Response to the questionnaire on LDAR minimum detection limits and first step underground leak thresholds in the EU Methane Regulation

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General remarks

Operators have an extensive experience in detecting and repairing leaks, as safety and control of emissions have always been at the core of their operation. Operators have also put a lot of effort into understanding the practical capabilities of current methane detection technology. E.g. GERG midstream operators lead a large study with academia performing data analysis[1].

Technological Neutrality Must Be Maintained: The proposed framework appears to favor certain technology providers, particularly those promoting laboratory-optimized ultra-low MDLs. This biases the regulation toward less field-robust solutions. The framework should maintain technological neutrality and focus on functional criteria: We fully support the EC position to rely only on the proven ability under field conditions to reliably detect and quantify leaks above the repair threshold. The field conditions encountered throughout all seasons are understood as normal operating conditions. It is important that operators can have a degree of freedom to design their own detection process, which should be able to match with grid and operational specificities as well as urban and environmental context (accessibility, distance, etc.).

Environmental Impact of Inspections Matters: Excessively low MDLs and detection thresholds may drive unnecessary inspections and follow-ups for small leaks that do not require repair—causing disproportionate environmental burden without delivering emission reductions.

Defining Key Terms & Operational Rules: **The definition of key terms and operational rules fall under CEN responsibility**. We understand that sections 3.5.2.1 and 3.5.2.2 are suggestions and recommendations on detection techniques but not regulation. For example, in windy conditions some suggestions as stated in the questionnaire cannot be matched. If needed, CEN should be the right body to give recommendations, accounting with the specificities of each country / operator/ environmental conditions. Until the definition of the key terms and operational rules through CEN when will use the best practices as applied in industry today.

Focus on Repairable Leaks: The framework should prioritize the detection of leaks above the repair threshold, which are the true contributors to emissions and mitigation targets. Time and resources should not be diverted to identify leaks that will not be repaired due to being below actionable thresholds. The questionnaire mentions a very specific case where 85% of the leaks will be missed with MDL >1 PPM; MARCOGAZ lacks information to be able to make a full analysis of this graph. In any case, this would make up for a very small amount of the total leak freight of methane. The quickest repair on the highest leaks has the biggest impact on the climate. Therefore, those should be prioritized in the coming years. This is supported by the regulation in article 14.9.

Measurement Location is Critical: For concentration based MDLs the distance to the leak origin matters. For some buried or submerged infrastructure, gas dispersion, contamination, and environmental factors (e.g., swamp gas, flow velocity in water) can make identification of a leak originating from the grid very difficult. Detection for below water and below ground components should be focused on the water-air or ground-air interface or the air above.

[1] https://amt.copernicus.org/articles/17/1633/2024/

Definition of MDL:

MARCOGAZ agrees on the overarching goal that MDLs should ensure detection of all leaks at or above the repair threshold, rather than aiming to detect the smallest possible leaks.

We emphasize the possibility of defining MDLs based on the uncertainty of the detection method, with a focus on measurement at the interface (air-ground or air-water) where realistic detection can occur. Based on the uncertainty of the deployed methane detection the MDL should be equal to the leak-repair threshold minus the uncertainty of the chosen detection.

MDL = [repair threshold] – [uncertainty]

We highlight inconsistency in the current regulatory definitions (2.2.1 vs 3.1.2) and urge harmonization, suggesting that the MDL definition in 2.2.1 be adopted consistently across the regulation.

We propose the following unified interpretation:

Minimum Detection Limits (MDLs) should be defined as the minimum detection capability, under normal operating conditions, required to **reliably identify methane leaks at or above the regulatory repair threshold**. This definition should apply consistently across all environments (aboveground, underground, and submerged) and account for the measurement uncertainty of the deployed technology and methodology. Detection should be framed with reference to the measurement interface (ground /water, air interface).

Question 1: Missing Leak Thresholds for Other Environments (e.g., rivers/lakes)

Do you agree with the contents and suggestions in section 3.2? If not, why not and what would you propose instead, including adequate justifications and evidence?

This question has been addressed from TSO perspective.
MARCOGAZ has no evidence to support or invalidate the proposed 17 grams per hour threshold for still water.
We recommend a differentiated approach in flowing water scenarios.
We agree with the argument that components in above-water areas onshore are analogous to above sea level components offshore and therefore support the application of the same threshold for type 2 leak surveys in these areas.

Question 2: Minimum Detection Limits for Aboveground Components (Type 2 LDAR)

Do you agree with the contents and suggestions in section 3.3.1.2? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence. Input would in particular be welcome in response to the specific requests for input expressed in points 2, 6 and 7 above.

MARCOGAZ proposes a pragmatic MDL of 10 g/hr, or alternatively, defining the MDL based on the uncertainty of the measurement in relation to the repair threshold for type 1 LDAR.

For type 2 LDAR surveys, MARCOGAZ agrees that the MDL should be realistic and grounded in the capabilities of existing technologies. MARCOGAZ suggest an MDL of 0.75 g/hr (75% of the repair threshold). Although 10 ppm detection can be achieved with some technologies, MARCOGAZ propose a concentration-based MDL of 50 ppm. This MDL gives enough confidence to detect leaks at or above the repair threshold of 500 ppm with those are close-contact measurements. Going below the value of 50 PPM would exclude leak detection equipment that is currently successfully used by operators in their LDAR campaigns. An MDL of 10 ppm has the risk of distorting the market for leak detection equipment and does not provide more environmental benefit in methane emission reduction. MARCOGAZ acknowledges that uncertainty-based approaches could justify higher MDLs and agree that such flexibility should be allowed.

Question 3: MDLs for Underground Components (Step 1 Detection)

Do you agree with the contents and suggestions in section 3.3.2.2? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence. Input would in particular be welcome in response to the specific requests for input expressed in points 2, 5 and 8 above.

MARCOGAZ agrees that Minimum Detection Limits should not exclude reliable technologies that consistently detect leaks above or equal to the repair threshold. Overall system performance matters, not only the sensor one. If a less sensitive sensor is used in close contact for detection, its detection performance can be comparable with the combination of a very sensitive sensor with a computer model with a high uncertainty. In addition, at a moment of rapid service demand increase, it is counterproductive to limit options for performing the surveys.

- MARCOGAZ supports a mass-flow-based MDL of 100 g/hr for aerial inspections of underground components, viewing this as technically feasible and supportive of wider adoption.
- MARCOGAZ also supports the use of aerial detection for both type 1 and type 2 LDAR.
- MARCOGAZ advocates additionally for a concentration-based MDL approach for ground-based type 2 LDAR, suggesting:
  - 1 ppm for detections within <5 meters of the source or the grid (typical: vehicle) or through a handled device.
  - 0.5 ppm for detections from more than 5 meters.
  - MARCOGAZ disagrees with the use of 0.1 ppm as a blanket MDL, arguing it unnecessarily restricts technology choice and lacks practical justification.

MARCOGAZ notes that when using a vehicle for detection in urban areas, it's not always done from a long distance. Many times, detection is done entirely on foot or by combining vehicle use with on-foot detection once a certain threshold is reached. In this case, the operator knows the threshold and, upon detecting it, exits the vehicle to confirm the leak location on foot.
On-foot detection involves trained personnel using hand-held detectors to survey the distribution grids and get close to the source, guided by maps or instructions.

About point 3 from section 3.3.2.2: We think that it is not possible from the graph provided in the questionnaire to reach the conclusion that a 0.1 ppm MDL is necessary for an efficient detection process of underground leaks. For further explanation see Appendix I of this document.
MDLs for underground leak detection should reflect the distance between the detection equipment and the source, the operational scenario vehicle or handheld or the combination of both, and the uncertainty of the method. A flexible MDL framework, using mass flow or ppm depending on proximity and technology, would support both field practicality and accurate detection.

Question 4: MDLs for Underground Components (Step 2 Detection)

Do you agree with the contents and suggestions in section 3.3.2.4? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence. Input would in particular be welcome in response to the specific request for input expressed in point 5 above.

MARCOGAZ agrees that the Minimum Detection Limit (MDL) for step 2 of underground leak detection should be aligned with the MDL for aboveground components, as the equipment and detection conditions are similar.

We recommend an MDL of 0.75 grams per hour for the second step in alignment with our reasoning in question 2.
MARCOGAZ opposes the proposed 0.1 ppm threshold, noting that:

- Such sensitivity is unrealistic and unnecessary in most field conditions.
- The actual equipment used in step 2 is closer to aboveground LDAR tools, not walking survey sensors.
- A higher MDL, in line with our answer on question 2 of 50 ppm or an MDL based on measurement uncertainty and the repair threshold, is more appropriate.

The MDL for step 2 should match that of aboveground detection or be defined relative to the measurement uncertainty and the leak repair threshold.

Question 5: MDLs for components situated under the sea level and under the seabed

Do you agree with the contents and suggestions in section 3.3.3.2? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence. Input would in particular be welcome in response to the specific requests for input expressed in points 1 and 2 above.

This question has been addressed from TSO perspective.
We have no support for or against an MDL of 3.4 g/hr for on land below water detection. **From a TSO perspective the below water inspection technologies are still developing technologies. Those technologies are not commonly deployed in the mid and downstream sector. Therefore, the TRL level of those technologies is not considered high in our specific sector.** We want to highlight once more that the MDL should ideally be based on the uncertainty with which leaks above the repair thresholds can be identified. An appropriate framework would describe the capability as: "Able to detect leaks of ≥XXX g/hr at the water-air interface."

Question 6: MDLs for Above/Below Onshore Water Areas

Do you agree with the contents and suggestions in section 3.3.3.4.2? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence.

This question has been addressed from TSO perspective.
On land - below water:
We support using the same MDL for type 1 and type 2 LDAR surveys on onshore below-water components. As stated in our answer to Question 5, we have no evidence to either support or invalidate the proposed MDL of 3.4 gram per hour.

On land – above water:
We agree with the proposal to align MDL thresholds for above-water areas with those used for above sea-level components. Following that those MDLs should be aligned with the MDLs for above ground leak detection we refer to our answer to question 2. I.e. For type 1 LDAR we suggest an MDL of 10 g/hr and for type 2 LDAR an MDL of 0.75 g/hr or an MDL that is defined by the uncertainty of the measurement and the repair thresholds.

Question 7: Thresholds for First Step Detection Underground

Do you agree with the contents of section 3.4.2? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence. Input would in particular be welcome in response to the specific requests for input expressed in points 1, 2, 3 and 4 above.

MARCOGAZ supports a realistic and practical approach to setting MDLs and detection thresholds for step 1 of underground leak detection.
Points of interest:

- A 0.1 ppm threshold is considered too sensitive and not meaningful in real-world conditions due to natural background levels of atmospheric methane of 1.9 ppm[2].

[2] https://www.iea.org/reports/global-methane-tracker-2024/understanding-methane-emissions

- MARCOGAZ opposes rigid low thresholds, especially if they lead to excessive false positives or unnecessary follow-up actions (e.g., excavation).
- There is agreement that detection distance should influence the threshold, with lower sensitivity acceptable at close range and higher sensitivity required at greater distances.
- As stated in question 3, when using a detection process through a combination of (vehicle + immediate detection on the ground), the operator is perfectly aware of the value of the step 1 threshold and, as soon as it is reached, will go down from the vehicle to get as close as possible to the source.
- Thresholds should be defined in relation to measurement uncertainty and repair thresholds to avoid unnecessary environmental and operational burden.
- The repair threshold is 1000 ppm for underground components.
- Unproductive digging operations should be avoided.
- There should be discrepancy between the step 1 MDL and the step 1 threshold to initiate step 2.

Proposed Thresholds Above Background Methane Level for Step 1:

- Measurement at the interface between ground and air in close vicinity to the leak source: 50 ppm (typical: pedestrian).
- Measurement at short distance (<5 m): 10 ppm (typical: vehicles).
- Measurement at long distance (>5 m): 5 ppm (typical: vehicles).

Question 8: Detection Techniques for Aboveground Components

Do you agree with the contents and suggestions of section 3.5.2.1? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence.

On point 2: We want to point out that in addition to techniques used for above ground close contact measurements more techniques are available for step 2 below ground measurements. For example, techniques such as carpet measurements or subsurface probes can detect, quantify and localize methane at the ground-atmosphere interface without excavating or accessing the component directly. These methods are effective and save emissions and should thus be explicitly acknowledged as viable options.

We welcome the acknowledgement that OGI cameras might be used for close contact detection of methane leaks. The potential influence of environmental factors for OGI camera use is also accessed. In order to make the implementing act more technology agnostic we support to also include other optical and acoustic based detection technologies as an alternative for close contact detection. Therefore, point 7 should be expanded to cover other remote sensing methods.

As mentioned in the general remark about standardization of key definitions CEN should be in charge of defining these.

Question 9: Detection Techniques for Underground Components

Do you agree with the contents and suggestions of section 3.5.2.2? If not, why not and what would you propose instead? Any input should be provided with adequate justifications and evidence.

MARCOGAZ opposes the prioritisation of detection methods for underground components as mentioned in the questionnaire. The selection of the appropriate method and technology should be left to the knowledge of the operator.

For example, walking or aerial inspections should be allowed even where a vehicle inspection is possible.

The implementation act should not enforce a specific detection method. Additionally, as mentioned in the general remarks, the definition of operational rules should be done by CEN.

Question 10: Aerial detection special points

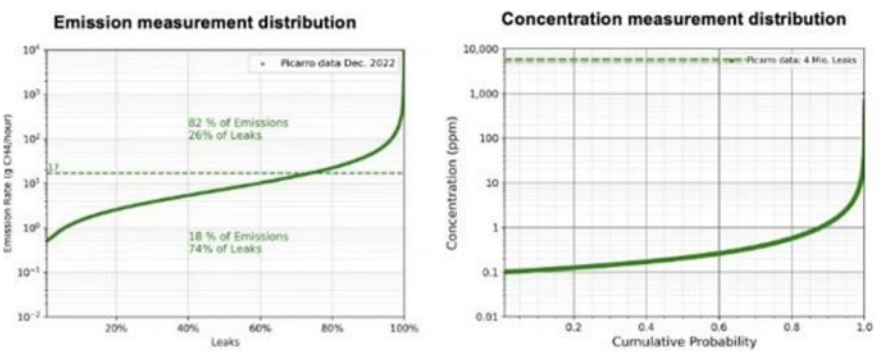
What essential elements of detection techniques covering aerial based underground and/or subsea/below the seabed LDAR surveys would you consider relevant for inclusion in the Implementing Act and why? Any input should be provided with adequate justifications and evidence.

This question has been addressed from TSO perspective.

Any detection technique that allows for compliance with the regulation should be allowed for type 1 and type 2. We welcome that aerial inspections are allowed for type 1 and type 2 LDAR below-ground inspections.

Appendix I

<u>Question 3, point 3:</u>



It is important to ensure that large leaks (above 1000 ppm for type 2 LDAR) are detected.

However, arguments used in the IA to justify the 0.1 ppm MDL for underground leaks do not rely on the necessity to detect large leaks to be repaired (above 1000 ppm), but on the willingness to detect all methane emissions. This is not consistent with the objective of the MDL "ensuring all leaks above repair threshold are detected". A better indicator would be the distribution of leaks size, such as the one presented in the graph « Emission Measurement Distribution » which shows that 82% of the emissions come from the 26% of leaks above 17g/h. This conclusion is certainly true for other thresholds, i.e. 5 g/h (type 2 LDAR threshold).

Beyond this observation, the graph « concentration measurement distribution » which illustrates the *Picarro* process is quoted as a source to illustrate that in the specific case of the picaro process 85% of the leaks would not be detected below the 1 ppm threshold. We recall however that different processus are in force for detection of underground leaks by DSOs (combination vehicle + pedestrian, pedestrian only, etc.) and that this illustration refers only to the picaro process.

In addition, further information would be needed to fully understand the data and be able to perform a thorough analysis – For instance:

- Information on the origin and nature of collected data and their urban environment – we understand that those data are coming 50% from Europe et 50% from the US. However, urban characteristics between the US and Europe are very different: distances to pipes, material characteristics, etc.)
- ratio of false positives
- ratio of leaks effectively repaired
- condition of detection (along roads…)
- process: are the data only collected only from a vehicle or through a combination of vehicle + handled device?
- the origin of the emissions: end-user, TSO or DSO is not known
- there is lacking transparency in the way the data was quantified.