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Comments & Answers on Questionnaire on LDAR minimum detection limits and first step underground leak thresholds in the EU Methane Regulation

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

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Conclusion and Summary

In many European countries standards for leak detection methods and technologies have already been developed. These standards have been applied successfully for decades. This is one of the reasons for the steadily declining and very low methane emissions from the gas infrastructure in Europe.
In Germany we are well experienced in the application of leak detection technologies and are familiar with different procedures and methods for detecting even the smallest gas releases. These procedures and methods are reflecting the state of the art and are laid down in the guidelines provided by DVGW. The detection results and operational data are regularly analysed and published[1]. The German guidelines and standards regarding operation of gas infrastructure therefore reflect fundamental knowledge on leak detection.
Based on these experiences the German associations BDEW, DVGW, FNBGas and FIGAWA would like to support EC in finalising its IA-LDAR by forwarding knowledge of our experts. Experts from DVGW and its member companies are already involved in the ongoing works at CEN in order to elaborate harmonised European standards for leak detection and emission quantification. By doing so we want to support establishing transparent and appropriate solutions for all EU member states by means of technical standards in accordance with Article 32 par. 1 of the EU Methane Emissions Regulation (MER).
The performance of leak detection depends on several parameters. The minimum detection limit (MDL) is one important parameter, but at the same time the distance between the measuring point and the leak, the measuring procedures, the experience of the person fulfilling this task as well as the external parameters (especially wind velocity, turbulences, temperature, humidity) must be considered. The highest concentration is found directly at the source, it decreases with increasing distance from the source. Therefore, a higher measurement sensitivity is required for measurements from a more distant point than from closer to the source (see presentation attached to mail).
Measurement methods are valid within their scope of application and lead to reliable leak detection results. Using for example handheld devices with an MDL of 1 ppm and a suction probe will detect every gas release if applied close to the source. This is because the gas is sucked in from the upper soil layers, where concentrations are always higher than 1 ppm. Therefore, the application of handheld-devices in combination suction probe with a lower MDL than 1 ppm will not lead to more detections. On the other hand, airborne and vehicle-based devices are only generating leak indications which must be validated afterwards using handheld-devices with MDL 1 ppm.

Table 1 Best available technologies and their MDL

Device	MDL	Statistics
Handheld with suction probe (according Standard DVGW G 465-4-2)	1 ppm	100% of existing leaks if applied close to release point
Mobile (car) over pipeline (according Standard DVGW G 465-4-3)	1 ppm	100% of existing leaks if applied above pipeline with porous surface
Mobile (car) aside of pipeline (according Standard DVGW G 465-4-4)	0.1 ppm	~ 100% of leak indications according to MDL
Airborne (according Standard DVGW-G-465-4-5, and DVGW G 501)	100 g/h at underground source	100% of leak indications for pipelines above 5 bar pressure
OGI (according Standard DVGW-G-465-4-7)	17 g/h at 2 m distance from source and 5 K temperature difference	Type 1, above ground
Handheld TDLAS (according Standard DVGW-G-465-4-6)	150 ppm m at 5 m distance from source	Type 1, only for above ground installations

As shown in Table 1, the state-of-the-art technologies generally ensure a reliable leak detection. An extremely low uniform MDL that is not adjusted to the application of the devices will not lead to an increased number of detected leaks but comes along with several disadvantages. The number

[1] EWP 12/2021, „Bestands- und Ereignisdatenerfassung Gas – Ergebnisse aus den Jahren 2011 bis 2020“, Ronny Lange (Stadtwerke Reichenbach/Vogtland GmbH), Agnes Schwigon (DVGW e. V.) & Dr. Michael Steiner (Open Grid Europe GmbH)

of false positives will result in increasing operational effort. In addition, the disposal of existing and then obsolete measuring devices and the necessary production of replacements will lead to a significant negative environmental impact.
Based on these considerations to ensure proper application, a corresponding MDL must be defined for each method. A uniform too low MDL would exclude proven procedures and technologies and unnecessarily restrict further innovation. To consider all possibilities and chances of the various measurement techniques, specifications adapted to the respective technology would have to be developed.

Following studies[2] have been conducted to describe principles on detection and mitigation of methane emissions such as:

- Determination of methane emissions from the gas distribution network (ME DSO)
- Continuation of measurements of methane emissions from underground pipelines and gas pressure regulating and metering stations in the German gas distribution network (ME DSO 2.0)
- Creation of a guideline with measures for the technical reduction of methane emissions in the gas distribution network (ME-Red DSO)
- Development of methane emissions gas applications (MeGAn)
- Analysis of the reduction of methane emissions by adjusting the survey and repair times of buried pipelines within the scope of the G 465 (Adaptation G 465)
- Environmental and safety aspects in gas distribution - UmSiAG

We would also like to refer to this testing:

- Validation of the minimum detection limit for the reliable detection of underground 5g/h methane leakage and the required leak threshold for repair, Dr. Johannes Herbst, Fraunhofer IP

[2] Reports (attached to mail)

Questionnaire

Question 1.

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?

No, we do not completely agree.

For pipelines onshore below water area our experience shows that gas releases can be detected at one or both sides of the water area (banks/ shores). Therefore, the thresholds for buried pipelines should be applied.
For pipelines that are crossing water areas above water level, the thresholds for above ground installation should be applied.

Question 2.

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.

No, we do not agree, we propose to apply best available technologies, and their application would recommend the specific MDLs:

- Type 1 LDAR: OGI 17 g/h (corresponding to OGI suitability test of EPA, Method 21)
- Type 1 LDAR: TDLAS 150 ppm m
- Type 1 and 2 LDAR: Gas concentration measurement device 10 ppm)* (based on the baseload of approx. 2 ppm in atmosphere[3])

*) From a technical point of view only, an MDL of 50 ppm is necessary to reliably detect every leak. The gas concentration measurement devices used for safety inspection in Germany have an MDL of up to 1 ppm. To promote technological openness, an MDL of 10 ppm (based on the baseload of approx. 2 ppm in atmosphere) would therefore be sufficient.

Question 3.

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.

No, we propose an adjustment.

The German DSOs mainly use hand-held carpet probes with extraction of the floor air, provided that the leak could be traced directly by walking over the pipe route. In the case of sealed surfaces, the gas detector must perform the detection at the nearest interruptions in the surface, as this is where the gas spreading in the ground escapes to the surface. See also the image showing the gas detector guiding the carpet probe along the joint between the asphalt surface and the edge plate. A vacuum generated in the detection device draws in the ground air via a hose leading from

[3] Concentration of atmospheric methane, average value for the period from 1983 to 2024 | database.earth

the detection device to the detection carpet at the underside of the detection carpet and transports it to the detection device, where the measurement is carried out.

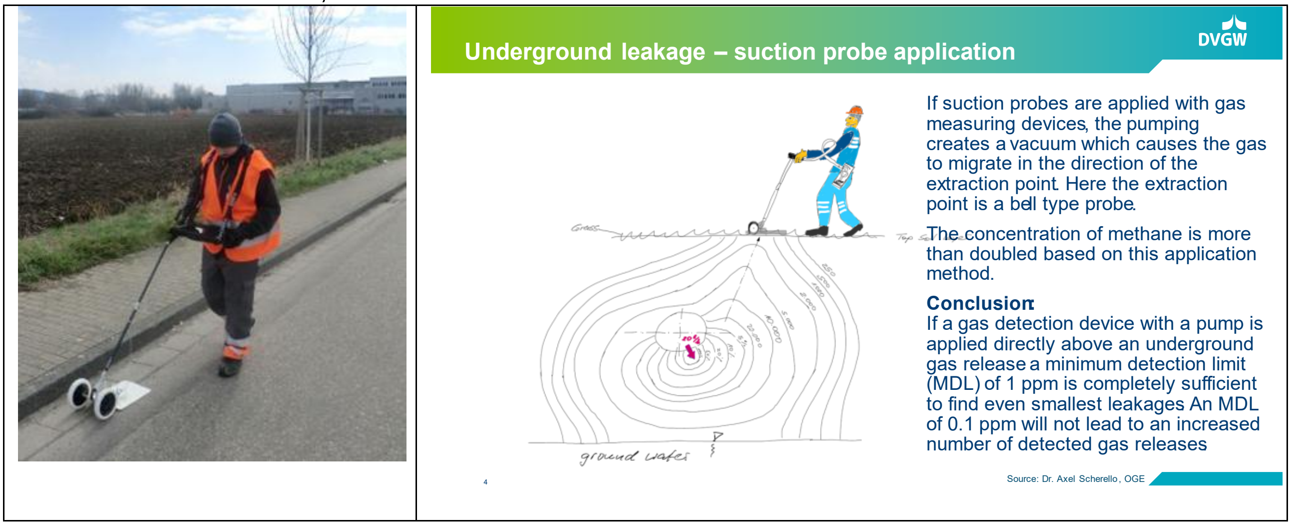

Figure 1: Suction Probe Application

According to DVGW Worksheet G 465-4, the minimum detection limit for hand-held devices with carpet probe and suction is 1 ppm. For leak detection in step 1, the devices are e. g. equipped with semiconductive, heat conduction, flame ionisation or laser absorption detectors.
Once a threshold value of approx. 5 ppm is reached, the next step is to drill and measure the gas concentration in the boreholes. Once the gas concentration reaches 1,000 ppm, the leak is repaired.
This is a proven and documented procedure that has been used for decades and has contributed to the high quality of German gas infrastructure. Setting the minimum detection limit at 0.1 ppm means that this technology is excluded from leak detection in accordance with the MER without there being any technical reason for this, as both technologies – i.e. detection using a vehicle and detection using a carpet probe and suction – are equivalent. This is explained by the fact that when detection is carried out using a carpet probe and suction, the floor air is sucked directly from the cracks and joints and the gas concentration is much less diluted than when measuring with a vehicle in the gas plume. For this reason, the minimum detection limit of 1 ppm is sufficient for the hand-held carpet probe with suction.

On the 8th of May 2025, the German Fraunhofer Institute in cooperation with Thüga AG and the Schütz GmbH Messtechnik (producer of measurement equipment) conducted a comparative testing. This scientific research[4] proves that an MDL of 0.1 ppm is not necessary for a handheld device to detect a leak of 5 g/h. The report will be finalised soon and could be delivered when published later with an additional mail. Based on the test results, we even propose a leak threshold for the initiation of step 2 of 10 ppm for the handheld device.

In recent years, various DSOs have also been using vehicle-based systems for leak detection, for example from Picarro, Schütz, Sewerin, Esders and ABB, which use a different measuring principle and deliver an equally high level of testing quality. Gas detection takes place when vehicles pass through the diluted gas plume in combination with a gas concentration measurement in the ppb range.
Where emissions above a threshold value of approx. 0.5 ppm are detected, the gas concentration in the boreholes is measured in a further step. In this case too, leaks from 1,000 ppm are repaired according to MER.

[4] Report of Testing: Validation of the minimum detection limit for the reliable detection of underground 5g/h methane leakage and the required leak threshold for repair; Dr. Johannes Herbst, Fraunhofer IP, May 2025 (attached to mail)

For measuring leakages from underground components, three different measurement points should be differentiated (see figure 2).

In Germany, measurement with an MDL of 1 ppm directly above an underground component is the most commonly used procedure. This procedure leads to detection success rates of 100%. Therefore, from our point of view, an MDL of 1 ppm at such measurement points (i.e. measurement point 1, see figure below) is entirely sufficient. Even for vehicles with an MDL of 1 ppm or better and a gas inlet close to the surface that are driving directly over the pipeline a successful detection is proven. (EvaNeMel[5])
Whereas, for inspections at measurement point 2 in a diluted gas plume a better sensitivity and an MDL of e.g. 0.1 ppm is required.
A measurement at point 3 at the upwind-side will not be successful. This is the reason why detection by vehicles aside the pipeline might lead to uncertainties described by Picarro. (EvaNeMel)

In abstract 3.3.2.2, point 3 the European Commission states that “a required leak detection threshold of 1 ppm would result in 85% of leaks from underground components remaining undetected”. The Commission concludes that “a required MDL of 1 ppm should therefore not be proposed”. Yet, the Commission is wrong with this generalisation. It is important to underline that such high rates of undetected leaks only appear in the case of leak detection by vehicle in a diluted gas plume. The graphs generated by Picarro (see graphic 1 in Annex 1 of the consultation document) do not show the case of handheld carpet probes, as Picarro's evaluation refers to the measured values in a gas plume. Picarro themselves confirmed upon request that the interpretation shown in the consultation document is incorrect. So, it is not correct that 85% of leaks can’t be found in direct ground-based leak detection using the carpet probe with suction. We emphatically urge the European Commission to take the necessary differentiation and to clarify the application area of the Picarro graphs in order to avoid misinterpretation and misleading guidance for policy recommendations.

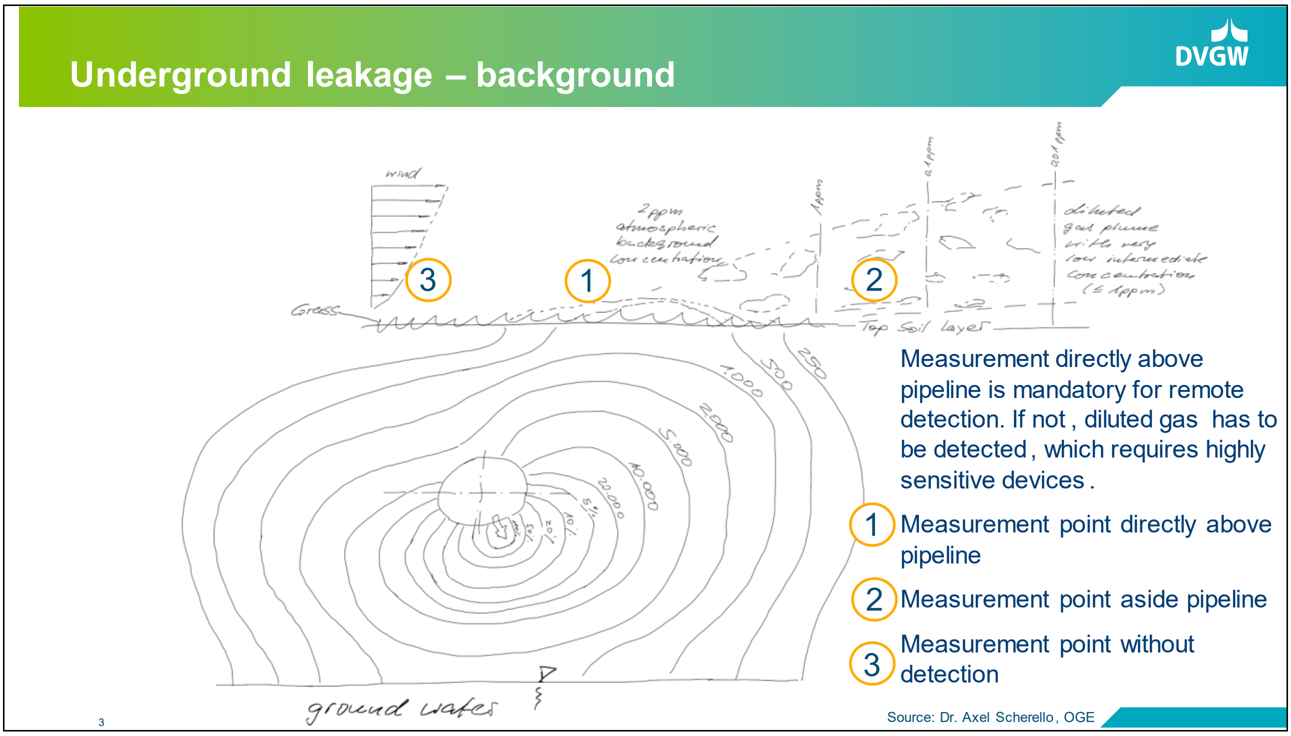

Figure 2: Different Measurement Point

[5] See **Evaluation of novel measurement methods for line inspection in gas networks – EvaNeMeL** report, July 2022 (attached to mail)

For the reasons mentioned above, we propose the following minimum detection limits and leak thresholds for LDAR inspections of underground pipelines:
Vehicles driving aside of the pipeline and its underground components

- Minimum detection limit <=0.1 ppm
- Leak threshold for the initiation of step 2 (measurement in the gas plume) 0.5 ppm

Handheld gas detection device with a carpet or bell type suction probe:

- Minimum detection limit 1 ppm
- Leak threshold for the initiation of Step 2 (measured with carpet probe and suction) 10 ppm

The measurement methods and sensors missing in Annex 1 must be added. These are

- Handheld with semiconductor sensor detector placed on the end of Carpet Probe with inlet
- Handheld with FID sensor detector placed on the end of Carpet Probe with inlet

In the heading of Table 2, column 2, a distinction should be made between a leak that requires further investigation, e.g. drilling, and the leak threshold that requires repair. We suggest the following terms for this:

- Leak threshold step 1
- Leak threshold step 2

The three scenarios described in section 2.2 restrict the variable use of the various detection methods adapted to the respective circumstances, as a ranking order is specified. Furthermore, the requirement under 1. '*Enables the use of vehicles with methane detection sensors that* can be driven ***directly over*** *the buried components'* severely restricts the use and potential of the new measurement technologies, as direct inspection above the pipe is very often not possible. Reasons for this are the pipe route in a pavement, park, green strip, at the roadside with parked cars, etc. The use of vehicles with measurement systems in the ppb range does not require direct inspection above the pipe. The reason for this is that these vehicles have the advantage of the ppb measurement method, which means that it is sufficient to drive through the gas plume, as the much more sensitive measuring cells can detect very low gas concentrations.
The ranking and requirement for direct inspection above the pipeline for vehicles should be removed, as detection with a hand-held carpet probe with extraction is equivalent to detection using a vehicle and direct inspection above the pipeline for vehicles is not necessary.

We therefore propose the following amendment to the wording in section 2.2:
The following measurement methods are equally qualified and shall be used for the first stage of underground detection:

- Pedestrians with hand-held methane detection sensors
- Vehicles with methane detection sensors
- Aircraft such as aeroplanes, drones, helicopters with methane detection sensors

Question 4.

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.

Answer: No, we propose an adjustment

Usually, handheld devices with an MDL of 1 ppm are used in step 2. Because of the atmospheric base methane concentration, an MDL of 10 ppm is completely sufficient for detecting the leak threshold of 1,000 ppm or 7,000 ppm in step 2.

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.

No. Today there are no technologies that are commonly used in the market that support measurements underwater.

Question 6.

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.

No. Concerning LDAR type 1 step 2 and LDAR type 2 step 2, we suggest 1.7 g/h or 500ppm for Type 1 and 0.5 g/h or 100 ppm for Type 2 based on the correspondence between the emission rates and concentrations.

Pipelines that are located under water surfaces on land (usually river crossings) do not run along the bottom of the water, but in a borehole under the bottom of the water in a protective tube. Methane emissions cannot escape from the protective tube and can therefore be safely detected at the beginning/end of the protective tube on the bank on both sides of the water. Here, the test is carried out in the same way as for underground pipelines. We therefore propose to use the same methods and limit values here as for buried pipelines.

Question 7.

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.

Answer: No, we propose an adjustment.

As already stated in our answer to question 3 on section '3.3.2.2 Proposed required MDL values for the first stage for underground components,' , a distinction should be made between the two different detection methods – i.e. detection with a vehicle the diluted gas plume and detection using a carpet probe and suction – when determining the leak threshold in step 1, after which a second detection must be carried out.
The reason for this lies in the location of the concentration measurement. While detection with the vehicle is carried out in the diluted gas plume, detection with the carpet probe is carried out directly above the gas mains or at the nearest joints in the surface. Detection with the carpet probe is therefore carried out directly at the point where the methane escapes from the surface, before it is further diluted by atmospheric influences.
Furthermore, leak detection using a hand-held carpet probe with suction is the generally accepted state of the art. Based on this, leak detection has been carried out successfully in Germany for decades. The statement made in section 3.4.1 under point 2 is not correct, as the gas detector systematically checks the entire area of the pipe route so that even methane that does not reach the surface directly is detected. This is achieved by detecting, for example, sealed surfaces at the interruptions in the surface closest to the pipe route, so that even migrated methane is detected.

Question 8.

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.

Answer: No, we propose an adjustment.

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.

Detailed comments and further examples:
Ad 1:

1. This section should be renamed to "LDAR surveys of components above ground" because there are technologies that are suitable and do not need to be applied in "close contact". We further suggest the implementing act to clarify that the "level as close as possible to each individual emissions source..." in Art 14.6 a) refers to a distance that is specific to the technology applied.

2. Can you please provide evidence to the claim on page 63 of the questionnaire that "The lowest minimum detection limits claimed by handheld detection technology providers which has been independently validated for devices with high technology readiness levels are as follows: 0.25 standard litres per minute/ 0.5 g/h and 100 ppm*m for an OGI camera with integrated quantification;"

Ad 2:
Add language enabling identification of leaks with laser sensors from a distance per the sensor requirements.

Ad 3:
Please incorporate language allowing emission detection using laser sensors, where the use of optical gas imaging cameras is allowed and change the text to "In all these instances, with the exception of when optical gas imaging cameras or laser sensors are used, the following detection techniques ...."

Ad 4:
We would suggest removing such detailed description as techniques will depend on the technology used and utilisation will be independently verified. Otherwise, suitable technologies will be excluded with such descriptive text.
As a minimum, please incorporate language allowing emission detection using OGI cameras and laser sensors, etc. where no probs are being used and detection is done the same way for many components.

Ad 5:
The use of laser sensors to detect emissions should be explicitly allowed - especially when leaks are not immediately accessible.

Ad 6:
This is incorrect, in our view e.g. sniffing devices cannot be used in the same way under water. Please explain the reason for this statement.
Pipelines that are located under water surfaces on land (usually river crossings) do not run along the bottom of the water, but in a borehole under the bottom of the water in a protective tube. Methane emissions cannot escape from the protective tube and can therefore be safely detected at the beginning/end of the protective tube on the bank on both sides of the water. Here, the test is carried out in the same way as for underground pipelines. We therefore propose to use the same methods and limit values here as for buried pipelines.

Ad 7:
Combination of XL-Laser should also be introduced to the table of detection technologies. The ability of lasers to measure methane concentration is not impacted by the wind. However, the dispersion and, therefore, concentration is impacted by the wind.
For OGI cameras, a. should also state that they should not be placed too close either so that the whole plume can be identified.
For lasers sensors these guidelines a-d do not apply.

Question 9.

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.

Answer: No, we propose an adjustment.

The prioritisation of detection methods for underground components as mentioned in the questionnaire should not be compulsory for companies. 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.
The three scenarios described in section 3.5.2.2 restrict the variable and respective circumstances adapted use of the various detection methods, as a ranking order is specified. Furthermore, the requirement under 1. 'E*nables the use of vehicles with methane detection sensors,* ***directly above*** *the buried components can be driven'* severely restricts the use and potential of the new measurement technologies, as direct verification above the pipeline is very often not possible. Reasons for this are the route of the pipeline in a footpath, park, green strip, at the roadside with parked cars, etc. The use of vehicles with measurement systems in the ppb range does not require direct inspection above the pipe. The reason for this is the fact that these vehicles have the advantage of the measurement method in the ppb range in that a pass through the gas plume is sufficient, as the much more sensitive measuring cells can also measure very low gas concentrations.
The ranking and requirement for direct inspection above the pipe for vehicles should be removed, as detection using a hand-held carpet probe with extraction is equivalent to detection using a vehicle and direct inspection above the pipe for vehicles is not necessary.

We therefore propose the following amendment to the wording in section 3.5.2.2, point 1:
The following measurement methods are equally qualified and shall be used for the first stage of underground detection:

- Pedestrians with hand-held methane detection sensors
- Vehicles with methane detection sensors
- Aircraft such as aeroplanes, drones, helicopters with methane detection sensors

Detailed comments and further examples:
Ad 1:
We disagree with this strict sequence of devices for all surveys. The leak detection for production and transport pipelines that are very hard to access needs to allow the use of helicopters and other aerial devices for step 1 and step 2. Some of these technologies can also achieve reasonably low MDLs. Hence, language should be added that allows the use of helicopter/aerial devices.
It would be better to provide flexibility by removing this section and leave the judgement of appropriate application/steps to operators.

Ad 2:
The second part of the sentence should be removed (, and it is every time carried out with a low sensitivity, contact-based portable instrument which measures methane concentration at the point of contact with the leak.) in order to allow the use of helicopter/aerial devices, in particular for production and transport pipelines.

Question 10:

Aerial detection special points. Official consultation question: 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.

We welcome that aerial inspections are allowed for type 1 and type 2 LDAR inspections if applicable and especially for transport and production sites. Because every detection method that complies with the specifications of the MER should be allowed for type 1 and type 2.