

BUREAU OF INDIAN STANDARDS

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<p>भारतीय मानक</p> <p>तेल और गैस उद्योग में प्रयुक्त शब्दों की शब्दावली</p> <p><i>(पहला पुनरीक्षण)</i></p> <p><i>Draft Indian Standard</i></p> <p>GLOSSARY OF TERMS USED IN OIL AND GAS</p> <p>INDUSTRY</p> <p><i>(First Revision)</i></p> <p>(ICS 71.100.20, 01.040.71)</p>	
Industrial Gases Sectional Committee, CHD 06	Last Date for Comments: 10 December 2023

FOREWORD

(Formal clause shall be added later)

This standard was originally issued in 1973. In the preparation of this standard considerable assistance had been derived from the following publications:

DIN 1340 : 1950 Combustible technical gases (fuel gases). Deutscher Normenausschuss.

DIN 1871 : 1961 Gases; specific weight and density in relation to the standard conditions. Deutscher Normenausschuss.20

DIN 8520 : 1962 Acetylene generator units definitions, classification, components, operating features, companion dimensions. Deutscher Normenausschuss.

BS 526 : 1961 Definitions of the calorific value of fuels. British Standards Institution.

BS 1179 : 1961 Glossary of terms used in gas industry. British Standards Institution.

BENNETT (H), *Ed.* Concise chemical and technical dictionary 1967. Chemical Publishing Company Inc, New York.

In this revision, additional terminologies used in oil and gas industries have been incorporated into the standard.

1 SCOPE

1.1 This standard defines the terms used in gas industry.

1.1.1 It does not include engineering terms.

2 TERMINOLOGY

For the purpose of this standard, the following definition(s) shall apply:

A

Absolute Thermodynamic Temperature — The temperature measured on the Kelvin scale of temperature. Also known as “Absolute Temperature” or “Thermodynamic Temperature”.

Absolute Zero — The zero on the absolute temperature scale which is the lowest temperature theoretically possible in this universe.

Absorption of Gases — The phenomenon of dissolution of gases in liquids or solids.

Accident; Accident Safety incident that resulted in the injury and/or illness of one or more people

Adiabatic Changes — The changes taking place in a system without the heat being allowed to leave or enter the system.

Adsorption — The concentration of a substance on a surface, for example, molecules of a gas or of a dissolved or suspended substance on the surface of a solid

Aeration Number — The reading of the opening of airport to give a standard cone height of 19 mm. This number is also used as an indication of the overall combustion characteristics of gases.

Aeration Test Burner — An aerated burner of standard construction having a controlled and graduated primary airport by means of which a gas flame of standard cone height can be produced.

Aerobic — The biological reactions taking place in the presence of free oxygen.

Aerosol — A dispersion of solid (smoke) or liquid (fog) particles in a gas.

After Contraction (After Expansion) — The percentage permanent contraction (or expansion) measured after cooling that takes place when a refractory material is heated for a specified period at a specified temperature.

After Damp — A poisonous mixture of gases containing carbon monoxide formed by explosion of firedamp in coal mines.

After Expansion — See ‘After Contraction ‘.

Air Borne Sealing — Tine repairing of carbonizing vessels by blowing a refractory powder into the closed empty vessel so that it fills the cracks and small holes and is fused in place by the heat of the walls.

Air Curtain — The projection of air across the doorway of a furnace to deflect hot gases away from the operator.

Air Gas Ratio — The ratio of the volume of primary air to the volume of combustible gas in the mixture.

Air Hardening Refractory Cement — A refractory composition containing chemical agents which ensure hardening at temperatures below that of ceramic bonding but above room temperature.

Air Port — An aperture for admitting primary air to a burner.

Air Setting Refractory Cement — A refractory composition containing chemical agents which ensure hardening at room temperature.

Air Slide — A movable metal plate at an air inlet to a producer or setting, for controlling the amount of air entering.

Alumina, Firebrick — A brick that in the fired state shows on analysis 35 to 40 percent of alumina, the remainder being essentially silica.

Ambient— Immediate surroundings are often referred to as ambient.

Ambient Air Analysis — It is the systematic, long-term assessment of pollutant levels by measuring the quantity and types of certain pollutants in the surrounding.

Ambient Vaporizers—Exchangers using ambient air to transfer the necessary heat of vaporization of cryogenic liquids for conversion to gas.

Anaerobic — The biological reactions taking place in the absence of free oxygen.

Anemometer — A meter for measuring the speed of wind.

Aneroid Barometer — A barometer which does not use a liquid colour.

Anoxia –When body doesn't receive enough oxygen.

Anthracite — A hard variety of coal containing a minimum of 90 percent carbon and maximum 10 percent of volatile matter with bright lustre, uniform texture and high heating value, relative density ranging between 1.47 and 1.70.

Antistatic (Fire Retardant) Material — Those materials used to reduce or eliminate build-up of static electricity.

Anti-Tow-Away — This is an immobilizing or an alarm generating device that cautions and thus prevents the cryogenic tanker driver from starting the engine and moving away while the transfer hose is still attached to the unloading bay. Thus, major liquid spillage incidents can be avoided.

Analyzer — A device /equipment / computer programme that examines something methodically and in detail. These runs on various principles.

As Built—Documents that allow a comparison and contrast between the design and what has actually been built after a project closure.

Ash Pan — A receptacle for 'ashes beneath the grate of a producer or generator.

Ash Pocket — A gastight chamber connected to the base of a dry sealed generator to receive ashes discharged by mechanical grate.

Assay — An assay is the process of analyzing a substance to determine its composition or quality.

Asset — An economic resource, tangible or intangible, which is expected to provide benefits to a business.

Asphyxia — Condition arising when the body is deprived of oxygen which may cause unconsciousness or even death due to suffocation.

ASU (Air Separation Unit)—Typical process plants where atmospheric gases are commercially manufactured using the air distillation technology.

Atmolysis — The process of separation of a mixture of gases through the walls of porous vessels, taking the advantage of the different rates of diffusion of the constituents.

Atmosphere — A unit of pressure equivalent to 101 325 pascals.

Atmospheric Condenser — An apparatus for cooling gas, the heat of gas being transferred to the atmosphere through a metal wall cooled with constant water spraying.

Audit—Systematic, independent and documented process for obtaining “audit evidence” and evaluating it objectively to determine the extent to which “audit criteria” are fulfilled.

Audit findings—Results of the evaluation of the collected audit evidence compared to audit criteria.

Note — Audit findings can indicate either conformity or nonconformity with audit criteria or opportunities for improvement.

Auditee—An organization as a whole or parts thereof being audited.

Auditor—Person independent of the Facility and/or Activity being audited, having the competencies to conduct an audit.

Auto Ignition Temperature—Auto-ignition temperature (AIT) is defined as the lowest temperature at which the substance spontaneously ignites in ambient air, without an external ignition source, such as a spark or flame.

Avalanche — A shower of particles caused by the collision of a high energy particle with any other form of matter.

Avogadro's Law — Equal volume of all gases contain equal number of molecules under the same conditions of temperature and pressure.

Avogadro's Number — The number of molecules in a gram molecule or of atoms in a gram atom of a substance to 6.02×10^{23} .

B

Babo's Law — The addition of a nonvolatile solid to a liquid in which it is soluble, lowers the vapour pressure of the solvent in the proportion to the amount of substance dissolved.

Back Run — A modified down run in which steam is supplied to the top of the superheater and is preheated to a high temperature by passing backwards through the hot chequerwork in the superheater and carburetor before reaching the generator.

Balanced Reaction — *See* 'Chemical Equilibrium'.

Bar — A unit of pressure in the metric system equal to 1000 000 dynes per square centimeter. It is slightly less than one atmosphere. The commonly used 'unit is barye or microbar which is 'one dyne per square centimeter. Bar is equivalent to 100000 pascals and barye is equivalent to 0.1 Pascal.

Barometer —An instrument for measuring atmospheric pressure.

Barye — *See* 'Bar'.

Beckmann Thermometer — A particular variety of liquid in glass differential thermometer used for measuring temperature differences.

Beehive Oven — A coke oven in which coal is carbonized by heat produced by burning in the oven, the volatile matter evolved from coal.

Benzene — An aromatic hydrocarbon found in coal tar crude oil with boiling point 80.1 °C.

Benzolized Gas — *See* 'Unstripped gas'.

Bitumen—Heavy, viscous oil (also known as asphalt or tar) that must be processed extensively to convert it into a crude oil before it can be used by refineries to produce gasoline and other petroleum products.

Blast — A destructive wave of highly compressed air spreading outwards from an explosion.

Blast Furnace Gas — The gas produced by reactions in a blast furnace.

Bloating — The permanent expansion accompanied by the formation of a vesicular texture which occurs when some types of clays are fired.

Block Diagram—A block diagram is a visual representation of a system that uses simple, labeled blocks that represent single or multiple items, entities or concepts of a process.

Block Filling — A form of regenerator packing comprising refractory blocks which have gas passages formed in them during manufacture or are of such a shape as to form gas passages when the blocks are packed together.

Blow — The period during which air is passed through the incandescent fuel in a generator to raise the temperature of the fuel.

Blow Gases — The gaseous products leaving a generator during a blow.

Blue Water Gas — The gas consisting almost entirely of carbon monoxide and hydrogen in nearly equal proportions produced by reactions of steam with coke at a temperature of about 1 000 °C.

Bog Ore — An iron ore suitable for extracting hydrogen sulphide from gas.

Boiling Point— It is the temperature at which the vapour pressure of a liquid equals the pressure surrounding the liquid and the liquid changes into vapour.

Bolometer — A radiation measuring device whose working depends on change of resistance due to heat produced by the radiations on a resistant grid.

Boltzmann's Constant — A physical constant taken as 1.38041×10^{-23} joule per Kelvin or as 8.6167×10^{-5} electron volt per Kelvin.

Bone Dry — Containing no moisture whatsoever.

Bosch Process — An industrial process for the manufacture of hydrogen.

Bottom Filling—Cryogenic tanks, typically filled from the bottom valve using blow down method in which the tank pressure is reduced by blowing out the head pressure of the tank in order to fill it.

Bourdon Gauge — A pressure measuring device depending on the opening out under pressure of a spiral of conduit. It is used for a variety of purposes, for example, for measuring pressure, level, temperature, etc.

Boyle's Law — It states that the volume of a given mass of gas is inversely proportional to its pressure as long as temperature remains constant.

Brazing— Brazing is a process that joins two or more metal surfaces by letting molten metal flow into the joint. The filler metal has always a lower melting temperature than the parts to be joined to keep the workpieces from melting.

Bridge Main — A main which conveys gas from the two collecting mains of a double collecting main system to a common off take main.

Briquetting — Moulding of small or fine coal with or without the admixture of an adhesive material (binder) into forms of predetermined size and shape by applying pressure.

British Thermal Unit (International)

- a) A unit of heat equivalent to 2.326 joules per gram or 252.075 calories at 15° Celsius or 251.996 calories of international table, the quantity of heat required to raise the temperature of one pound of water through one degree Fahrenheit.
- b) A unit of heat energy generally taken as 1 055.00 joules.

British Thermal Unit (Mean) — A unit of heat equivalent to 1 055.79 joules.

Brown Coal — The coal of low rank of a soft friable nature with high inherent moisture content.

Brownian Movement — The erratic random movements performed by microscopic particles in a dispersed phase.

BSV—Behavioral Safety Visit is a scientific approach to positively reinforce a safe work environment by modulating unsafe behavioral patterns and is done by observing and analyzing employees' behavior while they work.

Bubble Type Separation — Removal of suspended tar particles from gas by dividing it into numerous small streams which bubble through a liquid.

Burner Brick — A refractory brick forming a port.

Bursting Disc — A metal disc which is a part of a safety device, and which is intended to burst and allow the gas to escape within predetermined pressure limits to prevent the rupture of the container. Sometimes used in conjunction with a fusible plug.

Business continuity plan—A plan to help ensure that business processes can continue during a time of emergency or disaster.

By-Product — Substance obtained simultaneously during the manufacture of the main product.

C

Calorie — A unit of heat equivalent to 4.1855 joule at 15°C calorie. It is the quantity of heat required to raise the temperature of one gram of water through one degree centigrade.

Calorific Value (Declared) — The gross calorific value of town gas declared by a gas undertaker as the basis of charge to the gas consumer.

Calorific Value, Heat of Combustion — The amount of heat liberated by the complete combustion under specified conditions of unit volume of gas or unit mass of solid or liquid. It is measured in joule per kilogram, A distinction is made between the following:

Gross Calorific Value — In the determination of which the water produced by the combustion of the fuel is assumed to be completely condensed and its latent heat released, and is measured in joule per kilogram.

Net Calorific Value — In the determination of which the water produced by the combustion of the fuel is assumed to remain as vapour. It is measured in joule per kilogram.

Calorific Value of Town Gas (Official) — The gross calorific value of the town gas as determined by an official gas examiner.

Calorifier — A liquid heating equipment in which the liquid is heated through a heat exchanger.

Calorimeter — The standard instrument used for measuring the calorific value of fuel.

Canal Coal — A non-banded coal of satin sheen and conchoidal texture, hard and generally high in volatile matter.

Carbon Steel — A series of alloys of carbon containing about 1% carbon and up to 1.6 % manganese, with element added in specific quantities for deoxidization and residual quantities of other elements.

Carbonization — Decomposition of nonvolatile carbonaceous substances, usually coal, into gaseous, liquid and solid products by heating out of contact with air.

Carburetted Water Gas — Water gas to which gases of high calorific value obtained by thermal decomposition of oil have been added.

Carburettor — A chamber between a generator and superheater usually filled with chequer work and which is kept hot.

Carnot's Cycle — The simplest heat cycle, comprising isothermal and adiabatic changes in volume.

Carnot's Principle — The efficiency of any reversible heat engine depends only on the temperature range through which it works and not upon the properties of any material substance. If all the heat is taken up at absolute temperature T_1 , and all the heat is given out at absolute temperature T_2 , the maximum efficiency is $\frac{T_1 - T_2}{T_1}$.

Carrier gas — The gas (usually helium or nitrogen) which carries / pushes the vapor sample undergoing analysis through the column in gas chromatography.

CAS Number — Chemical Abstracts Service registry Number. It is a numeric designation assigned by the American Chemical Society's Chemical Abstract Service and uniquely identifies a specific element or chemical compound. The entry allows one to conclusively identify a material regardless of the name or naming system used. e.g. C.A.S. No. for oxygen: 7782-44-7.

Cascade Process — A process used in the separation of isotopes.

Cast — To pour molten metal into a mold to produce an object of desired shape.

Castable Refractory — Mixture of refractory aggregate and heat resisting hydraulic cement.

Catalysis — The alteration of the rate at which a chemical reaction proceeds by the introduction of a foreign substance which remains unchanged at the end of the reaction.

Catalyst — The foreign substance which alters the rate at which a chemical reaction occurs but itself remains unchanged at the end of the reaction. It provides an alternative pathway for transformation of reactant to products.

Catalytic Cracking — The cracking in the presence of a catalyst which controls the process of fission and recombination.

Catch Box — A purifier box through which gas passes after leaving the main dry purification plant to remove any remaining hydrogen sulphide.

Cavitation — Formation of vapour bubbles within a liquid at low pressure regions that occur in places where the liquid has been accelerated to high velocities.

Celsius Temperature Scale — It is approximately same as the centigrade scale of temperature. It is equal to $K - 273.15$ ($K = \text{Kelvin}$).

Centrifugal Force — The outward force acting on a body rotating in a circle round a central point.

Centrifugal Pump—A type of pump used to transfer fluids. Centrifugal pumps move fluid by rotation and draw fluid into the suction end of the pump and then, through centrifugal force, forces it out of the discharge end.

Centrifugal Separation — Removal of suspended tar particles from a gas in a suitable apparatus by throwing the particles at the periphery of the apparatus by centrifugal force.

Centrifugal Washer — The gas washing apparatus consisting of vertical series of compartments, solvent being sprayed in each compartment by a device mounted on a central vertical shaft rotating at high speed.

Centripetal Force — The radial force imposed by the constraining system, necessary to keep the body moving in its circular path.

Chamber Oven — An intermittent carbonizing vessel generally having a capacity between one and five tons of coal.

Change of State — The conversion of a substance from one of the physical states of matter into another.

Charging Car; Charging Lorry — A car running all along the top of the coke oven battery from which the coal is discharged into the chambers either mechanically or by gravity.

Charles's Law — The volume of a given mass of gas at constant pressure is directly proportional to the absolute temperature.

Chemical Change — A process in which one or more substances change into one or more different ones: rearrangement of elements, atoms or molecules into chemically different identities.

Chemical Equilibrium — Many chemical reactions do not go to completion but in such cases a state of equilibrium or balance is reached when the original substances are reacting at the same rate as the new substances are reacting with each other to form the original substances.

Chemical Equivalent — The chemical equivalent of an element is the number of grams of that element which will combine with or replace 1 g of hydrogen or 8 g of oxygen.

Chemical Reaction — The interaction of two or more substances resulting in chemical changes in them.

Circulator — An appliance for heating water in a hot water circulating system.

City Gas — The gas supplied to urban areas and industries and is delivered by the gas network supplying the municipality.

Clamp — A device designed to bind or constrict or to press two or more parts together to hold them firmly.

Clean Box — A purifier box through which gas passes after leaving the main dry purification plant to remove any remaining hydrogen sulphide.

Clean Coal — The coal out of which impurities have mostly or fully been removed by any commercial process of cleaning.

Coal Gas — The gas produced by carbonizing coal.

Coal Valve — A gas tight valve at the top of an auxiliary coal hopper, immediately under the outlet of the coal storage hopper.

Coal Washing — A general term covering all the processes of cleaning coal involving the use of liquid, usually water.

Cochrane Abrasion Index — A measure of resistance of coke to abrasion.

Coke — It is a by-product of coal carbonization remained as residue.

Coke Breeze — Small coke having no specified lower size limit.

Coke Extractor — A mechanical device for removing coke from a vertical retort at a controlled rate.

Coke Oven — An intermittent carbonizing vessel generally having the capacity between 5 and 20 tons of coal.

Coke Oven Gas — The coal gas produced in a coke oven.

Coke Pad — A small quantity of coke or breeze which is dropped on the bottom door before the actual process of charging.

Coking Pressure — The pressure exerted on the walls of a retort, chamber or oven by coal carbonization.

Cold Box — Cold boxes are the pressure vessels that hold gas or liquid at very low temperature. The distinctive feature of the cold boxes are the double-wall construction which allows insulation to be filled between the inner and outer walls.

Cold Embrittlement — This happens when a non-resilient material such as carbon steel, PVC piping, glass etc. are exposed to cryogenic liquid or gas at temperatures that are too low causing rupture

Cold Embrittlement — Exposure of non-resilient materials (carbon steel, PVC pipes, glass etc.) to cryogenic liquid or gas (liquid oxygen, liquid argon, liquid nitrogen etc.) at temperatures that are too cold causing embrittlement.

Collecting Main — A main which receives the gaseous products from a number of carbonizing vessels.

Combustion Chamber — The space in a furnace where the main combustion of gases takes place.

Combustion Characteristics — Properties of gas which influence the behaviour of the flame when the gas is burnt.

Commissioning—Project phase consisting of the preparation and initial startup of the equipment and industrial gas or other engineering systems comprising a facility or an activity in a systematic and controlled fashion under normal operating conditions (fluids, utilities, environment, process) with the intent of achieving specified production.

Complete Gasification — The conversion of coal to gaseous fuel without leaving a combustible solid residue.

Condensate—The liquid phase produced by condensation of any gas or vapor.

Condensation — The chemical change in which two or more molecules react with the elimination of water or some other simple substance.

Condensation of Vapour — The change of vapour into liquid when the pressure of the vapour becomes equal to the maximum vapour pressure of the liquid at that temperature.

Confined Space — Any space not intended for continuous employee occupancy, having a limited means of egress.

Connected Load — The volume of gas which would be used in unit time if all the appliances connected to a supply main were in a full operation simultaneously.

Consumer Density — The number of consumers in a unit area supplied from a unit length of distribution main.

Consumer Saturation — The ratio of the number of consumers connected to a distribution system in an area to the number of consumers who could be possibly connected to the system.

Contact Process — A process for the manufacture of sulphuric acid by catalytic contacts of sulphur dioxide and oxygen.

Continuous Carbonization — A qualifying term applied to carbonization or to carbonizing vessels indicating that the coke is withdrawn from and coal introduced into the retort continuously.

Control — A clock or valve placed inside a consumer's premises to control the supply of gas from the service pipes to the installation pipes.

Control Room—A room inside an air separation plant from where all process activities are monitored and controlled using PLC / SCADA systems. Control rooms can be manned or unmanned.

Controlled Atmosphere — The gas specially introduced into the working chamber of a muffle furnace in order to provide an atmosphere of desired chemical composition round the stock.

Controlled Carbonization — The carbonization of coal until a desired low volatile content is left in the coke.

Controller — A mechanism by means of which burners are automatically lit and extinguished at predetermined times.

Convection — Transference of heat through a liquid or gas by the actual movement of the fluid.

Cooling — The process of reducing the temperature of substances leaving the hot chamber.

Cooling Tower; A device for evaporative cooling of water by contact with air.

Cooling Water — Cooling water generally referred to the blowdown from the cooling towers.

Cornice — The margin of a hot plate on a gas cooker.

Corrected Volume — A volume of gas corrected to standard conditions of temperature, pressure and humidity.

Corrective Action — Action to eliminate the cause of a detected gap (nonconformity) or other undesirable situation. (Corrective Action; Preventive Action)

Corrective Maintenance — No periodic maintenance tasks (“run-to-failure-based”). The approach to maintenance is only reactive when the item needs to be fixed in case of fault or break. This is a repair or replacement function only.

Corrosion — The surface chemical action specially on metals by the moisture, air or chemicals.

Cover — The depth from ground level to the top of a buried pipe.

Cover Furnace — A muffle or oven furnace of which the wall and roof are removable for charging and discharging.

Cracking — The thermal decomposition of hydrocarbons.

Cracking Space — The heated space above the charge in a carbonizing vessel where volatile products from the coal are cracked.

Crazing — A network of surface cracks.

Critical Air Blast — A measure of the combustibility of coke based on a test in which the minimum rates of air supply to maintain combustion is determined.

Critical Point — This point is defined by a temperature and a pressure at which, for a pure substance, the properties of the two phases (liquid and vapor) are identical. On a phase equilibrium diagram, it is the highest temperature and pressure of the Liquid-Vapor saturation curve.

Critical Pressure — The pressure of saturated vapour of a substance at critical temperature. So, the pressure which is just sufficient to liquify a gas at its critical temperature is the critical pressure.

Critical Temperature — The temperature above which the gas cannot be liquified by pressure alone.

Critical Velocity — The velocity at which the flow of a liquid ceases to be in streamline and becomes turbulent.

Critical Volume — It is the volume occupied by a unit mass of the substance at critical temperature under the critical pressure.

Criticality Matrix — Matrix for assessing a potential risk in terms of its level of severity and probability.

Crown — The outer top face of a gas cooker oven.

Crown Plate — A separate enamelled tray covering the crown of a gas cooker oven.

Cryo-Condensation—The use of temperatures below -150°C to condense compounds contained in air or in a gas mixture.

Cryogen — It is the freezing mixture.

Cryogenic — This refers to the range of very low temperatures typically -73°C or colder.

Cryogenics — Cryogenics is the production of and behavior of materials at very low temperatures. The cryogenic temperature range has been defined as from $-150\text{ }^{\circ}\text{C}$ ($-238\text{ }^{\circ}\text{F}$) to absolute zero ($-273\text{ }^{\circ}\text{C}$ or $-460\text{ }^{\circ}\text{F}$), the temperature at which molecular motion comes as close as theoretically possible to ceasing completely.

Cryogenics — The study of materials and phenomena at temperatures close to absolute zero.

Cryogenic Gloves — These are the gloves specially designed for protecting the hand during extreme cold materials down to around $-200\text{ }^{\circ}\text{C}$.

Cryogenic Liquids — Liquids having an operational temperature range from $-150\text{ }^{\circ}\text{C}$ ($-238\text{ }^{\circ}\text{F}$) to absolute zero ($-273\text{ }^{\circ}\text{C}$ or $-460\text{ }^{\circ}\text{F}$).

Cryogenic Vessel — Gases may be stored conveniently and economically in liquid form. In view of the very low temperatures of these liquefied gases e.g. LOX(-183°C), LAR(-186°C), LIN(-196°C) it is necessary to use cryogenic vessels to store and transport them without significant evaporation losses.

Cryophorus — The apparatus used to demonstrate the cooling effect of evaporation.

Cryostat — The vessel in which a specified low temperature may be maintained.

D

Damper — A movable plate of metal and/or refractory brick placed in a heating gas, air or waste gas flue for controlling the flow of gas or air.

DCS — A distributed control system (DCS) is a digital automated industrial control system (set of mechanical or electronic devices) that uses geographically distributed control loops throughout a factory, machine or control area. The goal of DCS is to control industrial processes to increase safety, cost-effectiveness and reliability.

Deadend — These are locations in a process piping system where the flow of gas comes to a halt and cannot be transported further ahead.

Deriming — Deriming is a procedure in which cryogenic vessels and/or process systems are periodically warmed with hot, dry, purified air or nitrogen in order to purge all traces of moisture, carbon dioxide, and hydrocarbons.

Debenzolyzed Gas; Stripped Gas — Gas from which benzole has been removed.

Declared Calorific Value — See 'Calorific Value (Declared) '.

Decantation — It is the process of separation of liquid from solid by removing the liquid layer at the top from the layer of the solid or liquid below.

Deflagration — Rapid combustion or thermal decomposition characterised by the flame front propagating at subsonic velocity.

Detonation — A particularly rapid and damaging form of combustion or thermal decomposition characterised by flame front propagating at supersonic velocity.

Dehydration — The removal of water vapour from gas to lower its dew point and minimize condensation in mains.

Density — The physical property of density is the ratio between mass and volume of any substance.

Density of Gas — The mass of unit volume of gas at a specified temperature and pressure.

Deviation From Gas Laws — Gases do not strictly obey the gas laws but follow them more and more closely as the pressure of the gas is reduced. Various equations have been derived which attempt to give a better approximation to the behaviour of gases. The best known of these is van der Waals' equation.

Devil Gas — The gas evolved during distillation of gas liquor consisting mainly of hydrogen sulphide and carbon dioxide which are not absorbed by the sulphuric acid in the saturator or ammonia absorber.

Dip Tube — These are the tubes used in liquid and gas mixture cylinders to ensure consistency of the composition of the product.

- Dew Point** — The temperature at which the water vapour present in the air saturates the air and begins to condense.
- Diffusion of Gases** — The molecules of all gases move freely and tend to distribute themselves equally within the limits of the vessel enclosing the gas and are all perfectly miscible with one another. The phenomenon is called diffusion.
- Direct Ammonia Recovery** — The recovery of ammonia from hot raw coal gas by first removing suspended tar without cooling the gas and then passing the raw gas into sulphuric acid before condensation of water vapour occurs.
- Direct Cooler** — The apparatus for cooling hot gases, the cooling medium being brought into direct contact with the gas to be cooled.
- Dirty Box** — A purifier box through which gas containing hydrogen sulphide passes.
- Discharge in Gases** — The passage of electricity through a tube containing a gas at low pressure.
- Dissociation** — A temporary reversible decomposition of the molecules of a compound which occurs under some particular conditions.
- Distillation** — It is the process involving conversion of a liquid into vapour which subsequently condensed back to liquid form.
- Down Run** — The part of the run during which steam is supplied to the top of the generator and passes downwards through the fuel.
- Draught** — A pressure below atmospheric at the base of chimney or in a waste gas flue.
- Dry Cleaning** — The general method used to separate mechanical impurities of coal avoiding the use of liquid.
- Dry Lute** — A purifier cover seal consisting of a strip of compressible material attached near the edge of the underside of the cover and gripped between the cover and the top of the box by suitable fastenings.
- Dry Meter** — A volumetric meter which measures the volume of gas by successive filling and emptying of bellows.
- Dry Purification** — The removal of gaseous impurities mainly hydrogen sulphide by passing through the layers of solid material.
- Dry Seal** — An alternate to water seal for making a gastight joint round the base of a generator or producer fitted with a mechanical grate by extending the wall of the generator to enclose the grate completely.
- Dry Out**—The phenomenon of any product stock level falling to alarmingly low levels resulting in the associated process stopping functioning.
- Drain Valve** — It is a valve performing the critical function of allowing excess water vapour to escape into the atmosphere.
- Dust Collector** — A dust collector is a system used to enhance the quality of air released for the industrial process by collecting the dust particle.

E

- Economizer (Bulk Cryogenic Valves System)**— The function of an economiser valve is to divert excess gas into the customer's supply line in the event of heat leaking into a cryogenic storage tank and liquid reverting to its gas phase leading to a pressure rise in the vessel. Left unchecked, the process may continue until the relief valve lifts, wastefully venting gas to the atmosphere, hence the economizer.
- Eductor** — A device employing air under pressure for drawing flue gases from a furnace.
- Efficiency**—The achievement of planned objectives with the best use of resources.
- Effusion** — The passage of gases through a small aperture under pressure. The relative rates of effusion of different gases under the same conditions are inversely proportional to the square roots of their densities.

Effluent Treatment Plan (ETP) — It is a process designed for treating the industrial waste water for its reuse or safe disposal to the environment.

Electrolytic Gas — A mixture of hydrogen and oxygen in a ratio of two to one by volume formed by the electrolysis of water.

Electronic Specialty Gases — This include both high purity gases and gas mixtures that are specially designed and configured for electronic application.

Electrostatic Precipitation — A method for removing suspended tar or dust from gas by imparting to the particles an electric charge which causes them to be deposited on the oppositely charged electrode of the apparatus.

Endothermic Process — A chemical reaction in which heat gets absorbed. Now this is known as endoergic process.

Energy consumption — The use of electricity as a source of power, or as an input in the gas manufacturing process.

Engine — A device for converting one form of energy into another, especially for converting other forms of energy into kinetic energy.

Enthalpy — A thermodynamic property of a substance given by $H = U + pv$ where U is internal energy, p is pressure, and v is volume.

Entropy — The entropy of a system is defined as the internal and unavailable energy of the system, a quantity which rarely enters directly into calculation, but rather in the form of its changes. The entropy of a system is increased by a quantity δH , when a small quantity of heat δH is received by the system, the thermodynamic temperature of which is T , provided that no irreversible change takes place in the system.

Equation of State of a Substance — Any equation connecting the pressure, volume and temperature of the substance.

Equipartition of Energy — In any physical system in thermal equilibrium, the average energy per degree of freedom is the same and equal to $KT/2$ where K is the Boltzmann's constant and T the absolute temperature of the system.

Erg — An absolute unit of work or energy equivalent to 10^{-7} joule.

ERP — Enterprise resource planning is a software tool used by a company to manage key parts of operations, including accounting and resource management, procurement etc.

Evaporation — Conversion of a liquid into vapour without necessarily reaching the boiling point.

Evaporator — A piece of equipment used for evaporation. Evaporators may be of different types – e.g. Evaporators used for gasification of cryogenic liquids, evaporators used to evaporate the solvent from a solution etc.

Expansion of Gases — Gases tend to expand in a system on subjecting them to high temperature and/or reduced pressure.

Explosion — A violent and rapid increase of volume in a confined space, the cause may be anything.

Explosion — An explosion is a sudden violent blast of energy, for example one caused by a bomb.

Explosives — The substances which undergo a rapid chemical change with production of gas on being heated or struck.

Exothermic Process — The process in which energy in the form of heat is released.

F

Fahrenheit Scale — The temperature scale in which the melting point of ice is taken as 32° and boiling point of water as 212° under standard atmospheric pressure.

Fall — The gradient at which a gas main or service pipe is laid to ensure drainage of any condensate.

Filling Ramp — The cylinder filling ramp, commonly termed as “Filling Ramp” is used as a filling device for filling of gas cylinders usually in conjunction with a gas generator system.

Fines — The coal whose maximum particle size is usually less than 3.2 mm.

Fire — A chemical action accompanied by the evolution of heat, light and flame.

Firebrick — A brick that in the fired state consists essentially of alumina and silica and shows on analysis less than 78 percent of silica and less than 38 percent of alumina.

Fire Extinguisher — The device for putting out fires by cutting off the supply of air necessary for combustion.

Fischer Tropsch Process — A process for the manufacture of hydrocarbon oils from coal, lignite or natural gas. Essentially the process consists of hydrogenation of carbon monoxide in presence of a catalyst.

Fittig's Synthesis — The preparation of aromatic benzene derivatives by the action of metallic sodium on a mixture of an alkyl halide and a brominated benzene hydrocarbon.

Fixed Air — A former name of carbon dioxide gas.

Fixed Ammonia — The ammonia in the form of ammonium salts in solution from which ammonia is not liberated when the solution is boiled.

Flaking — The falling away of thin films from the surface of a material in use.

Flame — The glowing mass of gas produced during combustion.

Flammable Gases — A flammable gas is a gas that burns in the presence of an oxidant when provided with a source of ignition.

Flash Point — The lowest temperature at which a substance gives off sufficient inflammable vapour to produce a momentary flash when a small flame is applied.

Float and Sink Test — A test to determine the washability of coal by dividing a sample by floatation into fractions with defined limits of specific gravity.

Flocculation — The coagulation of finely divided particles into particles of greater mass.

Flow Meter — An inferential meter which measures the rate of flow of gas, which depends upon the specific gravity of the gas flowing through it with respect to time.

Flue — A port or passage conveying waste gas.

Flue Gas, Waste Gas — The products of combustion, mainly carbon dioxide, water vapour and nitrogen leaving the heating flues of a retort setting, coke oven or furnace.

Fluorocarbons — A group of synthetic organic compounds in which some or all the hydrogen atoms have been substituted by fluorine atoms.

Flushing Liquor — The hot ammoniacal liquor sprayed into the gas in gas offtakes and collecting mains to cool it and precipitate solid particles and heavy tar.

Flushing Tank — A tank to which surplus flushing liquor and condensed tar are returned from a collecting main.

Foam — A colloidal suspension of a gas in a liquid.

Fog — The effect caused by the condensation of water vapour upon particles of dust, soot, etc.

Foot Poundal — The unit of work in the foot-pound-second system; the work done by a force of one poundal acting through a distance of one foot.

Force — The external agency capable of altering the state of rest or motion in a body measured in dynes or poundals.

Formaldehyde — A gas having irritating smell and high solubility in water. It is the first member of aldehyde functional group having formula HCHO.

Formalin — A 40 percent solution of formaldehyde in water used as a disinfectant.

Fortin Barometer — The mercury barometer which is used in conjunction with various correction tables; enables accurate measurements of atmospheric pressure.

Fouling — The accumulation of sulphur and other impurities from gas in a purifying material.

Foundry Coke — The hard coke suitable for use in foundries.

Free Ammonia — The ammonia liberated by boiling a solution of ammonium salts or ammonia.

Free Energy — A thermodynamic quantity representing the energy that would be liberated or absorbed during a reversible process.

Free Moisture — The moisture removable by air-drying under specified conditions.

Froth Floatation — A process for cleaning the fines by which the fines get attached to air bubbles in a liquid medium and float as a froth which is scraped away continuously.

Fuel Gas — The gas supplied to carbonization plants for heating carbonization vessels.

Fuel Oil — The heavy distillates, residues or blends used as fuel for producing heat or power.

Furnace — A heat treatment appliance in which the stock is heated to temperature above incandescence.

G

Gas — A substance whose physical state is such that it always occupies the whole of the space in which it is contained.

Gas Bag — A bag which can be inserted in a gas main and inflated to block the flow of gas; the operation is called bagging off.

Gas Carbon; Retort Carbon — The hard deposit of fairly pure carbon found on the walls of the retorts.

Gas Chromatography — Any method of chromatographic analysis in which the moving phase is a gas.

Gas Coal — The coal used for the manufacture of town gas characterised by high volatile matter and moderate coking properties.

Gas Coke — The coke produced by carbonizing coal during the manufacture of coal gas.

Gas Constant R — In the gas equation $PV = RT$, the gas constant R is equal to 8.314 Joules or 8.314×10^7 ergs or 1.987 calories per degree Celsius.

Gas Curtain — A stream of combustion products distributed across the doorway of a furnace to prevent air entering the working hearth.

Gas Equation — An equation representing the relationship between the temperature pressure and volume of an ideal or a real gas.

Gas Exchange — It is the physical process by which gases moves passively by diffusion across a surface.

Gas Laws — The statements as to the volume changes of gases under the effect of alterations of pressure and temperature.

Gas Liquid Chromatography — Any method of gas chromatography in which the stationary phase is a liquid distributed on a solid support.

Gas Mantle — The structure composed of the oxides of thorium (99 percent) and cerium (1 percent), made by impregnating a combustible fabric with a solution of the nitrates of the metals and decomposing the nitrates by heat.

Gas Maser — A maser in which 'microwave radiation, interacts with gas molecules.

Gas Mask — A device for protecting the face and breathing organs against poisonous gases.

Gas Oil — A petroleum distillate having a viscosity and distillation range intermediate between those of kerosine and light lubricating oil. It is used as a fuel for high-speed diesel engines, as a burner fuel in heating installations, and for enriching water gas.

Gas Facility — A gas facility encompasses the equipment between the production and distribution including pipelines.

Gas Pressure — The pressure of a gas exerted on the walls of the containing vessel, caused by the bombardment of the molecules of the gas upon the walls of the vessel.

Gas Purifier — An apparatus for removing hydrogen sulphide from the gas.

Gas Reheater — An apparatus used in the semidirect recovery process for heating coal gas containing ammonia vapour before it enters the saturator.

Gas Reversing Valves — The two interconnected valves which operate simultaneously to reverse the direction of gas making in a generator.

Gas Scrubbing — *See* ‘ Gas Washing ‘.

Gas Solid Chromatography — Any method of gas chromatography in which the stationary phase is an active solid.

Gas Stopper — A device other than a gas bag which can be inserted in a gas main to block the flow of gas.

Gas Thermometer — A temperature measuring device using gas as the working substance.

Gas Washing — The removal of soluble particles and soluble constituents from a gas by bringing it into intimate contact with suitable liquid.

Gasification — The process of conversion of solid or liquid fuels by reaction with a gas such as steam, air or oxygen or the conversion of liquid fuels to gaseous fuels by thermal cracking.

Gasoline — A mixture of certain range of light liquid hydrocarbons obtained from petroleum.

Gates — The loose grid runners and their supports hinged for easy removal.

Gay-Lussac’s Law of Gaseous Combination — When gases combine they do so in a simple ratio by volume to each other and to the gaseous products, measured under the same conditions of temperature and pressure.

GC (Gas Chromatograph) — An instrument that applies the technique for analyzing a mixture of volatile substances in which the mixture is carried by an inert gas through a column packed with a selective adsorbent and a detector.

Generator — An apparatus for the preparation of a gas or vapour by chemical action, equipped with some device to control the rate of evolution of gas.

Gland Packing — It is a contact type sealing element. It is one of the traditional sealing solutions.

Gradient — Representation of the height of liquid column or static head above the elevation at any point of the line or vessel

Graham’s Law of Gaseous Diffusion — The relative rates of diffusion of gases are inversely proportional to the square roots of their densities.

Greenhouse Gases (GHGs)—A type of gas that contributes to the greenhouse effect by absorbing infrared radiation. Such gases include some refrigeration gases, carbon dioxide (CO₂), methane, nitrous oxide and ozone.

Grid — A system of interconnected feeder and/or transmission mains.

Grid Runners — The projections inside a gas cooker oven, which support shelves.

Grog — Specially crushed firebrick, used or unused, for use as nonplastic material.

Gross Carbonizing Time — The time between the introduction of consecutive charges of coal into an intermittent carbonizing vessel in regular operation.

Guard Rail — These are railings designed to minimize fall risk at a work site.

H

Haber Process — It is a process for the industrial preparation of ammonia from atmospheric nitrogen for use in fertilizers.

Hard Coke — A comprehensive term which includes metallurgical and foundry coke and also certain types of domestic coke.

Hard Hat — A rigid protective helmet used for the working areas where there is a potential for injury to head from a falling object.

Hard Stand — A hard surface area on which heavy vehicles can be parked.

HAZOP — A technique for identifying the potential hazards and operating issues associated with the design and construction of equipment and plants using a multi-disciplinary team. The study is carried out using a series of keywords to examine deviations in the process and their subsequent effect on the process as a whole. Keywords are used to ensure that the design is explored in every possible way. Once the hazard and operability issues are identified, appropriate actions are recommended in order to address the concerns.

Hazard — A hazard is a dangerous phenomenon, substance, human activity, object, behavior, situation or condition that has the potential to pose a risk resulting in an injury.

Hazardous materials — Gases or Liquids (cryogenic, flammable, pyrophoric, toxic, biological, chemical, radiological, and/or physical agents) or their mixtures which have the potential to cause harm to humans, animals, or the environment, either by themselves or through interaction with other factors.

Hazardous Waste — Industrial waste with properties that make it dangerous or capable of having a harmful effect on human health.

Heat of Combustion — *See* ‘Calorific Value’.

Heat of Formation — The quantity of heat expressed in calories, liberated or absorbed when one gram molecule of a compound is formed from its elements in their normal state.

Heat of Reaction; Thermal Value of a Chemical Reaction — The quantity of heat given out or absorbed in a chemical reaction, usually per gram equivalent of reacting substances.

Heat Exchanger — It is the core component of an air separation unit where the cleaned air is cooled to around -175 °C and partially liquified using the streams leaving the column block.

Heating Gas — *See* ‘Fuel Gas’.

HEL — Higher Explosive Limit. The maximum percent by volume of a gas which when mixed with air will form a flammable mixture.

Henry’s Law — The mass of a gas dissolved by a definite volume of liquid at constant temperature is directly proportional to the pressure.

Hesse’s Law — If a chemical reaction is carried out in stages, the algebraic sum of the amounts of heat evolved in the separate stages is equal to the total amount of heat evolved when the reaction occurs directly.

High Pressure Main — A main for conveying gas at working pressures above 0.70 kgf/cm².

High Temperature Carbonization — A qualifying expression applied to such terms as carbonization, gas coke and tar to indicate that the products are typical of a process in which the solid residue of the carbonizing process has attained a maximum temperature of 900°C or above.

Holiday — A fault in the protective coating of a pipe.

Holiday Detector — An electrical device for locating holidays.

Horizontal Directional Drilling — Drilling a bore in the earth that deviates from the vertical and travels horizontally through a producing layer.

Horizontal Storage Tank — A horizontal cryotank or cryogenic tank is a tank that is cylindrical and horizontally installed and used to store material at very low temperatures.

Hot-Plate — A flat heated surface or a set of these typically metal or ceramic which serves the purpose of heating

Humidifier — An apparatus for admitting steam or atomized water to gas immediately before or during some stage in dry purification.

HYCO Units— Typical modern hydrogen and Carbon Monoxide producing plant using natural gas as primary feedstock.

Hydraulic Refractory Cement — A refractory composition containing a heat-resisting hydraulic cement which ensures setting and hardening at room temperature.

Hydraulic Testing—Hydrostatic Testing is a process where components such as vessels, piping, cylinders etc. are tested for strength and leaks after being filled with pressurized water.

Hydrocarbon (or C_xH_y) — It is binary compound of carbon and hydrogen.

Hydrocarbon Enrichment Value — A term used in connection with the assessment of gas making results, to indicate the contribution to the total calorific value of the gas which is provided by the hydrocarbon gas.

Hydrocarbon Toxicity— Hydrocarbons have low surface tension and low viscosity for which they penetrate deep into the lungs leading to a severe necrotizing pneumonia which is commonly termed as Hydrocarbon Toxicity.

Hydrocarbons — Organic compounds containing only carbon and hydrogen, and are classified as aliphatic, (saturated and unsaturated) and cyclic (aromatics and non-aromatics).

Hydrocarbons — These are organic compounds that are entirely made up of only two kinds of atoms – carbon and hydrogen. For the gas industry, hydrocarbons are considered to be a process impurity due to their flammability nature.

Hydrogen Attack — It is also known as High Temperature Hydrogen Attack (HTHA) is a problem which concerns steels operating at elevated temperatures, typically above 204⁰C in hydrogen environment, in refinery, petrochemical and other chemical facilities.

Hydrogenation — It is the process of subjecting to the chemical action of or causing to combine with hydrogen.

Hypotonic — A solution is said to be hypotonic with respect to another if it has a smaller osmotic pressure.

H₂ Embrittlement — It is a failure process that results from the retention or absorption of hydrogen in metals, usually in conjunction with applied tensile or residual stresses.

I

Ideal Gas; Perfect Gas — This is the theoretical concept of a gas which would exactly obey the ideal gas laws.

IDLH — Immediately Dangerous to Life or Health - It is the maximum concentration from which one could escape (in an emergency) within thirty minutes without experiencing any irreversible health effects (e.g. in the event of a respirator failure).

Impact Breaker — A machine for reducing the size of coal by means of rotating elements which hit the coal particles and throw them against a fixed plate.

Impingement — A method of removing suspended tar particles from gas by dividing the gas into numerous small streams and causing the particles to impinge on a surface from which the tar is collected.

In Situ — Something that is accomplished or located at the site of a particular activity or happening.

In-Cab — Anything that is related to or is installed inside a transport vehicle cabin.

Incident — Occurrence that led or could have led to adverse consequences. Such adverse consequences may be related to people's safety and/or health, environment or reliability.

Index — Dials operated by a train of wheels indicating the volume of gas which has passed through the meter.

Indirect Ammonia Recovery — Recovery of ammonia from coal gas by first cooling the gas almost to atmospheric temperature, which causes ammoniacal liquor containing all fixed and some of the free ammonia to condense and then removing ammonia left in the gas by passing it into soft or softened cold water or cold dilute ammoniacal liquor.

Indirect Condenser — *See* 'Indirect Cooler'.

Indirect Cooler — The apparatus for cooling the hot gas, the cooling medium being brought into direct contact with the gas to be cooled.

Inert Gases — Chemically inactive gases.

Inerts from calorific perspective — Constituents of a gas which do not contribute to its calorific value. The usual inerts for this category are carbon dioxide, oxygen and nitrogen.

Inferential Meter — A device enabling the volume of gas passing through it to be determined by means other than positive displacement.

Inherent Ash — The ash arising from mineral matter in coal not removable by physical means.

Inherent Moisture — The moisture retained in coal even after air-drying under specified conditions.

Inner Crown — The inner top face of a gas cooker oven.

Insoluble Matter — Solid carbonaceous matter remaining after extraction of coal tar or pitch with pure toluene or certain other solvents.

Installation Pipes — The pipes on a consumer's premises between the control points at which appliances are to be connected.

Insulating Refractory — A refractory with a low thermal conductivity, used for reducing the heat loss.

Intermittent Carbonization — A qualifying term applied to carbonization or to carbonizing vessels, indicating that after charging coal in the vessel, it is not disturbed until the carbonization is complete.

Inventory — A complete list of items containing parts, products being made and finished product and also the items required for production/manufacturing.

Instrument Air — An extremely clean supply of compressed air that is free from contaminants such as moisture and particulates.

IP — Indian Pharmacopoeia (IP) is published by the Indian Pharmacopoeia Commission (IPC) on behalf of the Ministry of Health & Family Welfare, Government of India in fulfillment of the requirements of the Drugs and Cosmetics Act. IP is recognized as the official book of standards for the drugs being manufactured and/or marketed in India. It covers Liquid Medical Oxygen and gaseous medical oxygen.

Isothermal Changes — Changes taking place at constant temperature.

J

JHA — Occupational health and safety risk assessment methodology that focuses on the relationship between: the worker, the task or job and the work context (infrastructure, equipment, materials or substances, physical conditions, work environment).

Jointing Cement — A finely ground refractory composition which generally after addition of water is used for laying and jointing bricks.

Joule-Kelvin Effect; Joule-Thomson Effect — When a gas expands through a porous plug, a change of temperature occurs, proportional to the pressure difference across the plug, the gases expanding through a porous plug below their inversion temperature are cooled otherwise they are heated.

Joule's Constant — 4.18×10^7 ergs (see Mechanical Equivalent of Heat) .

JSA (Job Safety Analysis) — A job safety analysis is a procedure which helps integrate accepted safety and health principles and practices into a particular task. Identification of potential hazard and recommendation to carry out the job in the safest possible way is the goal of such analysis.

K

Kelvin Scale of Temperature — A thermodynamic temperature scale based on Carnot function which takes the triple point of water as exactly 273.15 K. Above 273.15 K, the temperature of this scale are often expressed in degree Celsius. The relationship is Celsius = K - 273.15.

Kinetic Theory of Gases — This is the mathematical explanation of the behaviour of gases on the assumption that gases consist of molecules which are in ceaseless motion in the space, the kinetic energy of molecules depend upon the temperature of the gas.

Kipp's Apparatus — A device for the production of a supply of any gas which can be evolved by the action of a liquid on a solid without heating.

Kjeldahl Flask — A round bottomed glass flask with a long wide neck, used in the estimation of nitrogen by the Kjeldahl's method.

L

Laughing Gas — Nitrous oxide gas, colourless and sweetish in taste, used as a mild anaesthetic.

Le Chaterier Principle — If a system in equilibrium is subjected to a stress, the system tends to react in such a way as to oppose the effect of the stress.

Lean Gas — Gas of relatively low calorific value.

Lean Liquid — In the context of air separation, the lean liquid which is the nitrogen enriched liquid are sent from the medium pressure column to low pressure column after sub-cooling in the exchanger.

Leakage — The accidental admission or escape of a fluid through a hole, crack or an improper joint.

Legs - These are weight bearing structures used as supports for industrial equipment installation and fixation on the foundation.

Level Gauge — A device to check the gas pressure in a pipe or apparatus.

LGC (Liquid Gas Cylinder) — A liquid gas cylinder is a containment apparatus (generally not exceeding 500 liters capacity) that stores a cryogenic liquid compound under gas pressure. The physical form of the stored compound can be gas or liquid, with the ultimate output from the apparatus being gaseous.

Liquefaction of Gases — The act or process of transforming of a gas into a liquid by either cooling or subjecting it to high pressure.

Liquid Purification — The removal of specific constituents from gas by means of liquid reagents.

Liquid Level—A measure of the quantity of cryogenic liquid inside a vessel is known as liquid level.

Liquified Ammonia — Ammonia gas of freezing point — 77.7°C when subjected to pressure gets liquified producing liquified ammonia.

Liquified Petroleum Gas — Mixture of light hydrocarbons obtained during distillation of petroleum gaseous under conditions of normal temperature and pressure and maintained in the liquid state by increase of pressure.

Liquor Ammonia Forte/Liquid Ammonia — An aqueous solution of ammonia of high purity containing 25 to 30 percent of ammonia.

Live Main — A main containing combustible gas.

LO Bath—Liquid Oxygen bath installed on the bottom portion of the low pressure column of a distillation unit in an air separation plant.

Logistics — It is the process of coordinating and moving resources – people, materials, inventory and equipment from one storage location to storage at desired destination.

Long Distance Gas — When gas is delivered under above-normal pressure over long distances from large centres of production.

Long Stem — The valve stem provides the necessary movement to the disc, plug or the ball for opening or closing the valve, and is responsible for the proper positioning of the valve disc. An extended stem is used for cryogenic applications and is slightly longer thus ensuring that the packing of the valve remains warm.

Loschmidt's Number — The number of molecules per cubic centimeter of a perfect gas, at NTP which is equal to 2.687×10^{10} .

Loss of Primary Containment / Spill / Release — An accidental, unplanned or uncontrolled release of any material from primary containment, including non-toxic and non-flammable products. Releases can occur when the structural integrity of a pipeline or a containment is compromised due to several reasons.

Lost Time Accident—A workman is said to have a lost-time injury if they are hurt while on the job and, as a result of their injuries are unable to complete regularly assigned job duties for that day and the day after.

LOTO — The whole set of measures which ensures that equipment, machines and installations are secured against the accidental consequences of an unexpected application of energy (whether electrical, chemical, hydraulic, mechanical, thermal, etc.) or contact with a hazardous fluid (e.g. chemical, cryogenic, biological or other substance).

Low Pressure Main — A main for conveying gas at working pressure up to 22 mm Hg.

Lower Flammable Limit — The lowest gas concentration limit (smallest) of a flammable vapor or gas (the lowest percentage of the substance in air), normally expressed in percentage by volume in air, that will support a self-emitting flame when mixed with air.

Low Temperature Carbonization — A qualifying expression applied to such terms as carbonization, gas, coke and tar to indicate that the products are typical of a process in which the solid residue of the carbonizing process has attained a maximum temperature not exceeding 600°C.

LP Column—Low pressure distillation column of an ASU.

LC50 — LC stands for Lethal Concentration. LC 50 is the concentration usually quoted in either parts per million (ppm) or milligram per cubic meter (mg/m^3) capable of killing 50% of a group of test animals.

LD50 — LD stands for Lethal Dose. LD 50 is the amount of a material, given at once, caused the death of 50% of a group of test animals.

M

Magnesite Refractory — A refractory consisting essentially of magnesia.

Main — A pipe line usually having a diameter of more than 51 mm used for conveying gas.

Manhole — A unit constructed underground to provide access to the utilities like a sewer system or drainage system.

Manifold — An arrangement of piping, valves, instrumentation and other equipment designed to control, distribute and typically monitor gas flow to a system.

Manifold — It is an arrangement used to split or combine the fluid i.e., gas or liquid.

Manometer — These are precision instruments used to measure pressure.

Marsh Gas; Methane (CH₄) — The first hydrocarbon of the paraffin series; inflammable and forms an explosive mixture with air.

Mean Free Path — The average distance travelled by a particle, atom or molecule between successive collisions. In a gas the mean free path between molecules is inversely proportional to the pressure.

Mean Free Time — The average time that elapses between two collisions of a particle, atom or molecule.

Mechanical Equivalent of Heat — Quantity of energy which, when transformed into heat, is equivalent to unit quantity of heat. Thus if H units of heat are completely converted into W units of work then mathematically;

$$\text{Mechanical equivalent of heat (} J \text{)} = W/H$$

Mechanical Grate — A power-operated grate which ejects the clinker and ash from the base of a producer or a generator and so eliminates hand clinkering.

Medium Pressure Main — A main for conveying gas at working pressure between 300 mm water gauge (22 mm Hg gauge) or 0.70 kgf/cm².

Medium Temperature Carbonization — A qualifying expression applied to such terms as carbonization, gas, cokes and tar to indicate that the products are typical of a process in which the solid residue of the carbonizing process has attained a maximum temperature between the normal limits of high temperature and low temperature practice (see high temperature carbonization and low temperature carbonization).

Meter — An apparatus for measuring the volume of gas passing through it without interrupting the flow of gas.

Meter Capacity — The authorized rate capacity of a meter expressed in any suitable unit marked on the front of the meter.

Meter Compartment — An enclosure provided to accommodate a meter.

Microbar — *See* 'Bar'. 10^{-6} bar = 1 microbar

Mist — Droplets of water formed by the condensation of water vapour on dust particles.

Mineral wool / Rock wool — Mineral wool is any fibrous material formed by spinning or drawing molten material or rock materials such as slag and ceramics.

Mixed Gas — A mixture of gases individually produced by two or more different processes.

MKS System — System of units derived from the meter, kilogram and second.

MOC—Management of Change OR Change management is a systematic approach to dealing with the transition or transformation of an organization's processes or technologies and ensuring that the changes are safe and do not add any risks to the process.

Moisture Allowance — A deduction from the washed coal in wagons to allow for the mass of water lost between the colliery weighbridge and the consumer.

Monolithic Materials — Materials for the production of shapes or of monolithic linings, their composition and grading are chosen according to their intended use.

Monkey Ladder — It is a type of ladder consisting of two parallel members connected by rungs for climbing up or down and generally installed at a perpendicular incline to the plane of ground.

Mother Liquor — The liquid left behind after separation of crystals from solution.

MP Column — Medium pressure distillation column of an ASU.

MSDS — A material safety data sheet (MSDS) is an important document containing a chemical product's physical data, potential hazards, handling and required safety precautions.

Muffle Furnace — An enclosed metal or refractory chamber in which stock is placed and around which flames and combustion products flow without coming into contact with the stock.

Mustard Gas — The oily liquid which has been used as a war gas; destroyed by oxidizing agents.

N

Naphthalene Extraction — A process of removal of naphthalene from gas by absorption in oil.

Nascent State — The state at which certain elements are more active when being set free in a chemical reaction than in their ordinary state.

Natural Draught — An air supply for combustion induced by the lowering of pressure due to warmed air rising in a chimney.

Near miss — Safety incident where no injury and/or illness occurs, but has the potential to do so under slightly different conditions.

Net Carbonizing Time — The time between charging coal into and discharging the resulting coke from an intermittent carbonizing vessel in regular operation.

Net Carbonizing Time — The time between charging coal into and discharging the resulting coke from an intermittent carbonizing vessel in regular operation.

Nitric Oxide — A colourless gas which reacts with oxygen to form reddish-brown clouded nitrogen dioxide.

Nitrogen Cycle — The circulation process of nitrogen compounds in nature through the various organisms to which nitrogen is essential.

Nomogram — An alignment chart arranged so that the value of a variable can be found, without calculation, from the value of one or two other variables which are known.

Normal Pressure — Pressure equivalent to 760 mm Hg at 0°C.

Normal Temperature and Pressure; Standard Temperature and Pressure — Temperature of 0°C and a pressure of 760 mm Hg, conditions under which the volumes of gases are compared.

Normally Closed Switch — A switch that allows electrical current to flow through when it is in its normal state (not compressed or activated).

Normally Open Switch — The switch or contact (when it is not compressed or activated) doesn't let current flow through in its normal state.

O

Occlusion — This is the phenomenon by virtue of which certain solids have the property of absorbing or occluding some gases either by the formation of a chemical compound or by forming a solid solution or by the condensation of gas on the surface of the solid.

Octane Number — It is the percentage by volume of iso-octane in a mixture of iso-octane and normal heptane which is equal to the fuel in knock characteristics under specified test conditions.

OEL — Occupational exposure limit is regulatory values that indicates the levels of exposure considered to safe for a chemical substance in the air of a workspace.

Official Calorific Value of Town Gas — *See* 'Calorific Value of Town Gas (Official)'.

Oil Gas — The gas prepared by the thermal decomposition of oil in the presence or absence of a catalyst.

On the Job Training (OJT)—Training on processes and procedures that is given to employees while he or she is doing the actual job in order to create an efficient and effective workplace.

Orsat Apparatus — An apparatus for determining the amount of carbon dioxide, oxygen, carbon monoxide, etc, in gases using wet chemistry principle.

Ortaon Cone — *See* 'Standard Pyrometric Cone'.

Osmometer — An instrument for measuring osmotic pressures.

Ounce Strength — The mass in ounces of pure sulphuric acid required to neutralize all the ammonia in one gallon of ammoniacal liquor.

Oven Furnace — A furnace in which stock is heated in a chamber through which flames and combustion products flow.

Overflow — This term is generally used in case of liquids which ensures the threshold or limiting value for a container after which liquid will come out from the container.

Oxidation — The phenomenon of combination of oxygen or removal of hydrogen from a substance.

Oxide — A binary compound of a substance with oxygen.

Oxidizing Agent — A substance which brings about an oxidation reaction.

Oxyacetylene Burner — A device for obtaining a very high temperature flame for welding by burning a mixture of oxygen and acetylene in a special jet.

Oxygen Enrichment — It is the general terminology used for any gas or liquid that has more than 21% oxygen by volume in the air.

Oxyhydrogen Burner — Same as oxyacetylene burner, only hydrogen is used in place of acetylene.

Oxygen Clean — The method that ensures removal of variety of contaminants from components to be used in oxygen service.

Ozone—A colorless gas that forms just above the earth's surface. This gas shields us and other living things from the sun's harmful ultraviolet radiation.

P

Pallet (also Bundle / Quad) — It is an assembly of gas cylinders fastened together, interconnected by a manifold within a rigid metallic frame and transported as a unit.

Panel Spalling Test — A test in which a panel of refractory bricks is subjected to alternate periods of heating and cooling under specified conditions.

Para Hydrogen — The hydrogen molecules in which the spins of the two constituent atoms are antiparallel.

Partial Pressure — Pressure which each gas in a mixture exerts in a closed system.

Particulate Matter—Particulate matter (PM) is the sum of all solid and liquid particles suspended in air, many of which are hazardous.

Pascal — A unit of pressure equivalent to one newton per square metre.

Perlite— Perlite is a naturally occurring mineral which exist in nature as a type of volcanic glass. Typically expanded perlite is used for insulating the bulk of the cold box where access is unlikely to be required.

Perfect Gas — *See* 'Ideal Gas'.

Permanent Expansion — That part of the increase in length occurring when a refractory material is heated and is retained after being cooled to its original temperature.

Permanent Linear Change — *See* 'After Contraction (After Expansion)'; only the measurement is linear here.

Peroxides — The oxides which yield hydrogen peroxide with an acid.

Personal Protective Equipment (PPE) — Equipment or Clothing designed to be worn or held by an individual for protection against one or more health and safety hazards. This is considered as last line of defense in terms of safety.

PESO — The Petroleum & Explosives Safety Organization, formerly known as Department of Explosives, is a nodal agency for regulating safety of hazardous substances such as explosives, compressed gases and petroleum.

Phase — The separate part of a heterogeneous body or system.

Photosynthesis — Process in which carbohydrates are formed from carbon dioxide and water in the presence of sunlight.

Pipeline (or Piping) — A pipeline is a series of pipes that allows liquid or gas to flow through.

Plant — It is a facility designed to produce gases /liquified gases by air separation and /or compression to an appropriate container

Plastic Layer — The layer of material in a plastic form, between coal and coke produced in a charge of coal undergoing carbonization.

Plastic Refractory — A refractory composition ready for mouldable refractory use which may contain chemical agents to ensure hardening at low temperature.

Point — The end of an installation pipe to which an appliance can be connected.

Porosity—Porosity is the percentage of pore volume, void or empty spaces in a material or formation that can contain fluids.

Porous Mass (In context of acetylene cylinders) – All acetylene cylinders contain a porous honeycomb material known as monolithic mass. These cylinders also contain acetone as a solvent which is absorbed by the porous mass and allows acetylene to get dissolved in it in quite a good volume thereby providing a solution for the packaging.

Porous Material — Porous material is typically solid containing void space.

Port — A passage or opening through which gas, air or combustion products flow.

Portable Cryogenic Container (PCC) — Also commonly known as **Mini Bulk Container (MBC)** are the double walled vacuum vessels with multilayer insulation in the annular space capable of storing cryogenic liquids.

Positive Displacement Meter — A meter which measures directly the volume of gas which passes through it.

Power Failure — It is a period of time when the electricity supply to a particular place is interrupted.

Power Gas — It is the technical fuel gas for driving the engines of the motor vehicle.

Power Outage — Is the loss of electrical power network supplied to an end user.

PPE (Personal Protective Equipment) — These are the equipment worn to minimize exposure to a variety of hazards Examples includes gloves, safety spectacles, protecting hearing devices like ear muffs, ear plugs etc.

Predictive Maintenance — Monitoring or measuring an item's condition, whether or not it could fail during a certain future period of time ("condition-based"). Different methodologies can be applied, as for instance specific objective techniques (e.g. vibration analysis, oil analysis), statistical process control techniques, monitoring item performance, the use of human senses (e.g. visual inspections), or a combination of them. This approach allows convenient scheduling of appropriate actions to prevent the occurrence or reduce the consequences of that failure.

Preheater — An apparatus for heating gas immediately before or during some stage in dry purification.

Prepayment Meter — A meter which works only after the insertion of coin or coins for a predetermined quantity.

Pressure Relief Valve — It is a type of safety valve used to control or limit the pressure in a system where the excessive pressure otherwise build up may create process upset, instrument or equipment failure or even fire and explosion.

Pressure Regulator — It is a device which reduces the inlet pressure to a lower outlet pressure and work to maintain the outlet pressure despite fluctuation in the inlet pressure.

Pressure Vessel—It is a closed container designed to hold gases or liquids at a pressure substantially higher or lower than the ambient pressure. The nature of the substance stored in the vessel may be different than the one when it is finally used.

Pressure Switch — A pressure switch is device which opens or closes a corresponding switch contact as soon as a preset pressure is reached.

Preventive Action — Action to eliminate the cause of a potential nonconformity. (Preventive action Corrective Action)

Preventive Maintenance — Planned routine maintenance tasks (“time-based”). This approach to maintenance aims at sustaining the item’s level of performance and minimizing item failures through maintenance tasks performed at regular intervals and/or based on the number of operating hours for equipment.

Preventive Measures — Measures designed to prevent a hazardous occurrence from happening and therefore reducing its probability (for example: risk assessment analysis, job safety analysis, work permit, Lock Out-Tag Out, instructions at workplace, training, inspections, tests, safety visits, personnel involvement etc.)

Primary Air — Air supplied to a generator or producer for gasification of solid fuels.

Primary Condenser; Primary Cooler — An apparatus for condensing tar and water from raw gas to a temperature suitable for the first process to which it is to be subjected.

Primary Meter — A meter connected to a service pipe.

Process Control — A system employed for ensuring adherence to the norms, stipulated for an industrial process, electronically, mechanically or manually.

Producer — An. apparatus for gasifying solid fuels.

Producer Gas — The gas produced by gasifying solid fuel in a mixture of air and steam.

Project Risk identification (PRI) — The project step that aims at identifying the main risks associated with a project.

Psychrometry — The measurement of the humidity of atmosphere.

PSA—Pressure swing adsorption process (PSA) is a gas separation method based on the phenomenon that under high pressure, gases tend to be trapped onto solid surfaces, i.e., to be "adsorbed", thus being separated.

PUF — Polyurethane foam

Pull — *See* ‘Suction’.

Pump—A device that raises, transfers, delivers, or compresses fluids or that attenuates gases especially by suction or pressure or both.

Pure Gas — Gas which has been purified from undesirable substances to the desired extent.

Purging — This refers to the introduction of an inert (i.e. non-combustible) gas into a closed system, vessel or piping in order to scavenge the contents and achieving the target purity.

Purging — The process of sweeping gas from mains, treatment or storage apparatus with another gas.

Purging — It is a method by which it is ensured that the desired output is free from undesired content. These may be used for inerting as a part of safety critical process or may be as per the process for removal of undesired component.

Purity — 'Purity' means Gases that do not contain impurities which affect the results of analysis

Pusher Ram — A machine used to push coke from a horizontal retort or coke oven.

Pyrometer — An instrument in which temperature is detected by an electric device, for example: resistance, thermocouple, voltage across a filament, etc.

Pyrometric Cone — ‘*See* Standard Pyrometric Cone’.

Pyrophoric — Substances that ignite upon exposure to oxygen /air.

P&ID — A piping and instrumentation diagram (P&ID or PID) is a detailed diagram which shows the interconnection of process equipment and the instrumentation used to control the process.

Q

Quad / Pallet/Bundle — These are high pressure gas cylinder storage system connected to each other with a common inlet-outlet system.

Quality Control — Testing all of the constituents involved in an industrial process with the object of detecting and controlling any variation in quality.

Quantum — According to the quantum theory, energy exists in discrete units, only whole number of which can exist: each unit is called a quantum.

Quantum Theory — The theory which grew up around Planck's introduction into physics of the concept of the discontinuity of energy.

R

Ramming Material — A granular refractory material hardening by ceramic bonding under influence of heat.

Ramp — A surface connecting a higher and a lower level having a gradual slope without steps and used for moving equipment and manpower.

Rank — An indication of the maturity of coal.

Rare Gases — Helium series of gases including helium, neon, argon, krypton, xenon and radon; the zero group of the periodic table, completely inactive chemically.

Ratchet Belt — It is a type of belt with no holes, where there is a ratchet system that locks into placed using a mechanism inside the buckle.

Raw Gas — A mixture of permanent gases, vapours and tar fog evolved from coal during carbonization.

Real Gas — The gases which obey the gas laws.

Recording Calorimeter — The standard instrument which provides a continuous record of the calorific value of gas.

Recuperator — A chamber, filled with chequer work between the generator and waste-heat boiler of a blue water gas plant, in which combustion of blow gases takes place.

Reducing Agent — A substance which removes oxygen from or adds hydrogen to another substance.

Reduction — The phenomenon of removal of oxygen from a substance or the addition of hydrogen to it.

Refinery Gas — Gas produced in the refining of crude petroleum consisting mainly of hydrocarbons.

Reformed Gas — The gas produced by a reforming process.

Reforming — Causing a hydrocarbon to react with steam and/or air in contact with heated refractory material, catalyst material or a bed of hot coke to produce a gas of high hydrogen content.

Refractoriness — The characteristic property of a material of withstanding high temperature.

Refractoriness Under Load — The resistance of a material to the combined effects of load, temperature and time under specified conditions.

Refractory Cement — A refractory composition which hardens at high temperature by ceramic bonding.

Refractory Coating — A refractory composition with similar characteristics to those of jointing cements but having a grading suitable for washes and coating.

Refractory Wash — *See* 'Refractory Coating'.

Reliability — Ability or probability of an item to perform a required function under given conditions for a given time interval. Reliability gives information about the failure-free interval, e.g. the frequency, expressed in %, of interruptions of the function meant to be provided by the facility, equipment and/or process. A process is considered reliable if it obtains the same result repeatedly. (Reliability; Availability)

Reliability Incidents—Such incidents which are related to the failure of plant and equipment that may lead to any kind of efficiency loss or increased risk to the business.

Remote Monitoring - same electrode potential as that of a given oxidation-reduction system at the same *pH* value.

Retort Carbon — *See* 'Gas Carbon'.

Reverberatory Furnace — A furnace designed for operations in which it is not desirable to mix the material with the fuel, the roof is heated by flames and the heat is radiated down to the material from the roof.

Reverse Flow—Flow of a fluid in the direction exactly opposite of what it is normally deemed to flow.

Reversible Expansion — An increase in length which is followed by an equal reduction in length when a material is successively heated and cooled.

Reversible Process — A process which can be performed in the reverse direction, the whole series of changes constituting the process being exactly reversed.

Reversible Reaction — A chemical reaction which may be made, under suitable conditions, to proceed in either direction.

Revivification — The process of reconverting fouled oxide for further purification of gas, usually by oxidizing in air.

Revivification *in Situ* — Revivifying fouled oxide by adding air to the unpurified gas passed through the purifier box.

rH Scale — A scale of hydrogen pressures which gives a measure of the strength of a reducing agent.

rH Value — It is the value expressed as $\log_{10} \frac{1}{H}$ where *H* is the hydrogen pressure which would produce the same electrode potential as that of a given oxidation-reduction system at the same *pH* value.

Rigid Pipe — Rigid pipes are generally considered pipes that cannot deflect 2% of their diameter before failing.

Rollover vehicle accident — A rollover is a type of vehicle crash in which a vehicle tips over onto its side or roof.

Run — The rapid period during which steam is passed through the incandescent fuel in a generator to produce blue water gas.

Rust — Hydrated oxide of iron formed on the surface of a body made of iron exposed to moisture and air.

R-Ratio — A ratio used in designing oxide boxes, equal to the volume of gas to be purified per hour, divided by the volume of oxide in a box, both in metre.

S

Saturated Pressure — The pressure exerted by a saturated vapour, this pressure is a function of the temperature.

Saturated Vapour — A vapour which can exist in equilibrium with its liquid.

SCBA — Self Contained Breathing Apparatus — It is a device worn to provide breathable air in an atmosphere that is immediately dangerous to life and health.

Screening — The method of separating the smaller pieces of coke by means of shaking them over a perforated arrangement.

Sealing — The operation of periodic removal of the layer of carbon formed on the inner surface of high carbonizing vessel by allowing air to pass over carbon.

Secondary Air — Air supplied at or near the top of the carburettor or the bottom of the superheater of a carburetted water gas plant for combustion of blow gases to heat the chequer work in the carburettor and superheater to the temperature required for oil cracking.

Secondary Condensers — An apparatus for cooling partially treated gas to a temperature suitable for subsequent process.

Secondary Coolers — *See* 'Secondary Condensers'.

Secondary Meter — A meter which registers the gas used in a separate part of premises or in separate appliances where the whole of the gas supplied to the premises or appliances passes through a primary meter.

Seeger Cones — A device for estimating the approximate temperature of a furnace; cones are made of material softening at a definite temperature.

Semidirect Ammonia Recovery — The recovery of ammonia from coal gas by first cooling the gas to almost atmospheric temperature which causes ammoniacal liquor containing all the fixed ammonia and some of the free ammonia to condense and then removing the ammonia remained in the gas by passing it through sulphuric acid after reheating. The ammoniacal liquor is generally distilled to recover ammonia which is added to the residual gas immediately before it passes into the sulphuric acid.

Semimuffle Furnace — A direct heated, side-fired, underfired furnace with furnace walls at the sides of the hearth to protect the stock from flame impingement.

Serpek Process — The process for the fixation of atmospheric nitrogen.

Shale Oil — The distillate obtained from oil shale when heated in retorts.

Shunt Meter — A meter in which the gas stream is divided into two parts bearing a definite volumetric ratio to one another.

Shutdown — A temporary closure of a facility e.g., Plant shutdown means the stoppage of that facility.

Side Flue — A waste gas flue lying along the side of the coke oven battery and conveying waste gases from the outlet of the regenerator to the chimney.

Silencer — A sound suppressor or sound moderator used in a device is known as silencer.

Silica Gel — Porous material consisting of pure silicon dioxide available in different sizes for different applications, such as, dehumidifying and dehydrogenating agent, as a carrier for active catalyst, and in gas chromatography.

Silica Refractory — A refractory that in the fired state shows on analysis not less than 92 percent of silica.

Siliceol Process — The process for the manufacture of hydrogen by the action of sodium hydroxide solution on silicon.

Sillimanite Material — Alumino silicates of rhombic nature.

Sillimanite Refractory — A refractory made from one of the sillimanite group of materials.

SLD—A single-line diagram (also known as an SLD or one-line diagram) is a simplified representation of an electrical system including the components used.

Sleeve — A tube fixed in a prepared hole in a structure to receive a service or installation pipe.

Sliding Joint — A joint which enables a horizontal course of a refractory material to move relatively to another course; composed of material having a lower coefficient of thermal expansion thereby preventing the opening of the vertical joints in the latter course.

Smoke — A suspension of fine particles of solid in a gas.

Societal risk — The likelihood that a population (total number of people) may be killed or seriously harmed at the same time in the event of an accident.

Soldering — Soldering is a process in which two or more items are joined by melting and putting a filler material (solder) into the joint. Unlike welding, soldering does not involve melting of the work pieces.

Sole Flue — A heating flue or waste gas flue lying longitudinally beneath an oven or regenerator.

SOP—A standard operating procedure is a set of written instructions (specific to the operation) that describes the step-by-step process that must be taken to properly perform a routine task.

Spalling — The cracking or fracture of a refractory product caused by differential expansion due to thermal shock, the effect of a steep temperature gradient or a crystalline inversion.

Sparking Plug — A device for providing an electric spark for exploding the mixture of air and fuel vapour in the cylinder of internal combustion engine.

Sparking Potential — The difference in potential required for an electric spark to pass across a given gap.

Specialty Gases — Specialty gases typically refer to calibration gases, zero gases, carrier gases, span gases, instrumentation gases etc.

Specific Gravity — The ratio of the weight of unit volume of dry gas to that of unit volume of dry air under the same conditions of temperature and pressure.

Specific Heat of Gas — Under given conditions of temperature and pressure it is the ratio of quantity, required to heat 1 kg through 1 K, of the gas to that of air at NTP. It is of two types, (a) that measured at constant pressure, and (b) that measured at constant volume.

Specific Shape — A brick which is not of a stock pattern but is made to a customer's design for a particular use.

Specific Volume — The volume at a specified temperature and pressure occupied by one gram of a substance.

Spent Oil — Benzole or naphthalene wash oil which by repeated use has become unsuitable for gas washing.

Spent Oxide — The fouled iron oxide unusable for dry purification.

Spontaneous Combustion — The combustion of a substance of low ignition point which results from the heat produced within the substance by low oxidation.

SPL (Safety Protection Loop) — It is a combination of two loops – 1. Association of objective risks via communication of the subjective perception of the objective risk & 2. Modification of the communication by the Protection motivation theory that includes both extrinsic protection that influences the intrinsic protection via modulations of expectations and value. Both loops meet at communication level.

Stainless Steel — A class of chromium steels usually containing 70 to 80 percent iron, 12 to 20 percent chromium and 6 to 9 percent nickel.

Stainless Steel — Stainless steel is made primarily from iron and carbon with addition of mainly chromium and nickel with suitable quantities of other elements (for different grades) to make it corrosion resistant.

Stakeholders — People with an interest in industry or business activities are considered stakeholders. They may include company team employees, customers, suppliers, regulatory bodies and other people.

Standard Pyrometric Cone — A pyramid of refractory material with a triangular base of specific shape and dimensions and of such composition that when it is heated under specified conditions it bends so that the top is in level with the base at a definite temperature.

Standard Square — A rectangular brick of 228 × 114 × 76 or 63.5 mm dimensions.

Standard Temperature and Pressure — *See* 'Normal Temperature and Pressure'.

Stand Oil — A drying oil which has been thickened by heating in an inert atmosphere without the addition of driers, due to polymerization of some of the constituents.

Start Permissive — It is a final contact of a coil at the end of an interlock chain that must be true before one can start a machine.

Start Up Review—A systematic and thorough check of process items to be verified before a process begins or start in order to ensure that potential hazards have been properly addressed.

Startup — The action or process of setting something in motion. e.g., Plant startup means the commencing of that facility.

Static Producer — A producer from which ash is removed manually.

Static Washer — The gas washing apparatus in the form of a series of compartments each containing material representing a large surface area.

Station Meter — A meter used at the gas works to measure the volume of gas manufactured.

Steam — Water in the vapour state above its boiling point.

Steaming — The passing of steam through incandescent fuel in a generator to produce water gas.

Steam Point — The temperature at which the vapour pressure of water is equal to standard atmospheric pressure.

Stefan's Law — The total energy emitted in the form of heat radiation per unit time per unit area of a black body is proportional to the fourth power of its absolute temperature.

STEL — Short Term Exposure Limit — A 15-minute exposure which should not be exceeded at any time during a working day. In addition, STEL's should not be repeated more than 4 times per day with at least 60 minutes between successive exposures at the STEL value.

Step Grate — An inclined grate consisting of horizontal plates arranged stepwise.

Stock — The material to be treated in a furnace or oven.

Stock — The goods or merchandises kept on the premises of selling facility for immediate or future use.

Store — A quantity or supply of something kept for use as needed.

Stripped Gas — *See* 'Debenzolyzed Gas'.

Stroke (as in a control valve) — The vertical movement of the actuator stem of a control valve between the fully closed to the fully open position is known as a valve stroke.

Sublimate — The solid obtained by the direct condensation of a vapourized solid without passing through the liquid state.

Sublimation — The conversion of solid direct into vapour and subsequent condensation without melting.

Submergence Area— The downward acting force per unit area in a water column is simply the water mass of a column times the acceleration due to gravity.

Suction (Vacuum) — A pressure below atmospheric in pipes and apparatus especially those on the inlet side of exhausters. Suction is termed as pull if it refers to the pressure below atmospheric in the heating and waste gas flues of a retort or chamber setting or oven battery.

Suction Gas — Producer gas which is drawn by suction from the producer by the gas engine, according to its requirements.

Sulphur Point — The temperature of equilibrium between liquid sulphur and its vapour at a pressure of one standard atmosphere.

Sump — A sump is a low space that often collects undesirable liquids such as water, chemicals, cryogenic liquids etc.

Support - All the equipment (mobile or fixed) required to fix, install, support the operation and maintenance of a system.

Supercooling — Metastable state of a liquid cooled below its freezing point.

Super-heated Steam — The steam at a temperature of more than 100°C obtained by heating water under a pressure greater than atmospheric.

Superheater — A chamber connected to the outlet of a carburettor filled with chequer work, in which the thermal decomposition of oil vapours begun in the carburettor is continued. The temperature of chequer work is maintained as required for efficient decomposition.

Superheating — Heating a liquid above its boiling point when the liquid is in a metastable state.

Supersaturation — The metastable state of a solution holding more dissolved solute than is required to saturate the solution.

Supply Chain — A supply chain is a network of individuals or companies who are involved in manufacturing and distribution of a product to consumer.

Support — All the equipment (mobile or fixed) required to fix, install, support the operation and maintenance of a system.

Surface Combustion — Combustion without flame on an incandescent surface achieved by a premixed air/gas system.

SWP (Safe Work Permit) — Documented information, prepared to ensure the safe planning and execution of non-routine work or a potentially hazardous routine work (or tasks), which includes the: ● description of the work to be performed, ● hazards involved, ● safety measures to be implemented (including specific complementary permits when applicable), ● required authorizations.

Synthesis — The formation of compound from its elements or simpler compounds.

Synthetic — Artificially prepared compound from the component elements not obtained directly from natural sources.

T

Tachometer — An instrument for measuring the rate of revolution of a revolving shaft.

Tar — The name given to various dark, viscous organic materials.

TAR — A turnaround is a periodical major maintenance event in a manufacturing process plant to return and/or enhance process units to their designed reliability, operability, and production capacity. This is done by performing predefined maintenance tasks, within the budget, schedule, without accidents, and at minimum risk.

Tar Fog — A suspension of very small particles of tar in a gas, these particles are difficult to remove by gravity alone.

Tar Tower — A device used to drain tar from a hydraulic main-without altering the liquor level.

Tear Gases — The substances which can be distributed in the form of a vapour or smoke producing an irritating effect on the eyes.

Temperature — That parameter of matter which determines the direction of heat flow from one body to another. The heat flows from a greater to a smaller temperature unless forced to do otherwise.

Temporary Hardness of Water — That hardness of water which can be destroyed by boiling.

Tertiary Air — An air supplied at the top of the superheater of a carburetted water gas plant or at the bottom of recuperator of a blue water gas plant in order to liberate any potential heat in the waste gases before they go to the waste heat boilers.

Temperature Gradient — The rate of change of temperature with displacement in a given direction such, for example with increase or decrease of height.

TGM—Total gas management is an integrated product management service wherein all the aspects relating to supply, transport, purity, maintenance and safety in the use of gases and related systems are left completely up to and in the hands of the supplying company.

Therm — The statutory heat unit of gas; one therm is equivalent to 100 000 Btu.

Thermal Diffusion — The phenomenon in which heavier molecules tend to diffuse downwards and the lighter ones in the opposite direction when a temperature gradient is maintained over a volume of gas containing molecules of different masses.

Thermal Insulation — This refers to many ways of inhibition of heat transfer from one object to another / one region to another region.

Thermal Value of a Chemical Reaction — See 'Heat of Reaction'.

Thermochemistry — The branch of physical chemistry dealing with the quantities of heat absorbed or evolved during chemical reaction.

Thermocouple — The instrument for measuring temperature consisting of two wires of different metals joined at each end.

Thermometer — A device to measure the temperature of a body.

Thermopile — A group of rigid thermocouples joined together in series. One of its common use is in the detection of radiation. If the thermocouples are not rigid, the combination is called a multiple thermocouple.

Thermostat — An instrument for maintaining constant temperature.

Tire Burst — Rapid, explosive loss of inflation pressure of a pneumatic tire.

TLV— Threshold Limit Values - are guide values in relation to air-borne concentrations of substances to provide safe workroom air for all workers. It is also known as Exposure Standards (ES).

Top Filling (of cryogenic tanks) — Cryogenic tanks, typically filled from the top using blow down method in which the tank pressure is reduced by blowing out the head pressure of the tank in order to fill it.

Total Moisture — The moisture in the coal as supplied, being the sum of the free and inherent moistures.

Tower Scrubber — The gas washing apparatus in the form of a circular or rectangular tower, usually containing material presenting a large surface area.

Town Gas — The gas normally supplied to the public by utility undertaking in accordance with statutory requirements.

Toxic Gases—Toxic gases are gases with hazardous physiological effects when inhaled.

Traffic Cones — Cone shaped markers that are placed on roads or inside a factory where vehicle movement is there to ensure that, it is safely parked.

Transition Temperature — The temperature at which one form of a polymorphous substance changes into another; the temperature at which both forms can coexist.

Transport Tank—A mobile cryotank or cryogenic tank is a tank that is cylindrical and horizontally installed on a moving vehicle chassis or pulled by a prime mover and used to store and transport material at very low temperatures.

Triple Point — In a pressure-temperature phase diagram, the triple point is defined by the pressure and temperature at which a pure substance (one sort of molecule) can be together liquid, gas and solid. Its three physical states coexist. The three phase equilibrium curves (Liquid/Vapor, Solid/Liquid and Solid/Vapor) meet at the triple point.

Troubleshooting — It is a step-by-step procedure whose purpose is to quickly and easily identify a problem in a system or process.

Try-cock — These are small assembly of two or more cocks arranged one above the other to ascertain the liquid level in a container.

Turbine — An expansion turbine (or turbine), also known as a turboexpander, is one of key parts in the cryogenic technological processes. Expansion turbines are designed to be used for the expansion of air, nitrogen or other gases during the processes of gas liquefaction. These devices are generally centrifuges and instrumental in creating work from pressurized gas to be used to drive a compressor or generator.

Turbine — Any motor in which a shaft is steadily rotated by the impact of a current of steam, air, water or other fluid directed from jets upon the blades of a wheel.

Turbogenerator — A steam turbine coupled to an electric generator for the production of electric power.

Turbulent Flow — The type of fluid flow in which the motion at any point varies rapidly in direction and magnitude.

Turnaround (TAR) — A turnaround (commonly abbreviated TAR) is a scheduled periodical event where entire process units are enhanced to their designed reliability, operability, and production capacity. This is done by performing predefined maintenance tasks, within the budget, schedule, without accidents, and at minimum risk.

TWA (Time Weighted Average) — The most common exposure standard for air borne concentrations which most persons may be exposed to in the ambient air 8 hours per day, 5 days per week.

U

Uncorrected Volume — The volume of gas as measured, without correction to the standard conditions of temperature, pressure and humidity.

Unit — A quantity or dimension adopted as a standard of measurement.

UN Code — A Substance ID Code (United Nations Number) for hazardous goods whose transport is regulated. It is expressed as a four-digit ID number, as for example the UN code for argon in a gaseous state is UN1006 and in a refrigerated liquid state is UN1951.

Unit of Ammonia — A commercial unit for reckoning quantities of ammonia equal to 10 kilograms of ammonia gas.

Univalent — Elements having valency of one.

Unstable — The substance that can be easily decomposed.

Unstripped Gas — The gas from which benzole has not been removed.

Up-Run — Part of the run during which steam is supplied to the base of the generator and passes upwards through the fuel.

Upper Flammable Limit — The highest gas concentration limit (richest) of a flammable vapor or gas (the highest percentage of the substance in air), normally expressed in percentage by volume in air that will support a self-emitting flame when mixed with air.

Utilities — These are essential services like instrument gas, cooling water, electrical power, steam, chemicals, air and sewers among others that play a vital role and provide support to the main process.

Utility — These refer to the auxiliary services such as instrument air supply, industrial cooling water supply, lighting, air-conditioning, sanitation and noise control systems used in a manufacturing plant in order to produce the primary products.

V

Vacuum — See 'Suction'.

Vacuum — A pressure less than atmospheric pressure, measured either from the base of zero pressure or from the base of atmospheric pressure. (From AGA)

Vacuum Distillation — The process of distillation carried out at reduced pressure.

Vacuum Insulated Storage Tank — It is a form of pressure vessel that allows the bulk storage of cryogenic liquids.

Vacuum Insulated Transport Tank — It is a form of pressure vessel that allows the bulk storage and transportation of cryogenic liquids.

Valve Bonnet — A valve bonnet covers the opening on top of a valve body. As a pressure -retaining part of a valve, the bonnet and its connection to the body are exposed to the operating fluid. Thus, these bonnets must withstand the operating pressure and corrosive effect of the fluid.

Valve Guard / Valve Cap — A device that is securely fixed around the valve and stands taller than the highest point of the valve so as to protect it from damage / ejection in the event of the cylinder falling down.

Valve Wheel — It is common type of valve actuator used to regulate the opening and closing of a valve manually.

Vander Waals' Equation — An equation of state which is considered more accurate than Charlee's Law. It takes into account the finite volume of particles and the mutual forces between them.

Vaporizers—It is an ambient air exchanger which utilizes the heat from the atmosphere to provide the necessary heat of vaporization for transformation of a cryogenic liquid to gas.

Vapour —

- a) A substance in a gaseous state which may be liquified by increasing the pressure without altering temperature.
- b) A gas below its critical temperature.

Vapour Density — A measure of the density of a gas or vapour usually given relative to oxygen or hydrogen.

Vapour Pressure — Pressure exerted at any temperature by a vapour existing in equilibrium with its liquid or solid phase.

Vent—An opening that allows air, gas or liquid to pass out of or into a confined space or may be to the atmosphere itself.

Vent Collector — A collector system used in a vent line.

Vent Valve — It is a device installed to prevent negative pressure in a piping system. It is also installed at the highest point in a piping, system down stream of shut-off elements or pumps.

Vertical Storage Tank —A vertical cryotank or cryogenic tank is a tank that is cylindrical and vertically installed and used to store material at very low temperatures.

Virgin Liquor — The aqueous condensate produced by cooling crude coal gas.

Viscosity —It is the resistance of a fluid (liquid or gas) to a change in shape, or movement of neighboring portions relative to one another.

Volatile Matter — The substance in the form of vapour having high vapour pressure, readily obtained from a solid or liquid.

Volatile Organic Compounds (VOCs) — Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate, which participates in atmospheric photochemical reactions.

Volatile Therms Per Ton

- a) The total heat in therms (on gross calorific value basis) produced by the combustion of volatile products like gas, tar, benzole, etc, from the carbonization of one ton of coal.
- b) The potential heat in therms (on the gross calorific value basis) in the form of gas recoverable from one ton of semicoke or coke on heating under specified conditions.

Volumetric Meter — *See* 'Positive Displacement Meter'.

Vulnerability Study —Vulnerability assessment is the testing process used to identify and assign severity levels to as many defects as possible in a given timeframe.

W

Warehouse — A building where commercial goods like gas cylinders etc. are stored before these are sold.

Wash Oil Still — Apparatus in which benzole is distilled from benzolized wash oil.

Washing — The process of reducing the ash content of cod or coke by removal of materials of high specific gravity.

Waste Gas — *See* 'Flue Gas'.

Water Bath — It is a laboratory equipment made from a contained filled with heated water and is used to incubate samples in water at a constant temperature over a prolonged period of time.

Water Gas — The fuel gas obtained by the action of steam on glowing hot coke, giving carbon monoxide and hydrogen.

Welding — Welding is a special process of fabrication that joint materials by using high heat to melt the parts together and allowing them to cool causing fusion.

Wet Lute — A purifier cover seal consisting of a trough containing water into which the edges of the cover dip.

Wet Meter — A meter in which the volume of gas is measured by admitting the gas to a drum having compartments of known volume sealed by water or other liquid. The drum rotates under the influence of the gas pressure differential and the gas is displaced from the compartments by the sealing liquid.

Wet Purification — The process of removal of moisture, tar and ammonia from raw gas.

WI — Work instructions are documents that contain very specific instructions or directions on how to carry out a certain task. A work instruction explains and describes in detail the steps required to complete a task and how to do each step correctly.

Wire mesh — A network of metallic wires interlocked together to form precise pore openings that can be used to decontaminate a substance.

Wobbe Number — An index of heat release when a gas is burned at constant gas supply pressure, heat release being directly proportional to the orifice area and that Wobbe number. This is given by the following formula:

$$\text{Wobbe number} = \frac{\text{Gross calorific value of gas}}{\text{Specific gravity of gas (air = 1)}}$$

Working Chamber — The part of a chamber where the stock is placed during heat treatment.

Y

YTD — Year to Date (YTD) refers to the period from the beginning of the current year to a specified date before the year's end.

Z

Zero Point Energy — The energy possessed by the atoms or molecules of a substance at the absolute zero temperature.