Methane Emissions

Glossary

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Introduction

In June 2019, **GIE** and **MARCOGAZ** published the report[1] "Potential ways the gas industry can contribute to the reduction of methane emissions". This industry-wide study was performed with contributions from representatives of the entire gas value chain, from production to utilisation, including biomethane.

Based on the challenges and gaps identified in the report, an action plan[2] was developed collaboratively by representatives from the entire gas chain and this action plan is updated on a regular basis. The report identified the need to have a set of harmonised definitions covering the complete gas value chain.

For this reason, this glossary was developed to support the industry and other stakeholders in the use of consistent terminology. This document is based on the frequent references used by the gas industry e.g. **IPIECA** Methane Glossary[3] and CEN standards. The use of common definitions will contribute to improve confidence in understanding and managing methane sources and to reduce their emissions.

On the 14th of October 2020, the European Commission published the Communication[4] on an "EU strategy to reduce methane emissions". The Commission announced in the Strategy that a legislative process will be conducted, and new regulations will be delivered in 2021. This glossary can also be used as a reference for the legislative process.

[1] Report "Potential ways the gas industry can contribute to the reduction of methane emissions" https://www.gie.eu/index.php/gie-publications/methane-emissions/methane-emission-report-2019/27786-gie-marcogaz-report-for-the-madrid-forum-potential-way-gas-industry-can-contribute-to-the-reduction-of-methane-emissions/file

[2] Action plan on methane emissions https://www.gie.eu/index.php/gie-publications/methane-emissions/methane-emission-action-plan/28053-action-plan-methane-emissions/file

[3] IPIECA Methane Glossary http://www.ipieca.org/resources/awareness-briefing/methane-glossary/

[4] COM(2020) 663 final – Communication from the Commission on an EU strategy to reduce methane emissions https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1833

Methane Emissions Glossary

- **Acoustic leak detection** (for through valve leakage) - Acoustic leak detectors capture the acoustic signal of pressurized gas escaping from a valve plug or gate that is not tightly sealed. They can detect either low or high frequency audio signals and are useful for detecting internal through valve leaks or ultrasonic signals from blowdown valves and pressure relief valves.

- **Activity Factor (AF)** - A numerical value describing the size of the population of emitting devices such as length of pipelines, number of valves (per type), number of pneumatic devices (per type), or the frequency of emitting events such as number of operating vents. *[12]*
  (Note – This is not an exhaustive list, the Activity Factor is linked to the Emission Factor and expressed by a numerical value consistent with the Emission Factor.)

- **Asset –** Part of the gas system owned by a natural gas company, comprising multiple devices that allows the company to produce, process, transport, store, and/or distribute gas.

- **Bagging –** The process of measuring a leak rate by enclosing an equipment piece in a bag or tent to determine the actual mass emission rate of the leak to determine an emission flow rate.
  (Note: typically consists of a suction pump combined with a calibrated flow and concentration measurement.)

- **Block valve** - A valve used to isolate a piece of pressurized equipment or a section of a pipeline for tie-in or maintenance purposes.
  (Note – Block valves typically are located to limit the volume of gas that may need to be depressurized for tie-ins and maintenance, and to reduce the amount of gas that would be lost in an event.)

- **Blowdown open ended line (BD-OEL)** - A pipeline to evacuate a pressurized section of the network from gas. *[12]*

- **Blowdown valve** - A valve used to empty a gas pipeline section or a whole asset and, when actuated, initiates the blowdown (e.g. when gas compressor units are shut down). *[12]*

- **Bottom-up emission approach/inventory** - Method based on direct measurements, engineering calculations, manufacturer data and emissions factors for emissions sources/activities, compiled to develop an account of emissions discharged to the atmosphere from an asset (e.g. compressor station) or a geographic area (e.g. basin, state, region).

(Note - The bottom-up approach is a source-specific quantification approach: the emissions from each identified source are individually quantified. Total emissions on a given perimeter are calculated by adding each type of emission source data.)

- **Calibration gas** – Reference gas or gas mixture used to adjust the meter reading of a measurement instrument to a known value. The calibration gas is generally the reference compound at a predefined concentration and is traceable to primary standards.

- **Calibrated vent bag** - Non-elastic bag of known, fixed volume when fully inflated.
  (Note - Measurement is made by timing the bag expansion to full capacity. The temperature of the gas is measured to allow correction of volume to standard conditions. Additionally, gas composition should be analysed to determine the methane content of the vented gas because in some cases air may also be entrained in the vent, resulting in a mixture of gas and air. Bags of various sizes and known volume are available as calibrated during manufacture. Calibrated vent bags are made from antistatic plastic with a neck shaped for easy sealing around a vent pipe.)

- **Component** - A part or element of a larger whole. In the context of equipment leaks, components are individual sealed surfaces on pressurized equipment such as flanges, valves, connections, pressure relief valves, open ended lines, etc. *[12]*
  (Note - Please see definition of Granularity terms below.)

- **Connection** - Area of contact between two or more linked parts, axially or radially, normally sealed by mechanical means in order to keep tightness. *[12]*

- **Control valve** - Modulating valve that controls either the flow rate, liquid level, or pressure in process equipment. In the latter case, it is often referred to as a (pressure) regulator. *[12]*
  (Note - Typically, high pressure gas from the pipeline is used as the supply medium needed to energize the valve actuator.)

- **Detection threshold** - The minimum quantity or concentration of a gas (e.g. methane) which is reliably detectable by detection equipment. This is sometimes called a minimum detection limit (MDL). *[8]*

- **Device** - Equipment (active or passive) related to the physical gas system and needed in order to keep the normal operation of the network. *[12]*
  (Note - Please see definition of Granularity terms below)

- **Directed Inspection and Maintenance (DI&M) -** Programme to confirm that equipment (e.g. pneumatic devices) are operating per design and emissions remain within specified ranges.
  (Note - DI&M can be a complement to LDAR programmes)

- **Distribution** – Supply of gas through local or regional pipeline networks to its customers, usually ending with the customer meter, and so excluding end-use.

- **Distribution System Operator (DSO)** - A natural or legal person who carries out the function of distribution and is responsible for operating, ensuring the maintenance of, and, if necessary, developing the distribution system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the distribution of gas. *[1]*

- **Emission Factor (EF)** - The emission factor describes typical methane emissions per unit of activity of a component or part of the gas system (e.g. valve, pipeline section) or from an event and can have units like [kg/km], [kg/event] or [kg/equipment]. *[12]*
  (*Note - this is not an exhaustive list, the emission factor is linked to the activity factor and expressed in a numerical value consistent with the activity factor)*

- **Emissions survey** – The action of using emission identification instrument that can identify the presence or absence of emission sources to examine all potential sources of emissions.
  (Note - a survey is typically part of a complete survey program and part of LDAR strategy)

- **Field survey** - A field emissions survey collects needed operational data onsite and utilizes specialized equipment to identify methane emission sources and measure emissions levels of unmitigated sources, both fugitive sources (unintentional emissions from flanges, valves, fittings, etc.), and vents from normal operations, such as tank roof vents or wet seal compressor degassing drum vents. *[16]*

- **Flaring** - Controlled burning of hydrocarbons mainly for safety reasons. *[12]*
  (Note 1 - Flaring also reduces hydrocarbons to CO_2 and water, thus lowering the global warming impact of the released gases.
  Note 2 - A definition for "routine flaring" will be included later)

- **Fugitive emission** - Leaks due to tightness failure and permeation. *[12]*

- **Gas compressor station** - Asset used for compressing gas (at a well, in a gathering pipeline, in the gas processing, from/to an underground gas storage asset) and for transporting gas in pipelines.

- **Gas distribution system** - A pipeline system for supplying natural gas comprising mains and service lines including piping above and below ground and all other equipment necessary to supply the gas to the consumer. *[12]*

- **Gas (pipeline) station –** An installation comprising all the equipment including the inlet and outlet pipework as far as the isolating valves and any structure within which the equipment is housed. There are stations such as pressure reduction & regulating stations, measurement stations, valve stations, consumer supply stations for metering and regulating, injection stations, etc.

- **Gas supply chain segments** – upstream, midstream and downstream[5]

  Upstream - The upstream sector/segment of the natural gas supply chain, which includes activities and/or operations involving the exploration, development, and production.
  (Note - In some circumstances, this section of the supply chain may also include gas gathering pipelines, gathering compressor stations, and gas processing plants.)

  Midstream - The midstream sector/segment of the natural gas supply chain, which includes gas transmission, storage and LNG regasification terminals.
  (Note - In some documents, the distribution grid and/or the gas-processing plants are considered part of this segment of the supply chain).

  Downstream/Distribution system - The segment of the natural gas supply chain covering distribution activities delivering gas to end-users.

Segment	Activity	Typical assets
Upstream	Exploration Production Gathering & boosting Processing Storage Liquefaction[6]	Exploration facility Production facility Processing plant LNG liquefaction plant
Midstream	Transmission Storage LNG Regasification[7]	High pressure gas system (e.g. transmission gas networks, compressor stations) Underground gas storage facility LNG regasification terminals
Downstream	Distribution	Gas system (e.g. distribution gas networks, city gates, service lines, LNG/ CNG refuelling station, compressor skids, LNG satellite stations, biomethane injection facilities)
End Use	Utilisation	Domestic and industrial appliances (e.g. boiler, turbine, CCGT)

[5] Biomethane production is not part of the segments. Biomethane is typically injected in transmission or distribution networks. LNG/CNG filling stations are sometimes connected to midstream or sometimes to downstream.
[6] Liquefaction is in some cases after transmission
[7] LNG regasification can also occur in distribution (LNG satellite stations)

- **Gas system** - Any transmission networks, distribution networks, LNG facilities and/or storage facilities owned and/or operated by a natural gas undertaking, including linepack and its facilities supplying ancillary services and those of related undertakings necessary for providing access to transmission, distribution and LNG. *[1]*

- **Gas transmission system** - A pipeline system for transport of gas, which mainly contains high-pressure pipelines and compressor stations. (Note that this does not include upstream gathering pipeline networks nor pipelines primarily used in the context of local distribution of gas, with a view to its delivery to customers).
  (Note - Transmission lines transport natural gas across long distances and occasionally across interstate boundaries. They are connected to the distribution grid via city gate stations and/or pressure regulating stations.
  High-pressure gas transport over long distance including pipelines, compressor stations, metering and regulating stations and a variety of above-ground facilities to support the overall system. Underground gas storage and LNG terminals are excluded. Operating pressure is normally equal or greater than 16 bar.)

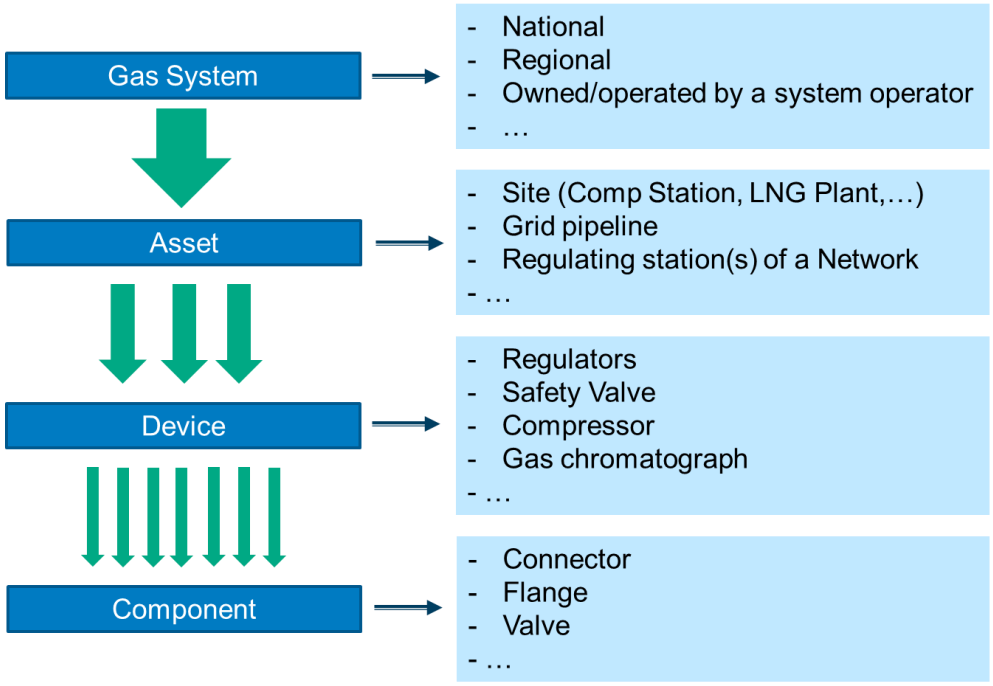
- **Gate station** - A facility located adjacent to a transmission grid where at least one of the following functions is performed: pressure reduction[8], odorization, measurement or flow of gas through a splitter system for distribution to different districts or areas. *[12]*

- **Global Temperature Change Potential (GTP)** - The ratio between the global mean surface temperature change at a given time horizon that is understood to follow an emission of an amount of gas relative to the same amount of carbon dioxide (CO_2). *[8]*

- **Global Warming Potential (GWP)** - A factor which estimates the contribution to global warming of a given mass of a greenhouse gas species, relative to the same mass of CO_2 over a particular time frame. *[8]*
  (Note - The time period for any quoted GWP is important as there are significant differences between 1-year, 20-year and 100-year GWPs; for example, the GWP for methane is understood to range from 25 to 84 depending on the timeline adopted. The time period usually used for GHG inventory reporting is 100 years. The IPCC Assessment Reports provide relevant GWPs for methane and other GHGs.)

[8] See definition of pressure regulating station.

- **Granularity** – Terms used to describe the structure of the gas system.



- **High flow sampling** - A method used to quantify the methane emissions from a source using complete capture of the leakage with a high airflow. The resulting air flowrate is measured and the concentration of methane in the airflow is measured in order to calculate methane emissions.

- **Hot tap** - A method of making a new connection to an existing pipeline or pressure vessel without the need to interrupt the operations nor empty the vessel or pipeline.

- **Hotwire anemometer** - Device used to measure the flow speed of a gas or air stream.
  (Note - It is similar to a vane anemometer. It is inserted in the gas flow from an open ended pipe or through a port in a gas flow pipeline. It consists of an exposed hot wire either heated up by a constant electric current or maintained at a constant temperature when inserted into a flowing gas stream. It operates on the principle of heat transfer.)

- **Identification –** Listing and compiling all emission sources from a system based on known, designed emission sources, and surveying for unintended or undesired emissions. (This is also synonymous with 'detection' in some circumstances.) *[14]*
  (Note – This information will be part of the inventory)

- **Incident** - Unexpected occurrence, which could lead to an emergency situation. *[4]*

- **Incident emission** - Methane emissions from an incident/event. *[12]*

- **Incomplete combustion emissions** - Unburned methane in the exhaust gases from natural gas combustion devices, such as turbines, engines, boilers or flares. *[12]*
  (Note – Sometimes incomplete combustion is also called methane slip)

- **Infrared (IR) camera** - Optical device (camera) equipped with infrared sensors for detecting gases that have infrared absorption bands within the band-pass filter installed in the device. Includes Optical Gas Imaging (OGI) and forward-looking IR cameras.
  (Note - Hydrocarbon emissions absorb infrared (IR) light at a certain wavelength and an IR camera uses this characteristic to detect the presence of hydrocarbon gas emissions from equipment at an oil and gas facility. The IR camera operator scans the leak area in real time (user selectable for cold/hot temperature environments). This scanned area is viewed as a live, image such that the gas plumes are visible on the camera display due to their absorption of the IR light. IR camera is also an optical gas imaging (OGI) technology.)

- **Inventory -** A record of all known sources of emissions and emission rates. An inventory provides a summary of emissions over a given period of time. *[14]*
  (Note – Inventory includes information gathered during the identification, detection, measurement, quantification and repairs of methane emissions)

- **Laser leak detection** - Methods for locating potential methane emissions sources by using laser frequencies that are tuned to be absorbed or scattered by a target gas species.
  (Note - This technology allows operators to safely scan a facility and equipment from a distance provided the background provides appropriate reflective return of the laser signal. It also prevents operators from walking the entire length of a pipeline or service line, allowing them to stay in place and scan for leaks along the sight line)

- **Leak** - Unintentional emission from pressurized equipment used in the gas industry. Leaks are usually caused by imperfections in or ordinary wear and tear of sealed joints, such as flange gaskets, screwed connections, valve-stem packing, or by poorly seated valves. Leaks can also come from the wall of a pressurized vessel or pipeline, as a result of corrosion or damage.

- **Leak Detection And Repair (LDAR)** - A programme to identify and repair the equipment or infrastructure that can be a source of emissions due to leaks from pressurized equipment. It is often accomplished by a periodic inspection survey to identify leaks, followed by repair of any found leaks..
  (Note - Within the LDAR programme, a variety of techniques can be employed for detecting the leaks. While LDAR in certain jurisdictions can have a specific regulatory definition, it is more generally used to describe the processes and systems by which leaking equipment is identified, prioritized and then repaired.)

- **Linepack** - Storage of gas by compression in gas transmission and distribution systems, but not including facilities reserved for transmission system operators carrying out their functions. *[1]*

- **LNG storage** – A facility used to provide storage of natural gas in liquefied form. These may exist in various locations along the gas supply chain, and may be used for the same purposes as other gas storage facilities.

- **LNG system operator** - A natural or legal person who carries out the function of liquefaction of natural gas, exportation or the importation, offloading, and re-gasification of LNG and is responsible for operating a LNG facility. *[1]*

- **LNG terminal/facility** – An asset which is used either for the liquefaction of natural gas, exportation, or for the importation, offloading, and re-gasification of LNG, and includes ancillary services and temporary storage necessary for the re-gasification process and subsequent delivery to the transmission system, but does not include any part of LNG terminals used for storage. *[1]*

- **Main lines of distribution** - Pipework in a gas supply system to which service lines are connected. *[2]*

- **Methane emission** - Any release of methane to the atmosphere, whatever the origin, reason and duration. *[12]*

- **Methane emission detection** - Process of identification of methane emissions from potential sources, without the measurement of the mass quantity (flow rate, e.g. kg/h). Several devices, screening instruments and methodologies are available to detect methane emissions, including optical gas imaging cameras, laser leak detectors, portable analysers (OVAs, TVAs), soap bubble screening and/or AVO methods. Some of these are able to detect and provide a concentration level (volume, e.g. ppmv) that can be used to estimate the mass emission (e.g. by applying specific emission factors or correlation equations available from literature). *[8]*

- **Methane emission programme** - The set of methods chosen by a gas company for identifying, detecting, measuring and quantifying methane emissions. The program may include several screening and surveying technologies and techniques, as well as various quantification techniques to determine the rate of emissions from each detected source. The program summarizes and tracks emissions. *[15]*

- **Methane flux** - The rate of mass flow of methane through a unit area perpendicular to the wind flow direction. Units of measure are preferably expressed in g $CH_4/m^2/yr$.

- **Methane intensity** - The ratio of methane emissions (numerator) over a selected variable (denominator).
  (Note - A methane intensity prevalently used is total methane emissions emitted from an asset, area or value chain (numerator) divided by well production volume, facility throughput, area production volume or gas transported or distributed (denominator) and reflected as a percentage.)

- **Methane measurement** - The process of taking a reading of a methane emission. Measurement can be of any variable (volume, concentration, mass, frequency and so on) that allows for detection or for an estimate of emission rate.

- **Open Ended Valve or Line (OEL) –** Any valve having one side of the valve seat in contact with the process fluid and one side open to the atmosphere, either directly or through open piping, (but excluding any pressure relief valve). *[13]* A line to safely evacuate gas. *[12]*

- **Operational emissions** - Methane emissions from normal or planned operating activities. This includes release through stacks; blow off valves, pressure release and purging of turbines and emissions due to normal maintenance inspection and control. Operational vents comprise planned venting and purging of pipelines, which is usually done during commissioning, decommissioning, renewal and maintenance of pipelines for safety reasons to prevent the risk of explosions. Pneumatic device emissions are also operational emissions. *[11]*

- **Organic Vapour Analyser (OVA)** - Portable hydrocarbon detectors that can be utilized to identify methane leaks. An OVA consists of a flame ionization detector (FID) or photoionization detector (PID), which is capable of measuring the organic vapour concentration in air.

- **Permeation** - Penetration of a permeate (such as a liquid, gas, or vapour) through a solid.
  (Note - In case of natural gas through pipelines made of polymer materials, it is directly related to the pressure of the gas, intrinsic permeability of polymer materials and wall thickness. Polymers can be polyethylene, polyamide or PVC.)

- **Pneumatic device emissions** - Emissions caused by gas operated devices (control valve actuators, chemical injection pumps, etc). These can be continuous or intermittent emissions. *[11]*

- **Pneumatic emission sources** - Devices where natural gas pressure is used as an energy source to operate various instrumentation and equipment, ultimately resulting in emissions of the actuation gas. This type of instrumentation and equipment is normally used in places where electrical power or instrument air are not available. *[8]*

- **Point of delivery** - Point where the gas is transferred to the user. This can be at a means of isolation (e.g. at the outlet of an LPG storage vessel) or at a meter connection. For this document the point of delivery is typically nominated by the distribution system operator and can be defined in National Regulations or Codes of Practices. *[11]*

- **Pressure regulating station -** Asset comprising all the equipment including the inlet and outlet pipework as far as the isolating valves and any structure within which the equipment is housed, used for gas pressure regulation and over-pressure protection. *[2]*

- **Pressure regulator** - Device which reduces the gas pressure to a set value and maintains it within prescribed limits. *[12]*

- **Pressure relief valve -** A safety device designed to release gas in the event of an unacceptable pressure being detected within the system it protects. *[2]*
  (Note - Safety relief device is the same)

- **Pump down** - A process where a compressor is used to remove pressurized gas from an isolated pipeline or vessel, by pumping it into another pressurized gas system.

- **Purging** - Process for safely removing air or inert gas from pipework and/or pipeline components and replacing it with gas, or the reverse process. *[12]*

- **Quantification** - Determining an emission rate, such as mass per time or volume per time. This can be done directly through measurement of the emissions, or indirectly through estimations, calculations, and modelling.

- **Refueling point of CNG/LNG -** facility for the provision of CNG and/or LNG for vehicular or maritime use, consisting of either a fixed or mobile facility, offshore facility, or other system.

- **Response factor** - Ratio between the actual concentration of VOC present at the location where an investigative measurement is made and the observed instrument reading. This quotient represents the correction that must be applied to the instrument reading to take into account that the instrument has been calibrated with a calibration gas that may be different from the substance or mixture of substances present in a leak. *[5]*

- **Response time** - Time interval of a change of stage in the VOC concentration at the input of the sampling system and the time in which 90% of the corresponding final value is reached, as presented in the instrument reading meter. *[5]*

- **Screening** - Evaluations with the main purpose of identifying sources of emissions. In many contexts, screening can be the same as surveying. However, in some regulatory contexts,

screening applies only to less rigorous or less sensitive detection approaches, such as AVO (Audio, Visual, and Olfactory). *[14]*

- **Sector/segment** - Part of the complete gas value chain. *[12]*
  (Note: The oil and gas industry is usually divided into three major sectors: upstream (or exploration and production - E&P), midstream and downstream.)

- **Service lines** - The pipework from the main lines to the point of delivery of the gas into the installation pipework. *[2]*
  (Note: Service line is usually a short, small diameter pipeline that delivers gas from distribution main or transmission pipeline to the customer. They are usually made of steel pipe or steel tubing (either cathodically protected or not), or plastic (usually polyethylene, but sometimes PVC or other plastic), although copper tubing was also used in the past. Service lines can be installed under or above ground.
  Note: Cathodic protection is a technique used to mitigate the corrosion of a metal surface by making it act as an electrical cathode)

- **Soap bubble screening ("soaping")** - A quick and low-cost leak detection technique. This method involves squirting a soap solution on small and accessible components such as flanges, valves, fittings, threaded connections, etc. If there is a leak, soap bubbles will develop from the solution. Soaping is effective for locating loose fittings and connections. It is not effective on large openings such as open ended pipes or vents. *[16]*

- **Source** – A component within a process or equipment that releases methane to the atmosphere either intentionally or unintentionally, intermittently or persistently. *[12]*

- **Stopple** - A temporary seal, plug or stopper. They are used to repair pipelines, or to isolate (cut off) a section of pipeline where there is no existing shut-off valve. *[15]*

- **Storage facility** - A facility used for the stocking of natural gas and owned and/or operated by a natural gas undertaking, including the part of LNG facilities used for storage but excluding the portion used for production operations, and excluding facilities reserved exclusively for transmission system operators in carrying out their functions. *[1]*

- **Storage system operator (SSO)** - A natural or legal person who carries out the function of storage and is responsible for operating a storage facility. *[1]*

- **Super-emitter** – Methane emission source that represent a disproportionate amount of the total methane emissions released from all sources.
  (Note - The term 'super-emitter' can refer to malfunctioning equipment, particularly in unmanned installations where such equipment has the potential to exist for long periods of time. The determination of a super-emitter is best associated with emissions data from a given source and should not be viewed as an attribute of an entire site. Care should be taken when

utilizing methodologies for identifying super-emitters to differentiate between episodic events (e.g. gas actuation events), erroneous measurements and/or malfunctioning equipment. The term 'fat-tail' is often used to describe the statistical anomalously high values from a small number of sources seen from representation of the data—a probability distribution that is highly skewed relative to a well-behaved distribution such as the normal or an exponential distribution. Having super-emitters at a few sites could skew significantly the distribution of emissions from a sample of sites.)

- **Survey** - Using detection equipment and measurements to examine a group of assets for signs of emissions. *[14]*

- **System integrity** - Any situation in respect of a gas network including necessary assets in which the pressure and the quality of the gas remain within the minimum and maximum limits laid down by the system operator, so that the operation is guaranteed from a technical standpoint. *[17]*

- **Third-party damage** - Any accidental damage caused to a natural gas system as a result of activities not associated with the system. Examples are excavations or other private or public works that are performed by parties not associated with the gas supply (for example, work on water mains).

- **Top-down emission approach** - Estimate made using different remote sensing based techniques, e.g. satellite and airborne, to measure ambient air concentrations of methane, calculate methane flux based on atmospheric and meteorological conditions, and then attribute the emission to different activities. Each measurement technique has different resolution capabilities, strengths and weaknesses.
  (Note - Methane emissions are allocated to the natural gas industry by: (a) using a ratio of methane to ethane or propane (longer chain aliphatics which do not occur from biogenic sources); (b) isotopic ratio analysis, using a co-located tracer (such as SF_6 or C_2H_2); or (c) subtracting estimates of other sources of methane emissions such as, livestock, wetlands, agriculture, waste management, etc. together with background methane concentrations.)

- **Toxic Vapour Analyser (TVA)** - Portable hydrocarbon detector that can be utilised to identify methane leaks.
  (Note - For higher concentration leaks, a TVA combines a flame ionization detector (FID), which is particularly sensitive to methane, with a photoionization detector (PID), which is sensitive to other hydrocarbons but insensitive to methane. In combination, OVAs and TVAs can measure the methane concentration in the area surrounding a leak over a large range.)

- **Transmission** - The transport of natural gas through a network, which mainly contains high-pressure pipelines, other than an upstream pipeline network and other than the part of high-

pressure pipelines primarily used in the context of local distribution of natural gas, with a view to its delivery to customers, but not including supply. *[17]*

- **Transmission System Operator (TSO)** - A natural or legal person who carries out the function of transmission and is responsible for operating, ensuring the maintenance of, and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transport of gas. *[1]*

- **Uncertainty (of measurement)** – A parameter, associated with the result of a measurement, that characterizes the dispersion or range of the values that could reasonably be attributed to the quantity measured. *[10]*
  (Note 1 - The parameter may be, for example, a standard deviation (or a given multiple of it), or the half-width of an interval having a stated level of confidence.
  Note 2 - Uncertainty of measurement comprises, in general, many components. Some of these components may be evaluated from the statistical distribution of the results of series of measurements and can be characterized by experimental standard deviations. The other components, which also can be characterized by standard deviations, are evaluated from assumed probability distributions based on experience or other information.
  Note 3: It is understood that the result of the measurement is the best estimate of the value of the measurand, and that all components of uncertainty, including those arising from systematic effects, such as components associated with corrections and reference standards, contribute to the dispersion.
  Note 4: The definition of uncertainty can also apply to characterize the dispersion for estimated values and calculated values.)

- **Underground Gas Storage (UGS)** – The part of the gas supply chain that stores natural gas underground under pressure, to be used when there is a high demand.
  (Note - Underground gas storage facilities are created in depleted gas or oil reservoirs, salt cavern formations and aquifers.)

- **Upstream pipeline network** - Any pipeline or network of pipelines operated and/or constructed as part of an oil or gas production project, or used to convey natural gas from one or more such projects to a processing plant or terminal or final coastal landing terminal. *[1]*

- **US EPA Method 21** - A specific emission detection methodology specified by the US EPA Technical Guidance on 'Determination of Volatile Organic Compound Leaks'. This method is applicable for the determination of VOC leaks from process equipment. These sources include, but are not limited to, valves, flanges and other connections, pumps and compressors, pressure relief devices, process drains, open-ended valves, pump and compressor seal system degassing vents, accumulator vessel vents, agitator seals and access door seals. *[8]*

- **Vane anemometer** – Device to measure flow using a vane wheel.
  (Note – Consists of a vane wheel flow velocity sensor and handheld unit that displays the measured velocity of gas that passes through the device's vane wheel. Vane anemometers are best for measuring open ended lines and end-of-pipe vents of known cross-sectional area. They do not require complete capture of emissions.)

- **Vented emissions** - Gas released into the atmosphere intentionally from processes or activities that are designed to do it, or unintentionally when equipment malfunctions or operations are not normal.
  (Note - In the case of transmission and distribution grids, unintentional vented emissions during not normal operation cover also vents due to external interference (third-party damage), ground movements, over pressure, etc.)

- **Venting** – Operational release of gas into the atmosphere.
  (Note - Often carried out in order to maintain safe conditions.)

List of acronyms on methane emissions

AF	Activity Factor
AVO	Audio/Visual/Olfactory
BAT	Best Available Techniques
BOG	Boil-off gas
CCAC	Climate and Clean Air Coalition
CCGT	Combined Cycle Gas Turbine
CCS	Carbon Capture and Storage
CDP	Carbon Disclosure Project
CEN	European Committee for Standardization
CH_4	Methane
C_2H_2	Acetylene (or ethyne)
CHP	Combined Heat and Power
CNG	Compressed Natural Gas
CO	Carbon monoxide
CO_2	Carbon dioxide
$CO_{2\text{-eq}}$	Carbon dioxide equivalent
DI&M	Directed Inspection and Maintenance
DSO	Distribution System Operator
EEA	European Environment Agency
EF	Emission Factor
EOR	Enhanced Oil Recovery
FID	Flame Ionization Detectors
GHG	Greenhouse gases
GMI	Global Methane Initiative
GTP	Global temperature change potential
GWP	Global warming potential
HFS	Hi Flow Sampler
IPCC	Intergovernmental Panel on Climate Change

Glossary on methane emissions

IR	Infrared
LCNG	Liquefied-to-Compressed Natural Gas
LDAR	Leak detection and repair
LNG	Liquefied Natural Gas
MDL	Minimum detection limit
MOP	Maximum operating pressure
MGP	Methane Guiding Principles
MRV	Measuring, reporting and verification
NG	Natural Gas
NGL	Natural gas liquid
NIR	National Inventory Report
NOC	National Oil & Gas Companies
OEL	Open Ended Line
OGI	Optical gas imaging
OGMP	Oil and Gas Methane Partnership
OVA	Organic vapour analyser
PID	Photoionization detector
PVC	Polyvinyl chloride
PPMV	Parts per million by volume
SLCP	Short-lived climate pollutants
SSO	Storage System Operator
TVA	Toxic vapour analyser
TSO	Transmission System Operator
UGS	Underground Gas Storage
UNEP	United Nations Environment Programme
US EPA	United States Environmental Protection Agency
VOC	Volatile organic compounds

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