SAE International™ SURFACE VEHICLE STANDARD

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Emissions Terminology and Nomenclature

1. ***Scope***—This SAE Recommended Practice applies to nomenclature of emissions and emissions reduction apparatus as applied to various engines and vehicles. Modifying adjectives are omitted in some cases for the sake of simplicity. However, it is considered good practice to use such adjectives when they add to clarity and understanding.

1.1 **Purpose**—This document was prepared to standardize terminology and nomenclature in order to facilitate clearer understanding for engineering discussions, comparisons, and the preparation of technical papers.

2. ***References***

2.1 **Applicable Publications**—The following publication forms a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 323—Test Method for Vapor Pressure of Petroleum Products (Reid Distillation)

2.2 **Related Publications**—The following publication is provided for information purposes only and is not a required part of this document.

2.2.1 FEDERAL PUBLICATION—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

40 CFR Part 86 Reference (Definitions 86.082.2)

3. ***Definitions***

3.1 **Adaptive Memory**—A feature often used in electronic feedback air/fuel control systems electronic control strategy. Air/fuel ratio values are dynamically updated during engine operation and used as reference parameters to control other engine operating functions, i.e., timing, mixture, throttle modulation.

3.2 **Add-On Part**—A part which does not replace an OEM part and was not part of the originally certified vehicle configuration.

3.3 **Adjusted Loaded Vehicle Weight (ALVW)**—Curb Weight plus Gross Vehicle Weight Rating divided by two.

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3.4 Aftermarket Part—A part produced by a manufacturer other than the original equipment manufacturer.

3.5 AIR (Air Injection Reactor)—A system of auxiliary air injection for reducing emissions using an air pump.

3.6 Air Distribution Manifold—The manifolding which distributes and proportions air to the individual exhaust ports.

NOTE—The manifolding may consist of external tubing or integral passageways.

3.7 Air Gap Pipe—A double-walled pipe with an annular air space between two basically concentric pipes.

3.8 Air Injection Relief Valve—A pressure relief valve, usually integral with the air pump or air pump diverter valve, which limits the maximum delivery pressure of the injected air.

3.9 Air Injection Tube—A tube projecting into the exhaust manifold or passage through the cylinder head which directs injected air from the air distribution manifold to the vicinity of each exhaust valve.

3.10 Air Pump Diverter Valve—A valve which interrupts the delivery of air to exhaust ports -- typically during vehicle deceleration in order to prevent engine backfires.

3.11 Air Switching Valve—A valve which directs auxiliary air from a location upstream of the three-way catalyst to a location downstream of the three-way catalyst.

NOTE—This provides optimum oxidation catalyst light-off while protecting three-way efficiency after warm-up.

3.12 Air/Fuel Ratio Control Device—A device that limits the amount of fuel to that which can be burned with the air available during acceleration of a turbocharged diesel engine.

3.13 Alcohol—A compound having the general formula ROH where R represents a hydrocarbon radical.

3.14 Aldehyde—A compound having the general formula R · CHO, where R represents a hydrogen atom (H) or a hydrocarbon radical.

3.15 Alternative Fuel Vehicle—See Flexible Fuel Vehicle.

3.16 Amine—A compound having the general formula RNH_2.

3.17 Analytical Train—The entire system required to obtain and determine a particular constituent in exhaust gas. Typically, this system will include such items as sample piping, particle filter, condenser, sample pump, analytical instrument, and flowmeter.

3.18 Anti-Diesel Device—A device to close the throttle further or block the idle fuel within the carburetor when the ignition is turned off.

3.19 Aromatic—A hydrocarbon containing one or more rings with general formula C_nH_m ($n \geq m$).

3.20 Base Metal Catalyst—A catalyst in which the active catalytic material is one or more non-noble metals such as copper or chromium.

3.21 Beer Lambert Law—For purposes of diesel smoke measurement, an equation approximating the relationship between the opacity of a smoke plume, the optical path length through the plume, and the opacity of the smoke per unit path length, may be used:

$$\text{Opacity} = 1 - e^{KL} \qquad \text{(Eq. 1)}$$

where:

e = base of natural logarithms = 2.718 in
K = attenuation (or extinction) coefficient of the smoke
L = path length through the smoke, expressed in inches

3.22 Benzo(a)pyrene (BaP)—See Poly Nuclear Aromatic or Polynuclear Aromatic Hydrocarbon (PNA or PAH).

3.23 Bi-Fuel Vehicle—See Dual Fuel Vehicle.

3.24 Blow-Off—The dislodging of particulates in a trap caused by flow or backpressure.

NOTE—This is more prevalent in wire mesh than in the blockable monolith catalyst.

3.25 Brake Specific Emissions—Mass (mass or weight) of pollutant emitted per units of output work (brake horsepower [kW] hour).

3.26 Breakerless Ignition System—A system which differs principally from a conventional ignition system in the following two ways. First, the conventional cam and breaker points are replaced by a pulse generator. Second, a solid-state electronic device uses the pulse generator signal to switch ignition coil primary current on and off.

3.27 Bypass Valve—A valve used to isolate the diesel particulate trap during regeneration.

NOTE—The valve that switches the exhaust gas to another trap or expels raw exhaust into the atmosphere.

3.28 CAA—The Federal Clean Air Act.

3.29 Calibration Gas—A gas mixture of known concentration of one constituent used to establish the instrument response for that constituent and usually used in conjunction with other similar calibration gases of differing concentrations to determine the response curve of an analytical instrument.

3.30 CARB—California Air Resource Board.

3.31 Carbon Canister for Evaporative Emissions—A component of an evaporative control system which is used to collect and store evaporative hydrocarbon emissions from the fuel tank and/or carburetor.

3.32 Carbon Canister Vent Valve—A device used to seal the atmospheric vent of the carbon canister for purposes of executing an evaporative system leak monitor.

3.33 Carburetor Deceleration Combustion Control Valve—See Fuel Decel Valve.

3.34 Catalyst—A substance that accelerates a chemical reaction but which itself undergoes no permanent chemical change.

NOTE— For automotive emission control applications, catalysts are classified as oxidation catalysts (oxidize HC and CO), reduction catalysts (reduce NO_x), or three-way catalysts (oxidize HC and CO and reduce NO_x simultaneously).

3.35 Catalyst Assembly—See Catalytic Converter.

3.36 Catalyst Heat Storage Device/System—See Heat Battery.

3.37 Catalyst Poisoning—The deterioration of catalyst efficiency when foreign material such as lead, phosphorus, or sulfur is introduced to the catalytic converter, lessening or eliminating the chemical action of the catalysts on the exhaust pollutants.

3.38 Catalytic Converter—An assembly, including such major components as structural shell, substrate, and the catalyst material. Depending on the type of catalyst-oxidation, reduction, or three-way-this assembly decreases HC and CO emissions or NO_x emission, or all three simultaneously.

3.39 Catalytic Efficiency—See Conversion Efficiency.

3.40 Catalytic Trap—A device for trapping exhaust particles, which can be continuously regenerated utilizing the heat of the exhaust to accelerate a chemical reaction. Regenerations occur randomly.

3.41 Charcoal Canister—See Carbon Canister for Evaporative Emission.

3.42 Chassis Dynamometer—A laboratory apparatus capable of simulating the road operation of a vehicle. The dynamometer possesses the capability to simulate the inertial, frictional, and wind-resistance forces acting on a moving vehicle.

3.43 Chemiluminescent Analysis—An instrument in which the amount of light or radiation produced by a chemiluminescent reaction is used to determine the amount of a reactant, as with the reaction of nitric oxide and excess ozone.

3.44 Closed-Loop Control— See Feedback System for Controlling Air/Fuel Ratios.

3.45 CNG—Compressed Natural Gas.

3.46 Consolidated Replacement Part—A part which is functionally equivalent to the OEM parts which it replaces.

3.47 Constant Volume Sample (CVS)—A device for diluting the entire flow of exhaust gas with a variable amount of dilution air so as to keep the total volumetric flow rate (at a constant temperature) of dilute exhaust constant and known during a test.

NOTE—Mass emissions of an exhaust constituent can be determined from the time-average constituent concentration in the dilute exhaust, the total volume of dilute exhaust, and the density of the constituent.

3.48 Continuously Regenerating System—A particulate collection system in which trapped particles are continuously burned off when the engine is operating.

NOTE—This is done without an add-on regeneration mechanism; see Periodically Regenerating Trap Oxidizer.

3.49 Control Strategy—A description and flow diagram which explains the interaction of the powertrain control module, its calibration, and affected components.

3.50 Conversion Efficiency—The percentage of a given exhaust constituent that is changed into chemically different species as a result of the operation of the catalytic converter.

3.51 Converter Bypass—A method for routing exhaust gas around a catalytic converter typically to prevent converter damage due to excessively high operating temperatures. See Bypass Valve.

3.52 Coolant Override Valve—See Thermal Vacuum Switch.

3.53 Curb Weight—The weight of the vehicle in operational status with all standard equipment, the weight of fuel at normal tank capacity, and the weight of optional equipment.

NOTE—For the purpose of emission testing, the weight of optional equipment with an installation rate of more than 33% is used.

3.54 Deceleration Spark Advance Control—A device that advances spark timing during deceleration.

3.55 Deceleration-Throttle Modulator—A device that regulates the rate of closure of the carburetor throttle.

3.56 Detector—That component in an analytical instrument which responds to a particular exhaust gas constituent.

3.57 DF—Deterioration Factor. The deterioration factor is used in EPA's Emission Certification Test Procedure.

3.58 Diesel Engine—Any compression ignition internal combustion engine using the basic diesel cycle, that is, combustion results from the spraying of fuel into air heated by compression.

3.59 Diesel Particulate Matter—Emissions consisting mainly of soot and adsorbed H_2O, SO_4=, NO_3-, PO_4≡, and adsorbed hydrocarbons.

NOTE— This material has a bulk density approximately 0.066 g/cm^3.

3.60 Diesel Smoke—Particles, including aerosols, suspended in the engine's gaseous exhaust stream which absorb and/or scatter light.

a. Black smoke is comprised primarily of carbon particles (soot) which are usually less than 1 µm in size resulting from incomplete combustion.
b. Blue smoke is usually due to droplets resulting from the incomplete burning of fuel or lubricating oil.
c. White smoke is usually due to droplets resulting from the incomplete burning of fuel droplets at low combustion chamber temperatures.

The observed blue or white color results from the refractive index of the liquid in the droplets and the droplet size.

The observed color results from the refractive index of the liquid in the droplets and the droplet size.

3.61 Dilution Tunnel—A device in which the engine exhaust is diluted and mixed with air for collection of exhaust.

3.62 Direct Replacement Part—A part which is functionally identical to the OEM part which it replaces.

3.63 Diurnal Breathing Losses—Fuel vapors emitted into the atmosphere as a result of increase in tank temperature.

NOTE—This temperature increase simulates the daily range of ambient temperatures that fuel tanks experience in service.

3.64 Diurnal Emissions—See Diurnal Breathing Losses.

3.65 Driver's Aid—An instrument intended to guide the vehicle driver in operating the vehicle in accordance with a specified schedule of speed as a function of time.

3.66 Dual Diaphragm Distributor—A distributor with two vacuum diaphragms which can either advance or retard spark timing depending on the vacuum signals applied to it.

NOTE—Spark is often retarded at idle and during deceleration for emission control but advanced for part-throttle fuel economy.

3.67 Dual-Catalyst System—A system that uses two catalyst beds, one oxidation and one reduction, to decrease the HC, CO, and NO_x pollutants in the engine exhaust. These two beds may be packaged together or in two separate containers.

3.68 Dual Fuel Vehicle—A motor vehicle that operates on a mixture of two different fuels simultaneously which are stored in separate containers and metered to the engine in specific proportions

3.69 ECM—The Electronic Control Module (the on-vehicle computer used to control engine and other vehicle operations).

3.70 EEPROM—An Electrically Erasable computer chip. See PROM.

3.71 EGI—Exhaust Gas Ignition is a system for rapid catalyst heating and reduced emissions in which a rich exhaust gas mixture is supplemented with air provided by an auxiliary pump to produce a combustible mixture which is ignited directly in front of the catalyst.

3.72 EGR Backpressure Controlled—An exhaust gas recirculation control system (pneumatic or electronic) that is also modulated by exhaust system backpressure.

3.73 EGR Control Valve—The valve that controls the amount of recirculated exhaust gas entering the engine induction system.

3.74 EGR Vacuum Amplifier—A device used to amplify relatively weak carburetor signals under certain driving modes to improve the proportionality between the amount of EGR and Engine air flow.

3.75 EGR Vacuum Port—The carburetor port or opening from which vacuum to control the EGR system is sensed.

3.76 Electrically Heated Catalyst (EHC)—A catalyst that is heated electrically to provide fast light-off for reduced tailpipe emissions.

3.77 Electronic Ignition System—See Breakerless Ignition System.

3.78 Emission Index, Mass—(Grams) of pollutant emitted per unit mass of fuel burned.

3.79 Emissions Correction Method (for Trap Equipped Vehicles with After Treatment)—An exhaust emission calculation which weighs the regeneration emission test results with the non-regeneration emission test results. For cold-start trap equipped vehicles with catalytic after treatment.

3.80 Engine Heat Storage Device/System—See Heat Battery.

3.81 Environmental Chamber—A sealed vehicle test facility which has temperature, humidity, and barometric pressure controls.

3.82 EPA—Environmental Protection Agency.

3.83 EPROM Computer Chip—An Erasable comuter chip. See PROM.

3.84 Equivalent Test Weight (ETW)—For emissions testing purposes it is equal to Loaded Vehicle Weight (Curb Weight, including 33% options, plus 300 lb).

3.85 Esters—A compound having the general formula RCOOR′.

3.86 ETA—Electric Thermactor Air is an auxiliary air injection system for emissions reduction using an electric air pump.

3.87 Ethers—A compound having the general formula ROR′.

3.88 Evaporative Emissions—Hydrocarbons emitted into the atmosphere from a motor vehicle, other than exhaust and crankcase emissions.

3.89 Evaporative Emissions Control System—All vehicle components which contribute to the management and containment of hydrocarbon emissions; this includes the liquid fuel containment system, evaporative control system, and powertrain system.

3.90 Evaporative Purge System—The computer logic and hardware (including PCM, purge valve, carbon canister, fuel tank, and associated subcomponents) that is used to control the consumption by the engine of vapors stored in the carbon canister and those generated in the tank during engine operation.

3.91 Evaporative/Refueling Emission Family—A unique combination within an evaporative/refueling family of canister adsorptive material, purge system configuration, purge strategy, and other related parameters.

3.92 Evaporative System Leak Monitor—An in-use self-diagnostic test that is executed by the vehicle powertrain control module (PCM) and which checks the evaporative emissions system for leaks.

3.93 Exhaust Emissions—Any substance (but normally limited to pollutants) emitted to the atmosphere from any opening downstream from the exhaust port of the combustion chamber of an engine.

3.94 Exhaust Gas Recirculation (EGR)—A system which returns a portion of the exhaust gases to the combustion chamber. The lower combustion temperatures in turn reduce the formation of oxides of nitrogen.

3.95 Exhaust Port Liner—A sheet metal or ceramic component inserted in the exhaust ports for the purpose of reducing heat losses from the exhaust gas.

3.96 Feedback System for Controlling Air/Fuel Ratios—A system which uses a feedback signal generated by an exhaust gas oxygen sensor to control the air/fuel ratio of the combustion mixture.

3.97 Filter Cell—That portion of the nondispersive infrared (NDIR) instrument which is filled with a particular gas in order to reduce interference signals.

3.98 Flame Ionization Detector (FID)—A device containing a hydrogen-in-air flame that produces an electrical current approximately proportional to the mass of the carbon component of the hydrocarbons entering the flame per unit time.

NOTE—The term FID often refers to the entire analyzer.

3.99 ”Flash” EEPROM—A form of EEPROM which uses “flash” technology and only allows complete (no selective) reprogramming of the computer chip memory contents.

3.100 Flexible Fueled Vehicle (FFV)—A vehicle that can operate exclusively on either alternative fuels or petroleum based fuels, or a mixture of them.

3.101 Flywheel Battery—An energy storage device which stores kinetic energy.

3.102 Fuel Cell—A device that uses a chemical reaction of materials to produce electrical energy.

3.103 Fuel Chemistry Sensor—A device connected to the powertrain control module and which is used to determine the alcohol content of flexible fuel alcohol vehicles.

3.104 Fuel Decel Valve—A valve which uses engine vacuum during deceleration to either open the throttle slightly or to meter an additional amount of air/fuel mixture from the carburetor around the closed throttle blades, thereby providing more complete combustion.

3.105 Fuel Fill Level Control Device—A device used to limit the maximum liquid level permitted in the fuel tank during refueling.

3.106 Fuel Filler Cap—The cap on the fuel filler tube which normally provides a positive seal and may contain relief valves for pressure and vacuum venting.

3.107 Fuel Filler Restrictor—A device in the fuel tank filler pipe that will only admit a small diameter fuel filler nozzle dispensing nonleaded fuel.

3.108 Fuel Fired Catalyst Heater—A burner placed in the exhaust system which generates a flame directly in front of the catalyst for rapid heating and reduced emissions. (This is the recommended terminology since "GasCat" is a trade name for a particular type of fuel fired catalyst heater.)

3.109 Fuel Fired Heater—An auxiliary fuel burning heater for the passenger compartment of an electric vehicle.

3.110 Fuel System—The combination of fuel tank, fuel lines, pump, filter, and vapor return lines, carburetor or injection components, and all fuel system vents and evaporative emission control systems or devices.

3.111 Fuel Tank Anti-Spitback Device—A device installed in the fuel tank filler pipe for the purpose of limiting liquid losses through the filler pipe opening during refueling operations.

3.112 Fuel Tank Check Valve—A mechanical device at the fuel tank that prevents liquid fuel from entering the evaporative storage system.

3.113 Fuel Tank Puff Loss—Fuel tank hydrocarbon vapors that are emitted to the atmosphere when the filler cap is removed or the fuel dispensing nozzle is initially inserted into the fuel tank filler pipe.

3.114 GasCat—See Fuel Fired Catalyst Heater.

3.115 Gas Chromatogram—The recorder output versus time of a detector signal from a gas chromatograph, which shows deflections to indicate the presence of separated components of a mixture.

3.116 Gas Chromatograph—An instrument commonly used to separate and detect individual gases in complex gaseous mixtures.

NOTE—In automobile exhaust gas analysis such instruments can be used to separate and determine the concentration of individual hydrocarbon species in a complex hydrocarbon mixture.

3.117 Gas Turbine Engine—Any engine using the basic gas turbine or Brayton cycle consisting of adiabatic compression, constant pressure heating, an adiabatic expansion.

3.118 Grab Sample—See Sampling.

3.119 Gross Vehicle Weight (GVW)—The manufacturer's gross weight rating, consisting of the curb weight plus payload.

3.120 Gulp Valve—A valve that briefly admits a metered flow of air to the intake manifold after a sudden closure of the throttle.

NOTE—This prevents an over-rich mixture being caused when high vacuum evaporates any liquid fuel in the manifold.

3.121 Hang-Up—The absorption and desorption of sample constituents (mainly higher molecular weight hydrocarbons) from the surfaces of a sample system that can cause a delay in instrument response, with initially low concentrations at the detector, followed by higher readings in subsequent tests.

3.122 Heat Battery—A latent heat storage device that captures normally wasted energy to be used for fast warm-up of a vehicle's engine and/or catalyst warm-up.

3.123 Heat Shield—A device, usually a sheet metal shield, placed adjacent to a high temperature component (exhaust system) to protect the surrounding environment.

3.124 Heavy-Duty Engine—Any engine which the engine manufacturer could reasonably expect to be used for motive power in a heavy-duty vehicle.

3.125 Heavy-Duty Vehicle—Any Federally certified motor vehicle designed primarily for transportation of property and rated at more than 3855 kg (8500 lb) GVW or designed primarily for transportation of persons and having a capacity of more than 12 persons.

3.126 Hexane Equivalent Concentration—(ppm hexane)—The concentration of hexane that would give the same signal as a propane calibrating gas. For nondispersive infrared instruments, hexane equivalent concentration has been established as propane concentration times 0.52. For flame ionization detectors, hexane equivalent concentration times 0.50.

3.127 Hot Soak—A specified time period beginning immediately after an engine is turned off. The Federal test procedure contains hot soak periods.

3.128 Hot Soak Losses—Evaporative emissions that occur after termination of engine operation following a sustained drive in elevated ambient temperatures.

3.129 Hydrocarbon—An organic compound composed of only carbon and hydrogen.

NOTE—The term is sometimes used to denote any combustion products that can be measured with a flame ionization detector.

3.130 Hydrocarbon Adsorption—The adhesion of hydrocarbon gases in a thin layer to the surfaces of solid bodies with which they are in contact.

3.131 I/M 240—An inspection and Maintenance 240 secondary test established by the EPA to measure mass tailpipe emissions (HC, CO, and NO_x) of in-use vehicles. The test involves driving a cycle on a chassis roll dynamometer.

3.132 Inertia Weights—A series of rotating disks on a chassis dynamometer used to simulate the inertial mass of a vehicle.

3.133 Inherently Low Emission Vehicle (ILEV)—A vehicle that must meet California Low Emission Vehicle (LEV) tailpipe requirements plus meet an evaporative emission standard of 5 g with disabled evaporative controls.

3.134 Inlet Air Throttle—A device which would limit the intake air into the combustion chamber, thus raising the temperature of the exhaust to initiate oxidation of the particulate matter in the trap.

3.135 Insulated Pipe—Double-walled exhaust pipe with insulating material between two basically concentric pipes.

3.136 Integrated Refueling Emission Control System—A vapor storage system where fuel vapors resulting from refueling are stored in a common vapor storage unit(s) with other evaporative emissions of the vehicle and are purged through a common purge system.

3.137 Interference—A false instrument response due to the presence of components other than that which is to be measured.

3.138 Latent Heat System—See Heat Battery.

3.139 Lean Reactor—A thermal reactor system that typically operates at air/fuel ratios leaner than stoichiometric.

3.140 LEV—"Low Emission Vehicle" is a vehicle that has been certified to the California low emission standards.

3.141 Light-Duty Truck—A Federally certified motor vehicle having a rating of 3855 kg (8500 lb) GVW or less and designed primarily for the transportation of property or designed for off-street or off-highway use.

3.142 Light-Duty Vehicle—A motor vehicle having a rating of 2722 kg (6000 lb) GVW or less and designed primarily for the transportation of persons on a street or highway and having a capacity of 12 persons or less.

3.143 LNG—Liquefied Natural Gas.

3.144 Loaded Vehicle Weight—The manufacturer's estimated weight of a vehicle in operating condition. For the purpose of emission testing, it is the curb weight of a light-duty vehicle plus 136 kg (300 lb).

3.145 LPG—Liquefied Petroleum Gas.

3.146 Malfunction Indicator Light (MIL)—An instrument panel light for informing the driver of an emission control system failure or deterioration.

3.147 Medium-Duty Truck—Any California certified motor vehicle having a rating of 2722 to 6350 kg (6000 to 14000 lb) GVW (2722 to 6350 kg) and designed primarily for the transportation of property.

3.148 Mesh Filter—A trap which depends for its operation on flow through a tortuous path.

NOTE—Impaction and diffusion are the primary trapping mechanisms. Particles impact on filaments and adhere to the surface of the filaments or particles previously collected. Smaller particles migrate to the surface by diffusion and are retained.

3.149 Metallic Substrate—The part of a metal catalytic converter on which the wash coat and precious metals are placed.

3.150 Methane—The simplest hydrocarbon, with formula CH_4.

3.151 MMT—Methylcyclopentadienyl Manganese Tricarbonyl (an octane improver manufactured by Ethyl Corporation).

3.152 Mode—A particular operating condition (for example, acceleration, deceleration, cruise, or idle) of a vehicle test schedule.

3.153 Modified Part—A part which replaces an OEM part that was included in the originally certified vehicle configuration but which is not functionally equivalent to it.

3.154 Molecular Sieve—A crystalline substance (as a zeolite) characterized by uniformly sized pores of molecular dimension that can adsorb small molecules.

3.155 Monolithic Diesel Particulate Filter—An extruded cellular ceramic filter with alternate cell channel openings blocked in a checkerboard fashion; the opposite end is similarly blocked but with one cell displaced so that exhaust must flow through porous channel walls.

3.156 Monolithic Substrate—A unitary catalyst substrate usually of honeycomb structure.

3.157 Naphthene (Cycloparaffin)—A hydrocarbon having a ring-type structure with only single bonds between the carbon atoms and with general formula C_nH2_n.

3.158 Natural Gas Vehicle (NGV)—A vehicle capable of operating using natural gas.

3.159 NCP—A NonConformance Penalty—The cost penalty determined by the EPA for failure of an engine to be certified in compliance with an emission standard and paid to the federal government for each unit built.

3.160 NMOG—Non-Methane Organic Gases. The total of the hydrocarbons and oxygenates found in emissions from vehicles excluding methane.

3.161 Noble Metal Catalyst—A catalyst in which the active material is made from a precious metal such as platinum, palladium, rhodium, or ruthenium.

3.162 Nondispersive Infrared (NDIR) Analyzer—An instrument that selectively measures a specific component of a gaseous mixture by responding to the specific infrared absorption characteristic of that component. For certification and development purposes, the NDIR analyzer is primarily used for carbon monoxide and carbon dioxide determination.

3.163 Non-Integrated Refueling Emission Control System—A vapor storage system where fuel vapors resulting from refueling are stored in a vapor storage unit(s) assigned solely to the function of storing refueling vapors.

3.164 Non-Methane Hydrocarbons (NMHC)—All organic hydrocarbon compounds, excluding methane, present in an exhaust sample.

3.165 Non-Regeneration Emissions Test—A complete emission test which does not include a diesel trap regeneration.

3.166 OBD or OBDII—See On-Board Diagnostics (OBD or OBDII).

3.167 Olefin—A hydrocarbon having an open chain structure containing one or more carbon-carbon double bonds. The general formula for an olefin containing one double bond is C_nH2_n.

3.168 OMHCE—Organic Material Hydrocarbon Equivalent. Total Hydrocarbons less the methanol contribution, plus methanol times a molecular weight ratio, plus formaldehyde times a molecular weight ratio.

3.169 OMNMHCE—Organic Material Non-Methane Hydrocarbon Equivalent. OMHCE minus methane.

3.170 On-Board diagnostics (OBD or OBDII)—Real-time on-board monitoring by the vehicle's Powertrain Control Module (PCM) of all emission-related components and systems. OBDII is the second generation of OBD.

3.171 On-Board Refueling Vapor Recovery (OBRVR)—The on-vehicle system for capturing gasoline vapors that would escape the atmosphere during vehicle refueling.

3.172 Opacimeter—An optical instrument designed to measure the opacity of diesel exhaust. Also called smokemeter.

3.173 Opacity—The fraction of light emanating from a source which is prevented from reaching the observer or instrument receiver.

$$\text{Opacity} = [1 - \text{Transmittance}] \times 100 \qquad \text{(Eq. 2)}$$

NOTE—This definition of opacity (or equivalent) is widely used in the field of diesel smoke measurement but is inconsistent with the definition used in other technical fields.

3.174 Organic Acid—A compound having the general formula RCOOH.

3.175 Organic Material Hydrocarbon Equivalent—The sum of the carbon mass contributions of non-oxygenated hydrocarbons, methanol, and formaldehyde as contained in a gas sample, expressed as gasoline fueled vehicle hydrocarbons. In the case of exhaust emissions, the hydrogen-to-carbon ratio of the equivalent hydrocarb is 1.88:1. In the case of diurnal and hot soak emissions, the hydrogen-to-carbon ratios of the equivalent hydrocarbons are 2.33:1 and 2.2:1, respectively.

3.176 Oxidation Catalyst—A catalyst that promotes the oxidation of HC and CO to form water vapor and carbon dioxide.

3.177 Oxides of Nitrogen (NO_x)—The sum total of nitric oxide (NO) and nitrogen dioxide (NO_2) in a gas sample; expressed as equivalent NO2.

3.178 Oxygen Sensor—A device providing an electrical signal that is a function of the oxygen level in the exhaust gas. The signal is used as an input parameter for feedback air/fuel control system

NOTE—Usually mounted in the exhaust manifold with exposure to passing exhaust gas.

3.179 Oxygenated Fuel—A mixture of hydrogen-carbon containing compounds (gasoline or diesel fuel) and some hydrogen-carbon-oxygen containing compounds (usually alcohols, ethers, etc.).

3.180 Paraffin—A hydrocarbon having an open chain or branching chain structure and containing only single carbon-carbon bonds, with general formula C_nH_{2n+2}.

3.181 Parts per Million Carbon (ppmC)—The mole fraction times 10^6 of hydrocarbon measured on a methane equivalence basis.

3.182 Passenger Compartment Heat Storage Device/System—See Heat Battery.

3.183 PCV Valve—A valve that regulates the flow of gases from the crankcase into the air induction system.

3.184 Pelleted Substrate—A catalyst substrate having such forms as pebbles, beads, small cylinders, or small spheres.

3.185 Periodically Regenerating Trap Oxidizer—A system incorporating an external heating source, such as heaters, burners, or temporary engine modification to increase the exhaust temperature sufficiently to ignite the stored particles.

3.186 Perturbated Flow—The variation of air/fuel ratio as signaled by an oxygen sensor in the exhaust flow to maintain proper feedgas condition for catalytic conversion.

3.187 Photographic Smoke Measurement—A measurement technique which relies upon an instrumental or visual comparison of the photographic image of a smoke plume with an established scale of blackness or opacity to determine the opacity of the original smoke plume.

3.188 Poly Nuclear Aromatic or Polynuclear Aromatic Hydrocarbons (PNA, PAH)—Relatively high molecular weight aromatics consisting of three or more fused rings. They are often formed in combustion processes and often emitted as a component of soot particles. The PNA benzo(a)pyrene is often cited as a potent human carcinogen.

3.189 Positive Crankcase Ventilation (PCV)—A system that routes gases from the crankcase (blow-by and air) to the air induction system of the engine.

3.190 Powertrain Calibration—The preset values, data, algorithms, and instructions needed for powertrain operation and stored in the powertrain control module's PROM chip(s).

3.191 Probe—A device inserted into some portion of an engine or vehicle system in order to obtain a representative gas, liquid, or particle sample.

3.192 PROM Computer Chips—Programmable Read Only Memory computer chip used in a vehicle's powertrain control module to store the various preset values, data, commands, and algorithms used for operation of the powertrain.

3.193 Proportional Exhaust Gas Recirculation—An EGR System designed to recirculate a fixed percentage (based on engine air flow) of the exhaust gas.

3.194 Pulse Air System—A system which uses sub-ambient pressure pulses in the exhaust system or crankcase to introduce ambient air into the exhaust system for the purpose of oxidizing HC and CO.

3.195 Purge Valve—A vacuum or electrically actuated device in the evaporative emission control system used to release entrapped hydrocarbons to the engine induction system.

3.196 Quick-Acting Choke—An electrical or mechanically operated device designed to shorten the choking period during engine start-up.

3.197 Quick-Heat Intake Manifold—An exhaust-heated intake manifold having relatively large crossover passages and, typically, a thin sheet metal section in the plenum floor.

NOTE—The sheet metal floor may have fins, convolutions, or similar means to obtain a high rate of heat transfer between the crossover exhaust and the intake charge. The objective of these manifolds is to provide rapid intake mixture warm-up to promote evaporation of fuel droplets.

3.198 Rare Earth Catalyst—A catalyst in which the active material is a rare earth element such as lanthanum or cerium.

NOTE—The rare earth elements range in atomic number from 57 to 71.

3.199 RDP—Revised Durability Procedure—The term assigned by EPA for revision of its durability procedures (RDP 1 for model years 1993 to 1998 and RDP II for model years 1999 and beyond).

3.200 (RAF) Reactivity Adjustment Factor—An adjustment factor indicating the smog forming potential of individual compounds.

3.201 Reactor Liner—A sheet metal or ceramic component inserted in the thermal reactor for the purpose of reducing heat losses from the exhaust gas.

3.202 Rebuilt Part—A previously used part which has been disassembled, processed, and reassembled to yield a part functionally identical to OEM specifications.

3.203 Reduction Catalyst—A catalyst that promotes the chemical reduction of nitrogen oxides (NO_x) by reaction with carbon monoxide (CO), free hydrogen (H_2), or chemical hydrocarbon (HC). The desired products of the reaction are nitrogen gas, carbon dioxide, and water.

3.204 Reference Cell—That portion of an NDIR instrument which is similar to the sample cell except that it does not contain the constituent to be determined.

3.205 Refueling Emissions—Hydrocarbon emissions that can occur during filling of the vehicle fuel tank.

NOTE—These emissions are made up of displaced fuel tank vapor, entrained droplets in this vapor, liquid spillage, and nozzle drip during insertion and removal of the nozzle from the filler neck.

3.206 Regeneration—The process of burning the accumulated diesel particles to clean the trap.

3.207 Regeneration Emission Test—A complete diesel emission test, which includes a particulate trap regeneration.

3.208 Regeneration Interval—The interval from the start of a diesel trap regeneration to the start of the next regeneration.

3.209 Reid Vapor Pressure—The absolute pressure of gasoline vapor at 37.8 °C (100 °F) determined in a special vessel containing a volume of air which occupies four times the volume of liquid fuel (ASTM D 323).

3.210 Remanufactured Part—A previously used part which has been disassembled, processed, and reassembled to yield a part functionally equivalent to OEM specifications.

3.211 Resolution—The minimum input concentration that produces a distinguishable change in the output of an instrument.

3.212 Resting Losses—Hydrocarbon evaporative emissions that may occur continuously, that are not diurnal emissions, hot soak emissions, running losses, or spitback emissions.

3.213 Rich Reactor—A thermal reactor system that typically operates in the range of air/fuel ratios richer than stoichiometric.

3.214 Running Losses—Hydrocarbon evaporative emissions resulting from vehicle operation. Test procedures evaluate running-loss emission performance using specific, standardized average urban drive trips.

3.215 Run-Away Regeneration—The rapid oxidation of the diesel particles causing the temperature to rise uncontrollably and the trap to fail.

3.216 Sample Cell—That portion of an NDIR instrument that contains the sample gas being analyzed.

3.217 Sampling—The technique of obtaining a representative sample of material for analysis. Sampling may be batch, continuous, or proportional.

a. A batch sample is taken in a syringe, bag, or other container over a short period of time for analysis.
b. In continuous sampling, a portion of the exhaust is continuously withdrawn for immediate analysis.
c. Proportional sampling is a method of obtaining a composite sample from a flowing stream that is weighted in proportion to the stream flow rate. Sometimes called variable rate sampling.

3.218 SHED—A Sealed Housing for Evaporative Determinations which is an enclosed chamber for determining a vehicle's evaporative emissions. This includes fuel and background emissions.

3.219 Simultaneous Oxidation Reduction Catalyst—See Three-Way Catalyst.

3.220 Space Velocity—The exhaust flow in m^3/s (ft^3/h), measured at standard temperature and pressure (1 atm and 25 °C), divided by the catalyst volume in m^3 (ft^3) equals the space velocity.

3.221 Span Gas—A calibration gas routinely used to calibrate an instrument at a single concentration.

3.222 Spark Advance—The number of degrees before top dead center at which the spark discharge occurs.

3.223 Spark Delay Device—Calibrated restrictor in the vacuum advance hose which delays the vacuum spark advance.

3.224 Spark Ignition Engine—Any internal combustion engine using the basic Otto cycle, with combustion initiated by an electric spark.

3.225 Spark Port—The carburetor port from which vacuum to control the distributor spark advance is sensed.

3.226 Speciation—The term for separating a complex mixture into its individual compounds.

3.227 Speed Controlled Spark—A system, generally used with an automatic transmission, that controls the vacuum to the distributor preventing vacuum advance below a selected vehicle speed.

3.228 Spitback Emissions—Hydrocarbon evaporative emissions resulting from the loss of liquid fuel that is emitted from a vehicle during a fueling operation.

3.229 Stage I—The system for capturing gasoline vapors that would escape to the atmosphere when filling a tank truck at a bulk gasoline plant or terminal and when filling an in-ground tank at a service station from a tank truck.

3.230 Stage II—The system installed on gasoline dispensing pumps in service stations for capturing gasoline vapors during vehicle refueling.

3.231 Stage II Vapor Recovery Nozzle—A fuel dispensing nozzle that incorporates a seal and balance-back system or a vacuum system for the purpose of capturing and storing refueling vapors at the fuel dispensing site.

3.232 Steady-State Condition—An engine operating condition at a constant speed and load and at stabilized temperatures and pressures.