prior to obtaining the Gold Standard, a company may achieve Gold Standard *pathway* before Year 3 by:

1. Submission of an OGMP 2.0-compliant Level 1 (or higher) report for all in-scope assets, in line with the reporting cycle.
2. Submission of the implementation plan per asset to get to Level 4/5 for all in-scope assets, within the required period.
3. Establishing a methane reduction target: absolute reduction or intensity based.

Cadent has already deployed measurement technologies for their material facility types: mains lines and services lines, and AGIs. It is important to consider that technologies used for source-level, i.e.: Level 4, measurements can be assigned for site-level measurements when other options for source-level become available. The options to obtain site-level measurements for the facility types above and reach Level 5 and improve the analysis are described in the subsections below.

5.1. Main lines and service lines

Much of the guidance from UNEP is focused on the oil and gas upstream segment, which is made up by discrete sites such as well pads, processing facilities, etc. Translating this guidance to a system with continuous assets (pipelines) and small emission rates is not obvious. Additional guidance for distribution is expected to be released in 2025.

Based on UNEP feedback provided in May 2025, there are two options for Level 5:

1. Use mobile survey to find and quantify emission sources. Follow up on the indications to identify the source of leakage. This approach connects the site-level measurements from mobile survey to the source-level confirmation of leakage. The follow up information, i.e.: find rate, should be considered in the analysis to obtain annual estimates.
2. Use Hi Flow Samplers for source-level quantification on a representative number of leaks and use mobile survey as site-level.

5.2. Reducing and/or metering stations (AGI)

Continuous monitoring systems are currently not accepted as the only site-level measurement technology by OGMP 2.0 according to the [recommendations published in April 2024](#). However, UNEP is more flexible with distribution, and a case could be made to attempt acceptance by UNEP where continuous emissions monitoring systems can be leveraged for Level 5 if the following additional items are present:

1. The continuous monitoring system can quantify.
2. Source-level measurements exist.

3. Leaks detected by the continuous monitoring systems are investigated as part of the reconciliation and measured with a Distran to confirm.

This approach should be shared with UNEP soon after becoming an OGMP 2.0 signatory to gather feedback early and adjust if needed. Cadent is also encouraged to leverage current continuous emissions monitoring data paired with on-site surveys to understand the nature of emission sources (fugitive, venting, or incomplete combustion). Engaging with technology providers to develop algorithms or methodologies that can help differentiate this type of emissions is also recommended.

When obtaining the emission estimates for the facilities from continuous monitoring systems, it is important to explain how the emissions were obtained for “periods with no information”, e.g.: the sensor was offline, not enough wind, etc. This is referred to as temporal extrapolation. In some cases, the manufacturer will automatically perform this estimate. In other cases, it will need to be done manually. The interpolation approach should be included in the report.

Two common approaches⁵ to infer emissions in those periods are:

1. Obtain a correction factor to account for emissions missed during "periods of no information". The factor is the duration of the reporting period divided by the duration intervals with emissions reported. This assumes that the data recorded is representative of emissions throughout the year.
2. Perform linear interpolation between the emission rate measured before the "period with no information" and the first emission rate after the "period of no information". If the first or last time point is missing, extrapolate single observed rate through entire window. This assumes that the average emission rate in the "period of no information" is well estimated by empirical average of observed end points.

6. Public Disclosure Requirements

6.1. OGMP 2.0

A company that is an OGMP 2.0 signatory will have their emission results and implementation plan reviewed by an independent group, the United Nations Environment Programme (UNEP). UNEP is the one that determines whether the submitted information is adequate for OGMP 2.0 requirements and provides feedback for future iterations. A company that becomes an OGMP 2.0 signatory must disclose:

- Declared methane reduction targets of company
- Company total emissions by core source, by reporting level (1-5) and by operated and non-operated assets, as well as progress towards targets.

An example of this publicly disclosed information can be found in Company Factsheets present in IMEO reports of [2021](#), [2022](#), [2023](#), and [2024](#). These factsheets also include the progress of company in achieving Gold Standard.

⁵ Fosdick, B. K., Weller, Z., Wong, H. X., Corbett, A., Roell, Y., Martinez, E., ... & Moore, C. (2025). Extrapolation Approaches for Creating Comprehensive Operator-level Measurement-Based Methane Emissions Inventories. <https://doi.org/10.31223/X5K14J>

6.2. Veritas

The public disclosure requirements of companies declaring to implementing the Veritas protocols are provided in Veritas Assurance Protocol. The requirements vary depending on whether a company has performed a third-party audit or not. If a company has not performed a third-party, there are more components to be publicly disclosed to assure transparency. Additionally, the protocol indicates that if a company is an OGMP 2.0 signatory, a public-facing report is encouraged but not required.

With a third-party audit, the information required to be publicly disclosed is:

- Final measurement-informed inventory (MII).
- Final measurement-informed methane emissions intensity.
- A description of the operating segment, a signed statement confirming the scope of assets covered, and the reporting period.
- Statement of the Veritas protocol used, which in the case of Cadent is distribution.
- Any known deficiencies in the MII.
- The percentage of sources reported at Level 4, if following the Pathway 3 Source-Level protocol.
- If not achieved, a statement of the company's goals and timelines to achieve the minimum 90% of sources reported at Level 4, if following the Pathway 3 Source-Level protocol.
- Confirmation that external assurance was completed, including the name of the third-party auditor.

Without a third-party audit, additionally to the information listed above, the following components need to be made public:

- Adjustments made to the measured data during reconciliation.
- Description of the emission sources put in the Best Measured and Best Calculated categories.
- Measurement technology(ies) used, frequency deployed, asset coverage by measurement, and referenced detection limit(s).
- Reconciled emissions estimate for assets with emissions added or subtracted based on Veritas source-level pathway.
- Comparison of the measurement-based inventory to an initial inventory and explanation of the discrepancies.
- Explanations (as much as possible) for year-to-year differences in the (net) measurement-based inventory result.
- Statement confirming assurance was completed internally by personnel that were not involved in the execution of protocols.

It is also recommended to disclose the uncertainty in the estimated MII and methane emissions intensities in both cases.

7. OGMP 2.0 Implementation Plan vs Veritas Implementation Report

As mentioned in Section 6.2, if a company is an OGMP 2.0 signatory, a Veritas public-facing report is not required. Therefore, the information provided to UNEP is, at least, as rigorous as that required in the Veritas report. The [OGMP 2.0 Implementation Plan template](#) requires

specific details regarding the calculation of uncertainty that are defined as optional in the Veritas public-facing Implementation Report Template. If an Implementation Plan is submitted to UNEP, it will be possible to extract all the information required for a Veritas public-facing Implementation Report.

Additional items of source-level measurements, which belong to Section 4 of the OGMP 2.0 Implementation Plan, are:

- Source Characterization: Temporal behavior (Continuous/Intermittent)? Mode (Routine/Abnormal)?
- Describe the spatial extrapolation methods that were used, if applicable.
- Describe how duration and frequency were estimated, if applicable.
- Specify the types of variables and/or uncertainties that were considered for estimating source-level uncertainty (e.g., quantification, sampling, temporal) What was their contribution and why? How was the total uncertainty determined? It is recommended to include an example calculation of the approach used.
- If results from a sample population of sources (or specific times) were extrapolated in space and/or time, how was the extrapolation uncertainty considered?
- Are low-level emissions/emission sources below the detection limit of the technology included in the Level 4 estimate? If yes, then briefly describe the methodology used.
- Does the Level 4 inventory also include emissions deemed nonroutine or abnormal? If yes, then please include those sources in the template above.

Section 5 of the OGMP 2.0 Implementation Plan template refers to reconciliation and Level 5 estimates. The Veritas Protocol steps outcomes and Implementation Report implicitly cover the questions of Section 5.A, 5.B, and 5.C in the OGMP 2.0 report. Section 5.D of the OGMP 2.0 Implementation Plan requires some answers that are optional in the Veritas public-facing Implementation Report and are outlined below:

- What factors contributed to the total site-level uncertainty based on the scale of reconciliation? (e.g., quantification, sampling, extrapolation). How were these uncertainties evaluated?
- If multiple measurements were made (in space or time), did each have its own uncertainty? If so, explain the contributing factors (e.g., wind speed, instrument accuracy) and how variability between measurements was assessed.
- Please report the total site-level uncertainty. How was it evaluated? How were individual uncertainties assessed and aggregated to determine the total site-level uncertainty?
- If site-level measurements were extrapolated to perform reconciliation at an annual scale or asset level, how were sampling and temporal uncertainties addressed and incorporated in the final estimate? Were assumptions made (e.g., consistent operating conditions across time)?
- What fraction of emissions has site-level measurements that occurred at representative sites/at representative points in time? Are there sub-groups of the emission population where there is no site-level measurement data?