



## Glossary

### A

#### **Abandoned well**

A well that is no longer in use, whether dry, inoperable, or no longer productive.

#### **Alternative Methods & Technologies**

Any method of sampling and analyzing for an air pollutant that is not a reference or equivalent method, but has been demonstrated to, in specific cases, produce results adequate for a determination of compliance.

#### **Annulus**

The space between the casing and the wall of the borehole, between two strings of casing, or between tubing and casing.

#### **Associated Gas**

Gas produced as a byproduct of the production of crude oil.

#### **Audio, visual, and olfactory (AVO) techniques**

Wherein an operator of natural gas systems would seek to detect a leak by human observation whenever near their equipment. In certain conditions, and for certain leak sizes, a person can detect the sound of a leak, or the smell of emitted gas, or other visual signals, such as darker deposits left on the equipment near a leak source where heavier condensing components in the gas stream drop out or as dead vegetation or small openings in the ground surface.

### B

#### **Barrel (BBL)**

A unit of volume measurement used for petroleum and its products or water used or produced by the industry (1 barrel = 42 gallons).

#### **Barrel of oil equivalent (BOE)**

A measure used to aggregate oil and gas resources or production, with one BOE being approximately equal to 6,000 cubic feet of natural gas.

#### **Baseline technology (BT)**

An existing technology that is already in use, generally accepted, and validated for use in the application.

#### **Brine**

A salt water and chemical mix that is produced after fracturing a well with elevated Total Dissolved Solids (TDS) levels and often naturally occurring metals such as barium and strontium. Brine must be treated or disposed of as contaminated waste water.

#### **British thermal unit (BTU)**

The heat required to raise the temperature of a one-pound mass of water by one degree Fahrenheit.

### C

#### **Casing**

Pipe cemented in the well to seal off formation fluids or keep the borehole from caving in.

#### **Catalytic combustion**

A chemical process which uses a catalyst to speed desired oxidation reactions of a fuel and reduce the formation of undesired products, especially pollutant nitrogen oxide gases far below what can be achieved without catalysts.

#### **Completion**

The installation of permanent wellhead equipment for the production of oil and gas.

**Compressor station**

A group of equipment designed to increase the gas's pressure to pump natural gas through pipelines over significant distances for delivery to markets.

**Controlled statistical field survey**

The Controlled Statistical Field Survey testing is to ensure that the Technology under Test (TUT) meets the requirements of the intended use and user requirements. This Blind Survey validation method compares statistical leak detection performance of the TUT to the performance of the Baseline Technology (BT) under actual field conditions. Single-blind and double-blind methods are used to collect independent data samples, which aid in identifying performance differences based on the technology and operator use of the technology.

**Crude Oil**

Liquid petroleum as it comes out of the ground as distinguished from refined oils manufactured out of it.

**D****Double-blind survey**

A leak survey conducted without prior knowledge of leak locations. Both the TUT and BT survey independently of each other but within time and distance constraints.

**Directional drilling**

The application of special tools and techniques to drill a wellbore at a predetermined angle. Horizontal drilling is a form of directional drilling where the wellbore is ultimately drilled at +/- 90 degrees to the vertical direction.

**Drill or Drilling**

The use of a rig and crew for deepening and advancing the borehole.

**Drilling mud/fluid**

Drilling mud and or drilling fluid is used to aid the drilling of boreholes into the earth. A mixture of base substance and additives used to lubricate the drill bit and to counteract the natural pressure of the formation. The three main categories of drilling fluids are water-based muds (which can be dispersed and non-dispersed), non-aqueous muds (usually called oil-based mud), and gaseous drilling fluid, in which a wide range of gases can be used.

**F****Fat-tailed distribution**

A fat-tailed distribution is a probability distribution that along with the other heavy-tailed distributions, exhibits large skewness or kurtosis. This comparison is often made relative to the normal distribution, or to the exponential distribution.

**Flaring**

The burning of natural gas for safety reasons or when there is no way to transport the gas to market or use the gas for other beneficial purposes (such as enhanced oil recovery or reservoir pressure maintenance). The practice of flaring is being steadily reduced as pipelines are completed and in response to environmental concerns.

**Fossil fuels**

Fossil fuels are the nation's principal source of electricity. Fossil fuels come in three major forms: coal, oil, and natural gas. Because fossil fuels are a finite resource and cannot be replenished once they are extracted and burned, they are not considered renewable.

**Fracturing**

A method of breaking down a formation by pumping fluid at very high pressures. The objective is to increase production rates from a reservoir.

**Fugitive emissions**

Emissions of gases or vapors from pressurized equipment, including pipelines, due to leakage or unintended or irregular releases of gases.

## **G**

### **Gathering lines**

Natural gas pipelines that are generally operated and maintained by an exploration and production company, or their midstream affiliate, to move gas from the well to the custody transfer point. Gathering lines are generally not permitted by the Federal Energy Regulatory Commission or regulated by the Pipeline and Hazardous Material Safety Administration.

### **Global climate change**

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from: (1) Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun. (2) Natural processes within the climate system (e.g., changes in ocean circulation). (3) Human activities that change the atmosphere's composition (e.g., through burning fossil fuels) and the earth's land surface (e.g., deforestation, reforestation, urbanization, desertification).

### **Global warming potential (GWP)**

The index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a greenhouse gas to that from the emission of one kilogram of carbon dioxide over a period of time (usually 100 years). Gases involved in complex atmospheric chemical processes have not been assigned GWPs.

### **Grade 1 Gas Leak**

A leak that represents an existing or probable hazard to persons or property and requires immediate repair or continuous action until the conditions are no longer hazardous (Courtesy of the American Gas Association) (AGA 2015).

### **Greenhouse Gas**

Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide, methane, nitrous oxide, hydrochlorofluorocarbons, ozone, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

### **Greenhouse Gas Inventory and Greenhouse Gas Reporting Program (GHGRP)**

The Greenhouse Gas Mandatory Reporting Rule (also known as the Greenhouse Gas Reporting Program) was published by EPA in October 2009 and went into effect in January 2010. The rule requires annual reporting of greenhouse gases, including methane, from large emission sources across a range of industrial categories, including the oil and gas sector.

## **H**

### **Horizontal drilling**

A drilling technique whereby a well is progressively turned from vertical to horizontal so as to allow for greater exposure to an oil or natural gas reservoir. Horizontal laterals can be more than a mile long. In general, longer exposure lengths allow for more oil and natural gas to be recovered from a well and often can reduce the number of wells required to develop a field, thereby minimizing surface disturbance.

### **Hydraulic fracturing**

Hydraulic fracturing (also referred to as fracking or hydrofracking or hydrofracturing) is an essential completion technique in use since the 1940s that facilitates production of oil and natural gas trapped in low-permeability reservoir rocks. The process involves pumping fluid at high pressure into the target formation, thereby creating small fractures in the rock that enable hydrocarbons to flow to the wellbore.

## **K**

### **Kick**

When gas or fluids escape into the wellbore that are metered through a mud/gas separator prior to the mud being recirculated back into the well for continuous operations.

## **L**

### **Lifecycle analysis (LCA)**

A cradle-to-grave approach for assessing industrial systems that evaluates all stages of a product's life. It provides a comprehensive view of the environmental aspects of the product or process.

### **Liquefied natural gas (LNG)**

Natural gas that has been converted to a liquid by refrigerating it to -260°F. Liquefying natural gas reduces the fuel's volume by 600 times, enabling it to be shipped economically from distant producing areas to markets.

## **M**

### **Methane**

A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 23 times that of carbon dioxide (CO<sub>2</sub>). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

### **Methane emission**

The release of methane, a colorless, odorless, flammable gaseous hydrocarbon that is a product of the decomposition of organic matter. Methane is a major greenhouse gas and is also the principal component of natural gas.

### **Method 21 - Determination of Volatile Organic Compound Leaks**

EPA Reference Method 21 (40 CFR Part 60, Appendix A) is a procedure used to detect VOC leaks from process equipment using a portable detecting instrument and the primary method for monitoring to detect leaking components for many New Source Performance Standards (NSPS) and National Emission Standard for Hazardous Air Pollutants (NESHAP) regulations with leak detection provisions.

### **Minimal Actionable Leak (MAL)**

A large enough leak that meets specific guidelines, levels, or conditions that require it to be repaired.

### **Minimal Detectable Leak (MDL)**

A leak with environmental conditions or gas plume characteristics that an instrument has a 50% probability of detecting when used in normal operation mode.

## **N**

### **Nanotube**

A tubular molecule composed of a large number of carbon atoms.

### **National Emission Standard for Hazardous Air Pollutants (NESHAP)**

A technology-based standard of performance prescribed for hazardous air pollutants from certain stationary source categories under Section 112 of the Clean Air Act.

### **Natural gas**

A naturally occurring combustible mixture of hydrocarbon and non-hydrocarbon gases in porous formations beneath the Earth's surface, often in association with petroleum, that is used chiefly as fuel. The principal constituent of natural gas is methane.

### **New Source Performance Standards (NSPS)**

Technology-based air emission standards issued by USEPA which applies to new, modified, and reconstructed stationary sources. Standards are published in 40 CFR Part 60 <https://www.law.cornell.edu/cfr/text/40/part-60> (USEPA 1971).

### **Non-detectable Leak**

A leak with environmental conditions or gas plume characteristics that an instrument is not able to detect.

## **O**

### **Optical Gas Imaging**

Devices such as a camera that make emissions detection possible by allowing visualization of a gas plume on a screen that is otherwise invisible to the naked eye.

### **Optical Modulation Index (OMI)**

A key variable in determining carrier power and thus carrier-to-noise ratio, which is a primary factor in the performance of optical communications systems.

## **P**

### **Permeability**

The property of a formation which quantifies the flow of a fluid through the pore spaces and into the wellbore. High permeability means fluid passes through the rock easily.

### **Pipeline Inspection Gauge (PIG)**

Performs various maintenance functions in a pipeline including cleaning, segmenting flow, inspecting, and recording information about the pipeline.

### **Pipeline**

Underground or surface tubing or piping that is installed across states, countries, and continents to deliver fuel.

### **Produced water**

Water generated from a well in conjunction with oil and natural gas production.

## **R**

### **Radiative forcing**

A change in the balance between incoming solar radiation and outgoing infrared (i.e., thermal) radiation. Without any radiative forcing, solar radiation coming to the Earth would continue to be approximately equal to the infrared radiation emitted from the Earth. The addition of greenhouse gases to the atmosphere traps an increased fraction of the infrared radiation, reradiating it back toward the surface of the Earth and thereby creating a warming influence.

### **Recompletion**

The process of entering an existing wellbore and performing work designed to establish production from a new zone.

## **S**

### **Shale**

A very fine-grained sedimentary rock that is formed by the consolidation of clay, mud, or silt and usually has a finely stratified or laminated structure.

### **Shale gas**

Shale gas refers to natural gas that is trapped within shale formations. Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas.

### **Single-blind survey**

A leak survey conducted using actual known leaks. The TUT is blind to where the known leaks are. Known leaks were acquired by previous surveys and have not been repaired.

### **Super emitter**

Super emitter is a term which has been used in the literature to describe sources with much higher emission rates than the average from that source type. The exact definition of super-emitters varies among the various references: for example, it may refer to the top 5% highest emitting sources that are responsible for the majority of that source type's total emissions (Brandt et al. 2016) or sites with the highest proportional loss rates (Zavala-Araiza et al. 2015). Depending on the definition, the term super-emitters may include chronic, episodic, routine, and malfunctioning sources. Due to the various uses of this term in the literature and its ambiguity, this report and the recent National Academies' report on methane have chosen to use the term 'high emitting sources' to describe these emission sources.

## **T**

### **Technology Readiness Level (TRL)**

Developed during the 1970-80s, the National Aeronautics and Space Administration (NASA) introduced the scale as “a discipline-independent, program figure of merit to allow more effective assessment of, and communication regarding the maturity of new technologies.”

**Technology Under Test (TUT)**

A new technology that is being tested to determine if it meets performance requirements.

**Thief hatch**

A closable aperture in a tank or vessel normally used on low pressure or atmospheric tanks in oil and gas operations.

**Transitional fuel (or Bridge fuel)**

A fuel used to allow for a smoother transition from one type of fuel or energy generation source to another, typically a source with less environmental impact. Natural gas has been suggested as a “bridge fuel” in the transition from coal to a near-zero emission energy system.

**Tunable diode laser absorption spectroscopy (TDLAS)**

Tunable Laser Absorption Spectroscopy (TDLAS) is based on spectroscopic principles, sensitive detection techniques and advanced infrared diode lasers. Gas molecules absorb energy in narrow and specific wavelengths in the electromagnetic spectrum. The laser wavelength is then rapidly scanned across the absorption line to determine the absorption amount. The absorption amount is directly related to the gas concentration.

**V****Volatile organic compounds (VOC)**

Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions.

**W****Wellbore**

The hole drilled by a drilling rig to explore for or develop oil and/or natural gas. Also referred to as a well or borehole.

**Workover**

Remedial work to the equipment within a well, the well pipework, or relating to attempts to increase the rate of flow.

**Y****Y-grade**

Refers to natural gas liquid byproducts from natural gas extractions. Also referred to as “raw natural gas liquids mix.”