

# A

## AA

Abbreviation commonly used for Atomic Adsorption spectroscopy.

## Absolute Pressure

A measurement of pressure which sets a total vacuum as having a value of zero, abbreviated as psia or bar. Absolute pressure is equal to the sum of a pressure gauge reading and atmospheric pressure (14.69 psia or 1 bar at sea level).

## Absolute Zero

The minimum point on the thermodynamic temperature scale: 0°K, -459.69°F or -273.16°C.

## Accuracy

The degree of statistical agreement (usually at the 95% confidence level) between a measured value and the true value, or the certainty or sureness with which a measured value is known.

## ALPHAGAZ™

A registered trademark for pure and instrumentation specialty gas mixtures offered by Airgas worldwide.

## American Conference of Government Industrial Hygienists (ACGIH)

A group that makes recommendations on the exposure levels of hazardous materials in the workplace.

## American Society of Testing Materials (ASTM)

An organization that sponsors committees that develop standards for industrial manufacturers and consumers.

## Anaerobic

Gases that do not contain oxygen and are used for biological culture growth.

## Analysis

Instrumental analysis in the lab after blending; a process based on statistics used to estimate the true concentration for each component of a gas mixture and to assign the analyzed concentration. A further objective of analysis is to determine the analysis accuracy for each component. Analytical measurements have sufficient work content to assure that component concentrations and accuracies meet customer and Airgas specifications. Example: A Certificate of Analysis stating Component X: 100 ppm  $\pm$ 2% (mole/mole) means Airgas has analyzed this gas mixture and determined that the most probable value for Component X is 100 ppm and the true value is between 98 and 102 ppm, on a mole basis, at the 95% confidence level.

## Analytical Accuracy

The difference or degree of statistical agreement between the analyzed and the true concentration for a component of a gas mixture (usually at the 95% confidence level), or the certainty or sureness with which the analyzed concentration is known. Analytical measurements have sufficient anchoring to reference standards, calibration, precision, resolution, and traceability to assure that the true concentration for a component can be estimated to the claimed accuracy. Analytical accuracy can be calculated because Airgas analytical measurements require actual data for reference standards, calibration, precision, resolution, and traceability.

## Analytical Tolerance

The degree of agreement between the analyzed concentration and the requested concentration for a component. Analytical tolerance is not determined by statistical means (whereas analytical accuracy is).

## Analyzed Concentration

The numerical concentration assigned to a component based on the results of analysis. The analyzed concentration is expressed in both concentration units (i.e. percent, parts per million) and concentration basis (i.e. mole/mole, weight/weight). An analyzed concentration is also accompanied by an analysis accuracy value (i.e.  $\pm$ 2%).

## Anhydrous

A term meaning without water or dry. It is often used with gases that are particularly corrosive in the presence of moisture such as ammonia.

## Asphyxiant Gas

A gas that displaces air in an enclosed space and can render unconsciousness or death due to a lack of oxygen.

## Avogadro's Law

A gas law that states that equal volumes of gases at the same temperature and pressure contain the same number of molecules.

## Avogadro's Number

The number of molecules in one mole or gram molecular weight of a substance ( $6.0221367 \times 10^{23}$  molecules/gm mole).

## Azeotrope

A mixture of two substances that typically cannot be separated easily by simple distillation. Also, a commonly used term to describe a liquid mixture that has a constant boiling point.

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# B

## Balance

Also known as balance gas.

## Blend Accuracy

Also known as process accuracy, this is the degree of statistical agreement between the blended and the true concentration for a component of a gas mixture (usually at the 95% confidence level), or the certainty or sureness with which the blended concentration is known. Blend (or process) accuracy can be calculated because Airgas gravimetric measurement requires actual data for scale calibration, resolution, and weight uncertainties.

## Blend Tolerance

The degree of agreement between the blended concentration and the requested concentration for a component. Blend tolerance is not determined by statistical means (whereas blend accuracy is).

## Blended Concentration

The numerical concentration assigned to a component based on the results of blending. A blended concentration is expressed in both concentration units (i.e. percent, parts per million) and concentration basis (i.e. mole/mole, weight/weight). A blended concentration may also be accompanied by a blend accuracy value (i.e.  $\pm 2\%$ ).

## Blending

A process by which component and balance gases of a gas mixture are metered into a container. Blending process measurements (i.e. scale resolution, actual weight data, partial pressures, response data) have sufficient resolution and accuracy to assure that components are in the required ratio to meet customer and Airgas specifications.

## Boiling Point (BP)

The temperature of a liquid at which the vapor pressure is equal to the pressure of the atmosphere above it.

## Bourdon Tube

A curved metal tube commonly used in pressure gauges. The tube flexes a known degree as pressure is applied and that movement is translated as the physical movement of a gauge needle across a scale.

## British Thermal Unit (BTU)

A unit of energy defined as the quantity of heat needed to raise the temperature of one pound of water 1°F.

## Burst Pressure

The designed test pressure at which a gas containment device (i.e. cylinder, piping, pressure adjusting device) will begin to leak but not violently rupture. For most gas handling equipment, the industrial standard of the burst pressure is four times or 400% of the normal operating pressure.

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# C

## **Calibration**

A process designed to determine the relationship between detector response and concentration for a given component on an instrument. During calibration, one or more samples of known concentration (i.e. standards) are introduced to the detector and detector response is recorded for each sample. Calibration may be performed with reference standards or with calibration standards accompanied by reference standard verification.

## **Calibration Curve**

A mathematical function produced by regression of the detector responses recorded during calibration of an instrument. The function describes detector responses over a range of concentrations and is used to predict the concentration of an unknown sample based on its detector response.

## **Calibration Gas**

A gas with an accurately known concentration that is used as a comparative standard in analytical instrumentation.

## **Calibration Gas Standard**

A gas mixture accurately analyzed against a known reference standard. This mix can be used as a comparative standard for determinations on analytical instruments.

## **Calibration Range**

A range between the highest and lowest concentrations of standards used for calibrations, from which the concentrations of unknown samples can be determined. A concentration range may be further limited by precision and accuracy requirements.

## **Calorie**

The amount of heat required to raise the temperature of one gram of water at 15°C by 1°C (59°F by 34°F).

## **Carrier Gas**

The gas that flows through a separation column of a gas chromatograph and propels a sample to a detector.

## **Celsius**

A temperature scale set up so ice melts at 0°C (32°F) and water boils at 100°C (212°F).

## **Certificate of Analysis (COA)**

A document which represents the certified concentration of a component of a mixture and its associated accuracy to the customer. Airgas Certificates of Analysis require actual analysis, can report either the blended or analyzed concentration, and require backup data to substantiate concentration and accuracy claims.

## **Certificate of Batch Analysis**

A printed guarantee by a gas producer that a particular lot of cylinders were all filled simultaneously and analyzed to meet the specifications of that product.

## **Certificate of Conformance (COC)**

A printed guarantee by a gas producer that a particular gas meets a recognized standard.

## **Certified Concentration**

The numerical concentration assigned to a component and that is printed on the Certificate of Analysis. This is the concentration represented to the customer for that component and the concentration the customer is supposed to use. The certified concentration may be either the blended or analyzed concentration.

## **Certified Reference Material (CRM)**

A gas reference standard available from VSL (formerly NMI). CRMs used to be available from U.S. EPA/NIST but have been phased out in favor of NTRMs.

## **Chemical Abstract Services (CAS) Number**

A Chemical Abstract Services numbering system assigned to each new chemical as it is reported in the world's literature. Virtually every commercially manufactured chemical has been assigned a CAS number allowing easy identification.

## Chemiluminescence

Absorption and emission of light by a chemical compound. Chemiluminescence detectors function by monitoring this absorption and emission of light at certain wavelengths by a substance.

## Chromatography

An analytical method where a mixture is physically separated into its individual components.

## Coefficient of Flow (Cv)

Rate of flow through a regulator or other gas handling device measured in U.S. gallons per minute at 60°F (16°C) with a pressure differential of 1 psig (0.07 bar).

## Component

One of the gases in a mix, either a minor component or balance. There is no such thing as a one-component mixture—this is referred to as a pure gas or material.

## Compressed Gas

Any material or mixture having one of the following: an absolute pressure exceeding 40 psia (2.72 bar) at 70°F (21°C); an absolute pressure exceeding 104 psia (7.07 bar) at 130°F (54°C); a flammable liquid having a vapor pressure exceeding 40 psia (2.8 bar) at 100°F (38°C) as determined by ASTM D323-72.

## Compressed Gas Association (CGA)

A nonprofit trade organization for the gas industry that develops and promotes industry standards for safe handling, transport, and storage of compressed gases. Also recommends cylinder valve outlet connections for specific gas services based on safety considerations.

## Concentration

The ratio or proportion of a given component to the total quantity mixture and expressed in terms of concentration units (i.e. % or parts per hundreds, ppm or parts per million, ppb or parts per billion) and concentration basis (i.e. mole/mole, weight/weight). Airgas states concentrations on a mole basis, unless otherwise specified.

## Concentration Basis

The basis for counting units for expressing the ratio of a component to the total mixture (i.e. mole per mole, abbreviated as mole/mole; weight per weight, abbreviated as w/w; volume per volume, abbreviated as v/v). Example: A Certificate of Analysis stating Component X: 100 ppm  $\pm$ 2% (mole/mole) means for every 1,000,000 total moles of mixture contained within this cylinder, 100 moles (no > 98, no < 102) are Component X.

## Confirmation

A process designed to demonstrate that a component of a gas mixture is present at or near the blended concentration, and to provide sufficient information to support the claim that the blended concentration is correct. Confirmation is less rigorous than analysis because, by design, it does not have sufficient work content to estimate the true value of the component concentration or to determine the accuracy.

## Contaminant

An undesired component in a pure gas or gas mixture.

## Continuous Emissions Monitor (CEM)

A device used to measure the emissions typically from an exhaust stack on a continuous basis. Also refers to the gas standards used to calibrate these monitors.

## Corrosive

Any gas that chemically attacks materials with which it comes in contact (i.e. metals, skin) and capable of irreversible damage.

## Cracking Pressure

The inlet pressure at which a gas begins to flow through a regulator, valve or other pressure control device.

## Creep

Slow increase in outlet pressure of a regulator that may be caused by changes in inlet pressure or failure of the regulator seat.

## Critical Density

The density of a pure substance at its critical point.

### **Critical Point**

The point of a temperature versus pressure curve of a pure substance above which a gas cannot exist in both gas and liquid phases.

### **Critical Pressure**

The pressure exerted by a material at the critical temperature.

### **Critical Temperature**

The temperature above which a gas cannot be liquefied by pressure alone.

### **Cryogenic Liquid**

A liquid having a normal boiling point below -2400°F (-151.1°C).

### **Cryogenic Vessel**

An insulated container for the storage, transport, and dispensing of liquids having a boiling point below -130°F (54°C).

### **Cylinder**

A container designed to safely hold compressed gases. Airgas' cylinders are designed and tested to meet government specified standards of construction.

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## **D**

### **Dalton's Law of Partial Pressure**

A gas law which states that for ideal gases, the pressure of a gas blend is equal to the sum of the pressures of each of its components.

### **Density**

The mass exerted by a given volume of a material. For gases, density is greatly affected by temperature and pressure.

### **Department of Transportation (DOT)**

A U.S. federal agency that regulates transportation of hazardous materials per Title 49, Code of Federal Regulations.

### **Dew Point**

The temperature at which condensation or formation of a liquid phase begins. The term most commonly applies to condensation of moisture from water vapor in the atmosphere.

### **Dewar**

A vessel that is usually portable and is used to contain cryogenic liquids.

### **Diameter Index Safety System (DISS)**

Type of valve designed with metal-to-metal seals for high leak integrity and generally used for high-purity, corrosive or toxic gases.

### **Discharge Ionization Detector (DID)**

A universal detector used in gas chromatography where the species detected is ionized by electrical discharges between plates.

### **DOT Numbers**

Product identification numbers assigned to chemicals for shipping purposes by USDOT that helps in rapid identification by emergency response teams.

### **Dual-Analysis**

Dual-analyzed gas mixtures are subjected to two full, independent analyses on two different occasions.

## Dual-Certification

Both blend and analyzed concentrations are reported and agree with each other. Dual-certified gas mixtures are supplied with both the blended concentration (accompanied by the calculated blend process accuracy) and an analyzed concentration (also accompanied by the calculated analytical accuracy). For dual-certified gas mixtures, it is also required that the blended and analyzed concentrations agree with each other to within the bounds of the least restrictive accuracy (i.e. the concentrations are interlocked). By providing both values, gas mixtures effectively have two certifications (dual-certified) and an extra assurance of mixture reliability is thereby provided to the customer.

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# E

## Eductor Tube

A tube inside a cylinder that allows for liquid withdrawal from the bottom of the cylinder when the valve is opened.

## Electron Capture Detector (ECD)

Chromatographic detector used commonly for halogenated compounds. Electrons are generated by a radioactive source and captured by the species being monitored. The current drop across two plates is measured.

## Environmental Protection Agency (EPA)

A U.S. government agency that issues emissions standards and monitoring policy for environmental pollutants in air, water, and soil.

## EPA Protocol Mixture

Standard gas mixture prepared and analyzed following EPA-600/R-97/121 guidelines. These standards are required for calibration purposes when EPA analytical methods must be followed.

## European Industrial Gases Association (EIGA)

A technically oriented organization representing European and non-European companies producing and distributing industrial gases. EIGA works toward achieving safety and environmental care in the handling of these industrial gases, and maintains communication with standardization, regulatory, trade and industrial organizations.

## Expiration Period

The stated date after which a gas mixture is no longer valid or legal to use for calibration purposes.

## Exposure Limits

Concentration of substances under which it is believed that nearly all workers can be repeatedly exposed to on a daily basis without adverse effects.

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# F

## Fill Density

The relationship expressed in percent between the weight of a gas in a container to the weight of water that the container will hold at 60°F (16°C).

## Flame Ionization Detector (FID)

One of the most used detectors for measuring organic compounds in a gas stream. Organic species are decomposed by a hydrogen flame and measured by electrodes near the flame.

## Flammable Gas

DOT definition of any gas that will either form a flammable mixture with air at concentrations of 13% or less by volume or has a flammable range wider than 12% regardless of the lower explosive limit (LEL).

## Flammable Limits

The upper and lower concentration limits for a flammable gas, above and below which flame propagation does not occur upon contact with a source of ignition. Flammable limits are calculated at ambient temperature and pressure in the air.

## Flash Point

The temperature at which a flammable liquid evolves enough vapor to form an ignitable mixture with air.

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# G

## Gas

A state of matter in which the individual molecules are almost totally unrestricted by cohesive forces. An ideal gas is one that obeys Gas Laws under standard conditions.

## Gas Manufacturers Intermediate Standard (GMIS)

A gas reference standard made by a gas supplier and certified according to the U.S. EPA protocol rules for GMISs. This term is frequently used in the gas industry to mean any generic gas reference standard, but Airgas restricts the meaning to only those standards (gas mixtures) made by the U.S. EPA GMIS procedure.

## Gas Phase

Pure materials or gas mixtures in which all components remain in the vapor state under the conditions (i.e. temperature) recommended for use of the product.

## Gas Processing Association (GPA)

Organization consisting of both member companies and suppliers to the Gas Processing Industry, established to exchange technology related to the industry and to develop standards applying to the processing of gas products.

## Gross Weight

The total weight of both the container and the contents therein.

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# H

## Halocarbons

A family of compounds made up of a hydrocarbon combined with one or more halogens from the Group VIIA elements in the Periodic Table. This name is commonly used for those compounds in the family that are used for refrigeration systems.

## Heat of Adsorption

The total heat generated from the initial adsorption of a compound on an adsorbate to equilibrium conditions are met and no more adsorption can take place.

## Heat of Fusion

The heat energy required to convert one mole of substance from the solid phase to the liquid phase at one atmosphere of pressure.

## Heat of Vaporization

The heat energy needed to transform one mole of substance from the liquid phase to the gas phase at one atmosphere of pressure.

## Hydrocarbon

An organic compound that contains both carbon and hydrogen in its molecular structure.

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# I

## **Impurity**

An additional or extra component of a pure gas or mixture. Impurities are most encountered in pure material used as the raw material source for a component of a gas mixture. An impurity may be removed by purification. Alternatively, the impurity may be measured and accounted for during blending, thereby preventing it from becoming a contaminant.

## **Inductively Coupled Plasma (ICP)**

An instrument used in atomic emission spectroscopy primarily for the quantitative analysis of trace metals in solids or liquids.

## **Inert**

A component with no uncontrolled chemical incompatibility with other components or with the container materials of construction, such as nitrogen, helium, carbon dioxide and methane.

## **Inorganic Compounds**

Substances which do not contain carbon in their molecular structure.

## **Interlocking**

Interlocked concentration values (interlocking features). Dual-certified calibration standards receive two rigorous, independent certifications: one during blending using the gravimetric process and the other using proprietary laboratory analytical procedures. The interlocking requirement assures that all dual-certified calibration standards are of the highest accuracy, with the two concentration values agreeing within  $\pm 1\%$  of each other.

## **Isotopes**

Forms of an element that have the same structure but differ from each other only in atomic mass. These slight changes in atomic mass often lead to instability and radioactivity.

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# K

## **Kelvin**

A temperature scale related to the triple point of water.

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# L

## **Level of Detection**

In chromatography, the amount of sample in a stream necessary to produce a peak height two to three times the baseline noise height.

## **Liquefied Compressed Gas**

A gas that is partially liquid at its charging pressure and a temperature of 70°F (21°C).

## **Liquefied Petroleum Gas (LPG)**

A term generally used to describe those hydrocarbon gases that exist as liquids at normal temperature and pressure.



## Liquid Phase

Pure materials or gas mixtures in which one or more components exist in a liquid state under the conditions (i.e. temperature) recommended for the product. Liquid phase materials can be stored in equilibrium with the gas phase (conventional cylinder) or forced to an all-liquid state (piston cylinders).

## Lower Explosion Limit (LEL)

The minimum percent by volume of a gas in air that forms a flammable mixture at normal temperatures and pressures.

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# M

## Manifold

A device having a single outlet but several inlets to which cylinders can be connected for simultaneous multiple use.

## Matrix

For a given component, the matrix is the background of all gases present in the gas mixture. This term is most frequently used to contrast two gas mixtures with a common minor component but with different combinations of other components which affect blending or analysis. Matrix Matching is one technique that can be used to overcome interferences caused by matrix effects. Example: Mixture A contains 500 ppm of NO in a nitrogen balance, and Mixture B 500 ppm of NO and 20% CO<sup>2</sup> and a nitrogen balance. The matrix for Mixture A is nitrogen, whereas the matrix for Mixture B is nitrogen with 20% CO<sup>2</sup>. The analysis for NO in these two gas mixtures is radically different because of CO<sup>2</sup> interference.

## Mean

The average of a set of replicate measurements. The replicate measurements should be made under similar conditions so that the mean value is a representation of the true value.

## Melting Point

The temperature at which the solid and liquid phase of a substance are at equilibrium (normally given for 1 atmosphere of pressure).

## Micron

A unit of length equivalent to  $1 \times 10^{(-6)}$  meters.

## Minor Component

A component making up less than half of a gas mixture and for which specifications have been requested by the customer.

## Mole

For a given molecule, one mole is the mass numerically equal to its molecular weight. A gram mole is the mass in grams equal to the molecular weight. A pound mole is the weight in pounds equal to the molecular weight.

## Molecular Weight

The sum of all the atomic weights of constituent atoms that make up a single molecule of a substance.

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# N

## National Formulary (NF)

A supplement to the United States Pharmacopoeia.

## National Institute of Standards and Technology (NIST)

A government agency that is part of the U.S. Department of Commerce and is responsible for establishing and providing standards of all types, including gas reference standards.

## NIST-Traceable Reference Material (NTRM)

A gas reference material (gas mixture) manufactured by a commercial gas supplier but certified by NIST. NTRM gas standards are equivalent to SRMs and are used to analyze and certify commercial gas mixtures, such as EPA protocols.

## Normal or Ambient Temperature and Pressure (NTP)

68°F (20°C) and 1 atm (760 torr).

## Nuclear Magnetic Resonance Spectrometer (NMR)

An analytical instrument normally used for the qualitative identification of compounds containing hydrogen and measures the absorption of radio frequency waves by hydrogen molecules as they are electromagnetically excited.

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# O

## Occupational Health & Safety Administration (OSHA)

An organization within the U.S. Department of Labor that sets standards for employers to ensure a safe working environment for its employees.

## Oxidant

A substance that supports or causes combustion of other materials.

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# P

## Partial Pressure

The vapor pressure exerted by one component of a gas mixture. In any gas mixture, the total pressure is equal to the sum of the partial pressures that each gas would exert were it alone in the volume occupied by the gas mixture.

## Parts Per Million (ppm)

A method of expressing low concentrations of impurities in a mixture. The unit can be expressed in moles, volume, or weight per million of the same units. Lower concentration may be expressed in parts per billion (ppb) or parts per trillion (ppt).

## Permissible Exposure Limit (PEL)

Maximum routine exposure levels for different substances in the work environment as set by OSHA.

## Phase Envelope

A graph of the dew point and bubble point temperatures for a gas mixture over a range of pressures.

## Poison

A substance that in small dosages can cause death or serious impairment to organs when entering a living organism by either ingestion, injection, absorption, or inhalation.

## Precision

The degree of variation of repetitive, equivalent readings of measured value. Precision is one of the critical contributors to overall analysis accuracy and must be known and controlled during analysis. Precision is commonly expressed in terms of CV% (Coefficient of Variation %) or RSD% (Relative Standard Deviation %).

## Primary Reference Material (PRM)

The highest pedigree gas reference material manufactured and certified by VSL (formerly NMI). NIST and VSL have declared mutual equivalence for most PRMs and SRMs, and PRM gas standards (gas mixtures) can be used interchangeably with SRMs in certain applications.

## Process Accuracy

Also known as blend accuracy, this is the degree of statistical agreement between the blended and the true concentration for a component of a gas mixture (usually at the 95% confidence level), or the certainty or sureness with which the blended concentration is known. Blend (or process) accuracy can be calculated because Airgas gravimetric measurement requires actual data for scale calibration, resolution, and weight uncertainties.

## Pyrophoric

A substance that can spontaneously ignite when exposed to air at temperatures of 130°F (54°C) or below.

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# R

## Random Error

The natural variation of each of the components of an analysis process, which causes measured values to deviate from each other to some degree. Repetitive measurements which consist of only random errors (no bias errors) will form a normal (Gaussian or bell-shaped) distribution around the true value.

## Rare Gas

Those constituents of air that make up less than 1% of air and are generally considered inert. Examples such as neon, krypton and xenon include the gases in the far-right column of the Periodic Table.

## Reference Standard

The origin of, or the transfer vehicle for, the true value of a measured quantity. Analysis can only be performed (and the true concentration for a component determined) using a reference standard (gas mixture) with an established traceability. The highest level of reference standards originates from standardization agencies (NIST, VSL) and include items like SRMs, PRMs and Class S Weights. Lower level reference standards include retained internal cylinders (i.e. GMIS cylinder) or temporary standards such as flasks and permeation tubes.

## Relative Accuracy Test Audit (RATA)

A test required for stationary source CEM systems on either a six month or one-year basis, depending on previous results.

## Reproducibility

The degree of agreement between the concentration of an old cylinder, used as a standard, and the concentration of a new cylinder, analyzed as an unknown. Agreement between these two cylinders verifies that the calibration of the instrument used to make the comparison is still valid and no recalibration is required.

## Requested Concentration

Also known as Ordered Concentration. The concentration of a component that the customer asked for or ordered.

## Research Gas Mixture (RGM)

A prototype gas reference standard (gas mixture) produced via collaboration with NIST under a CRADA agreement. The gas mixture is produced by a gas supplier and certified by NIST, if research results prove that required uncertainty limits and stability can be achieved.

## Resolution

The extent to which an instrument is capable of distinguishing closely adjacent responses.

## Restrictive Flow Orifice (RFO)

A safety device placed in the outlet of a valve that limits the release rate of a hazardous gas to a maximum specified range in the event of accidental opening of the valve or failure of the gas containment system downstream.

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# S

## Safety Data Sheet (SDS)

A datasheet for a particular substance describing the characteristics and hazards associated with the handling and use of the substance.

## Safety Relief Device

A safety device is usually incorporated in a gas cylinder valve that is actuated by excessive pressure or temperature. The safety relief device fails at predetermined limits to avoid failure of the pressure vessel (cylinder).

## Self-Venting Device

A device on certain types of regulators that relieves the outlet pressure as the regulator pressure is reduced.

## Shelf Life

The length of time over which Airgas will guarantee that components of a gas mixture remain at their certified concentrations within the specified tolerances. Basis includes Airgas history and experience, as well as stability studies conducted by Airgas Research and Development an expiration date may be based upon Airgas history/experience or is arbitrarily set by regulations, such as for EPA protocols.

## Single-Certification

Either the blend or the analyzed concentration is reported as the certified concentration. Scott™ brand single-certified gas mixtures are supplied with either the blended concentration (accompanied by the calculated blend process accuracy) or the analyzed concentration (accompanied by the calculated analytical accuracy). For single certified gas mixtures, Airgas requires that sufficient work is completed so that the blended or the analyzed concentration can be reported as a stand-alone value. There is no requirement for interlocking the blend and analyzed state to the gaseous state without going through the liquid state first.

## Span Gas

A calibration gas that is used to set the maximum reading on the scale of an analyzer.

## Specific Gravity

The ratio of the weight of a given volume of material to the weight of an equal volume of another substance used as a standard. For solids or liquids, the standard is usually water and for gases, the standard is air.

## Specific Heat

The amount of heat required to raise the unit weight of a material one degree of temperature at constant pressure.

## Specific Volume

The volume of a unit weight of a material at a given temperature and pressure. For gases, specific volume is greatly affected by temperature and pressure.

## Stability

The time over which components of a gas mixture will remain at their certified concentrations within specified tolerances.

## Standard Deviation

A measure of the amount of scatter of a group of replicate measurements around the mean value. The larger the standard deviation, the more scattered the individual measurements are around the mean value. A larger standard deviation also means that the precision of the set of measurements is lower (worse), and the accuracy of the overall measurement is worse.

## Standard Industry Methods

For certain applications or at a customer's request, additional analysis may be performed that conforms to a standard, non-Airgas procedure preferred or accepted by that application or customer. For example, by special arrangements with EPA, the internal reference standards used to certify H<sub>2</sub>S mixtures can be analyzed using EPA Method 11, the official EPA classical chemistry technique for H<sub>2</sub>S.

## Standard Reference of Material (SRM)

The highest pedigree gas reference material (gas mixture) manufactured and certified by NIST. The NIST SRM is equivalent in stature to the VSL PRM.

## Standard Temperature and Pressure (STP)

32°F (0°C) and 1 atm (760 torr)

## Sublimation

The direct passage of some substances from the solid state to the gaseous state without going through the liquid state first.

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# T

## Tare Weight

The weight of an empty cylinder without a valve or cap.

## Thermocouple Detector (TCD)

One of the earliest detectors used in gas chromatography. This detector operates as one leg of a Wheatstone bridge that detects slight changes in conductivity as the exposed wire changes temperature. Also, sometimes this type of detector is referred to as a hot wire.

## Threshold Limit Value (TLV)

Set by ACGIH, the time-weighted average concentration of an airborne substance that nearly all workers may be exposed in a normal 8-hour day, 5-day work week, without suffering adverse effect.

## Threshold Limit Value- Time-Weighted Average (TLV-TWA)

Refers to the time-weighted average over a normal 8-hour workday and a 40-hour week to which all workers may be repeatedly exposed without adverse effect.

## Threshold Limit Value-C (TLV-C)

Airborne concentration of a substance which should not be exceeded.

## Threshold Limit Value-Short Term Exposure Limit (TLV-STL)

Refers to a 15-minute time-weighted average exposure for substances that should not be exceeded at any time during a workday.

## Tolerance

The difference between the measured value and an Airgas or customer specified value, such as the requested concentration. All Airgas mixture grades have two tolerances: preparation and certification.

## Toxic

A substance that has the ability to produce injurious or lethal effects through its chemical interaction with the human body.

## Traceability

The relationship between a measured value and an established element of the National/International Measurement System. Also, the basis for establishing the true value of a standard. For traceability to exist, there must be an unbroken chain of comparisons between the sample and the National/International Measurement System. Elements of the National/International Measurement System can be fundamental units of measurement (i.e. weight, temperature, pressure) or secondary/transfer standards (i.e. synthetic gas standards).

## Triple Point

The defined pressure and temperature for a pure substance at which the three phases all exist in equilibrium.

## True Value

The real or perfectly accurate value that would be obtained by measuring 100% of all available samples using a measurement process with no random or systematic (bias) variations at all. The true value is, therefore, a theoretical value because all measurement processes have some variations regardless of how small. Accuracy is used to state how close a given measurement process approaches the true value.

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## V

### **Van Swinden Laboratorium BV (formerly NMI)**

A Dutch government agency that is responsible for establishing and providing standards of all types, including gas reference standards. VSL fulfills a role in Europe similar to NIST in the United States.

### **Vapor Pressure**

The pressure exerted when a solid or liquid is in equilibrium with its own vapor at a particular temperature.

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## Z

### **Zero Blend Tolerance**

The certified concentration and the requested concentration for a component are the same within claimed accuracy limits. In order for a gas mixture to be certified with the requested concentration, the certified concentration must be so close to the requested concentrations as to be within  $\pm 50\%$  of the allowed accuracy specification.

### **Zero Gas**

Calibration gas used to set the minimum reference point.